DEPARTMENT OF SCHOOL EDUCATION

RIGHT TO EDUCATION
SAMAGRA SHIKSHA - A.P.
EDUCATION FOR ALL

STRUCTURED LESSON PLANS FOR CBSE-AFFILIATED SCHOOLS

MATHEMATICS

GRADE - 09

A Teacher Resource Book for
Competency Based Teaching-Learning

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING (SCERT)

Committee for Development of Structured Lesson Plans

Honorary Advisors

Shri **Praveen Prakash** IAS
Principal Secretary to Government
Department of School Education, AP

Shri **S. Suresh Kumar** IAS
Commissioner of School Education , AP

Shri **B. Srinivasa Rao** IAS
State Project Director, Samagra Shiksha, AP

Shri. **M.Venkata Krishna Reddy**
MA., B.Ed
Secretary, Model Schools, AP

Dr. **B. Pratap Reddy** MA., B.Ed., Ph.D.
Director, SCERT, AP

Shri **K. Ravindranath Reddy** MA., B.Ed.
Director, Government Textbook Press, AP

Advisors

CRISP

Shri. **R. Subrahmanyam**
I.A.S.(Retd), Secratary of CRISP

Ms. K. Sandhya Rani
IPoS.(Retd), Founding member of CRISP

Mrs. P. Usha Kumari
I.A.S.(Retd), State Lead of AP Team CRISP

Azim Premji University
Faculty from APU

LFE

Kunal Patil
Shreyashi Ghosh

Programme Co-ordinators

Smt. **Chirakala. Sreelatha**
State Co-ordinator, CBSE, AP

Shri. **K. Dharma Kumar**
Co-ordinator,CBSE, AP

Smt. **Sripathi. Bhanumathi**
Faculty, SCERT, AP

Dr. **G. Kesava Reddy,**
Faculty, SCERT, AP

Subject Experts

Sri. **M. Vanapal Reddy**
Principal, APSWREIS, Karempudi

Sri. **P.V. Karunakara Rao**
APSWREIS - Kopperla,

Sri. **B. Udaya Bhaskar**
APMS, Reddy Gudem

Smt. **J. Jhansi Rani**
APRS, Nagireddy Gudem

Sri. **M. Srinivasa Rao**
APSWREIS, Adavitakkellapadu

Smt. **Y. Sesha Vagdevi Alekhya**
KGBV, Makavarapalem

Sri. **Venkata Ramana Murthy**
APMS, Bukkanaidupeta, Vepada

Sri. **K. Sanjeeva Reddy**
APMS, Kolimigundla

MESSAGE BY PRINCIPAL SECRETARY

It brings me a great joy to invite all the teachers of CBSE-affiliated government schools to this valuable resource book of structured lesson plans. Inspired by the vision of our honorable Chief Minister, we are committed to supporting the teachers in shaping a bright future for all the children in Andhra Pradesh. We envision our children transforming into global citizens, excelling in academics and being ready for the world of work. In order to aid the teachers in this pivotal task of preparing the students to emerge as global citizens, the School Education Department is committed to making available the best resources and training. This lesson plans resource book is a transformational step in that direction. Utilized appropriately, this resource books will transform the teaching-learning process and experience in the classroom and lead to deeply engaging the students.

I hope you make the best use of this resource, which has been put together by our own teachers trained by experts from Azim Premji University and facilitated by the Center for Research in Schemes and Policies (CRISP). They have taken into consideration the teaching-learning needs of all types of learners and created lesson plans that are rich in activities, examples, and assessments. They have followed the CBSE Learning Framework and NCERT Learning Outcomes for Secondary Stage, along with principles from the National Curriculum Framework: School Education 2023.

At the crucial juncture of secondary school, our children need spirited teachers like you to prepare them for the changing and dynamic world. You bear the power and responsibility to shape their minds and hearts and guide them to step out into the world and contribute to our state's growth and country's economy.

Your dedication and efforts in implementing these structured pedagogical approaches will not only enhance the learning experience of our students but also equip them with the necessary skills and knowledge to thrive in an ever-evolving global landscape. Together, let us embark on this journey of educational excellence and empower our students to become the leaders of tomorrow.

With great hope and appreciation,

Shri Praveen Prakash, IAS
Principal Secretary, Department of School Education
Government of Andhra Pradesh

MESSAGE BY COMMISSIONER

The United Nations Sustainable Development Goal 4 (SDG 4) underscores the pivotal role of education in unleashing human potential and fostering self-respect. As the Commissioner of School Education, I am privileged to champion a vision that empowers the children of Andhra Pradesh with boundless possibilities and opportunities. Through pioneering reforms in education, encompassing cutting-edge infrastructure, ongoing professional development for educators and administrators, innovative digital initiatives, and an unwavering commitment to providing top-tier educational resources, our state stands as a beacon of educational transformation.

Government of Andhra Pradesh is committed to implement best initiatives to enhance rthe quality of education in the State. Obtaining CBSE affiliation to 1000 schools is one of such key initiatives. This lesson plan resource book developed for the use of teachers working in CBSE schools represents yet another milestone in our journey. Recognizing teachers as the cornerstone of our education system, we have entrusted them to craft these lesson plans for your benefit. After undergoing rigorous training in pedagogy, subject matter, learning outcomes and competencies, our educators have infused these lesson plans with their profound knowledge of the subject, and understanding of our students and their diverse contexts. It is a labor of love and thought, an amalgamation of explorations and experiments, presented for you to embrace and utilize effectively.

These lesson plans are created with the aim of providing a rich repository of ideas to enhance classroom engagement and productivity, and provide yet another innovative resource that teachers can employ. Feel free to adapt and supplement these plans as you see fit. The teacher reflections section serves as a tool for self-assessment and improvement, allowing you to augment your lessons and address any gaps you may identify.

I am optimistic about our state's trajectory towards competency-based teaching, with a focus on measurable learning outcomes that can be continually evaluated and enhanced. The decision to affiliate 1000 schools with CBSE and implement a curriculum aligned with national standards is indeed a significant stride in the right direction. Together, let us embrace this transformative journey towards educational excellence and empower our students to thrive in an ever-evolving world.

I congratulate everyone who worked towards bringing this excellent resource book for the teachers. I thank Center for Research in Schemes and Policies (CRISP) for the innovative ideas they presented to the Government, including development of structured lesson plans. The support of SPD Samagra Shiksha, continuous facilitation by CRISP, expert technical advice of Azim Premji University faculty, hard work of our teachers, CBSE team in Commissionerate office and SCERT made it possible to bring out this resource book in time for the 2024-25 academic year.

With sincere optimism and appreciation,
Shri S Suresh Kumar, IAS
Commissioner,
Department of School Education,
Government of Andhra Pradesh

MESSAGE BY THE STATE PROJECT DIRECTOR

The National Education Policy 2020 highlights that the purpose of education is to develop good human beings capable of rational thought and action, possessing compassion and empathy, courage and resilience, scientific temper and creative imagination, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution. To realize the NEP's vision, it is essential for educators to align with this goal and transition from curriculum-centric to competency-driven teaching methods.

The State's commitment to this shared vision is visible in the Strengthening Andhra's Learning Transformation (SALT) Project, where one of the pivotal focus areas is the professional development of teachers. This entails utilizing insights from self-assessments, academic performance data from school-based evaluations, and classroom observations to enhance pedagogical skills. With continuous support from the education department, teachers will refine their pedagogical approaches, ensuring effective delivery of lessons.

In the same vein, I am delighted to introduce this Lesson Plan resource book for our CBSE-affiliated schools, crafted by experts from both within our state and across the nation. These lesson plans signify a shift away from rote memorization and content accumulation towards a structured approach aimed at fostering values, dispositions, and competencies in students. Rooted in the vision of the NEP and operationalized by the National Curriculum Framework: School Education 2023, each plan corresponds to a 40-minute class targeting specific learning outcomes from NCERT's Secondary Stage. These outcomes collectively contribute to observable learning achievements and the development of competencies over time. Moreover, this resource book empowers teachers to tailor their content and assessments dynamically by monitoring and addressing students' learning needs continuously.

I hope the teachers will find these resources valuable and helpful in transforming classroom transactions. Together I hope we will reshape the educational landscape of Andhra Pradesh in the years ahead. Best wishes for your endeavors!

Shri B Srinivasa Rao, IAS
State Project Director, Samagra Shiksha
Government of Andhra Pradesh

MESSAGE BY JOINT DIRECTOR, CBSE

In a landmark decision, the Government of Andhra Pradesh affiliated 1000 Government schools with the Central Board of Secondary Education (CBSE). This transition marks a significant milestone in our efforts to provide standardized and high-quality education to our students. The CBSE curriculum is widely recognized for its comprehensive and contemporary approach to learning, offering students a competitive edge on a national scale. The Board emphasizes holistic development of learners by providing a stress-free learning environment that will develop competent, confident and enterprising citizens who will promote harmony and peace. It is committed to providing quality education to promote intellectual, social and cultural vivacity among its learners.

By aligning our schools with CBSE, we aim to ensure our students are well-prepared to compete on a national level and excel in today's dynamic world. In order to achieve this, our utmost efforts have gone into developing these structured lesson plans incorporating NCERT's Secondary Stage Learning Outcomes, the National Curricular Framework: School Education 2023, and CBSE Learning Framework document developed by Azim Premji University. 'Structured Pedagogy' is a scientific, evidence-based, learner-centric approach for teaching that equips every teacher with clearly defined objectives, proven methods, well-structured tools, and practical training. After many rounds of rigorous training, expert teachers from our CBSE schools integrated the conceptual and practical aspects of their subjects and condensed them into these easy-to-use lesson plans.

We thank the Center for Research in Schemes and Policies (CRISP) and Azim Premji University for their innovative ideas and tireless support.

I encourage each of you to fully utilize these plans and personalize them to fit your teaching style. May this invaluable resource serve as a valuable tool as you guide Grade 10 students through this critical stage of their education. Your dedication as teachers brings us immense joy and pride, as we entrust the future of our state's children to your capable hands. Wishing you all the best!

Mr Krishna Reddy
Joint Director, CBSE
Department of School Education
Government of Andhra Pradesh

MESSAGE BY CENTRE FOR RESEARCH IN SCHEMES AND POLICIES (CRISP)

Shri. **R. Subrahmanyam**
I.A.S.(Retd), Secratary of CRISP

Ms. K. Sandhya Rani
IPoS.(Retd), Founding member of CRISP

Mrs. P. Usha Kumari
I.A.S.(Retd), State Lead of AP Team CRISP

In October 2023, the Centre for Research in Schemes and Policies (CRISP) forged a significant partnership with the Government of Andhra Pradesh, to help bring about a transformation for the state's School Education system. Our inaugural initiative was designed to cultivate excellence within the 1000 CBSE-affiliated schools. CRISP's primary focus was to support both teachers and students during the transition from the State Board to the CBSE Board.

Research reveals that an average teacher grapples with approximately 1,500 decisions daily. While it may be impractical to intervene in every decision-making process, our aim was to alleviate the cognitive load associated with tasks such as lesson planning, question formulation, activity design, and assessment creation. Recognizing the novelty of transitioning from the State Syllabus to CBSE, our initiative encompassed the provision of essential resources alongside comprehensive training for all educators involved.

To enhance our efforts, we collaborated with Central Square Foundation, a renowned organization in the field of Education, to train our teachers in their Structured Pedagogy approach. This evidence-based, learner-centric methodology equips educators with clearly defined objectives, proven methods, well-structured tools, and practical training.

We are thankful to professors from Azim Premji University who provided invaluable support by mentoring the core group of teachers over a six-month period, guiding them through NCERT's Learning Outcomes for the Secondary Stage and the National Curriculum Framework: School Education 2023. The culmination of these efforts is the creation of this resource book, comprising structured lesson plans for the benefit of teachers, and vetted meticulously by the SCERT. We hope that the tremendous effort of our teachers serves as an inspiration to continue shaping the minds of our youth.

We extend our sincere gratitude to Dr. Emmanuel Joseph, Joint Commissioner (Academics) at CBSE, New Delhi, professors from Azim Premji University, experts from Central Square Foundation, the State CBSE team, SCERT, and the entire Department of School Education for their invaluable guidance and support throughout this endeavor. Their deep commitment to enhance the quality of education and to transform the teaching-learning process in the classrooms made it possible to bring this initiative to life within a remarkably short span of time.

We thank the Government of Andhra Pradesh for giving us this opportunity, for the trust they reposed in accepting the innovative idea and facilitating it to germinate and fructify.

Centre for Research in Schemes and Policies
February, 2024

FOREWORD BY DIRECTOR, SCERT

At the heart of quality education lie two indispensable pillars: the teacher and the student. While textbooks, digital resources, infrastructure, and curriculum play crucial roles in the educational landscape, it is the teacher who bears the primary responsibility of delivering lessons, facilitating comprehension of complex concepts, nurturing independent thinking, and molding individuals into responsible members of society. The Department of School Education, Government of Andhra Pradesh aspires to create citizens equipped with the skills and competencies to succeed and solve problems at a global scale, while remaining locally rooted and aware.

To achieve this goal, we have developed a comprehensive resource book to support teachers across the state, enhancing their planning and teaching processes with ease and creativity.

These meticulously crafted lesson plans have been curated by trained educators and thoroughly reviewed by SCERT experts. Each lesson plan is structured into distinct period plans, addressing specific topics within the lesson. Clear learning outcomes are outlined at the beginning of each lesson and progressively addressed throughout the class session. Furthermore, each period plan is divided into sections including Learning Outcomes, Teaching-Learning Process, Pointers for Assessment, and Material Required, offering teachers a flexible framework to tailor to their preferences. The provided questions to assess prior knowledge, suggested activities, and prompts for understanding checks serve as guides, encouraging teachers to adapt the plans to suit the unique needs of their classroom and students.

The SCERT extends its sincere appreciation to the dedicated members of its textbook committee, source material reviewers, lesson plan creators, and technical partners for their invaluable contributions in realizing this vision. We also express our gratitude to the Principal Secretary and Commissioner, Department of School Education, and State Project Director, Samagra Siksha, Department of School Education for their steadfast commitment to promoting quality education, consistently driving us toward excellence in all facets. We appreciate the steadfast support of Center for Research in Schemes and Policies (CRISP) and professors from Azim Premji University in developing the lesson plans.

Dr B Pratap Reddy
Director,
State Council of Educational, Research, and
Training Government of Andhra Pradesh

INTRODUCTION AND BACKGROUND TO THE STRUCTURED LESSON PLANS RESOURCE BOOK

The National Education Policy, 2020 (NEP) focuses strongly on a need for a well-defined Curriculum and a Structured Pedagogy in schools, to ensure holistic, integrated, enjoyable and engaging learning of the students.[1] In pursuance of the Memorandum of Understanding (MoU) signed between Government of Andhra Pradesh (GoAP) and Centre for Research in Schemes and Policies (CRISP), and the recommendation made by CRISP in the Action Plan for CBSE, GoAP agreed that *"Structured pedagogy should be adopted for Classes 8 and above in the newly converted CBSE schools. For this purpose, while using material already available, standard lesson plans should be prepared."* In furtherance of adapting structured pedagogy approach in Government CBSE Schools to improve the quality of teaching-learning, the GoAP organized the following:

1. Organised a Structured Pedagogy workshop was organized in collaboration with CRISP in Vijayawada from 11th to 13th July 2023. Experts from Central Square Foundation and Azim Premji University (APU) anchored the workshop, with additional sessions by Room to Read, Leadership for Equity, Ambitus World School, and SCERT Telangana. Sessions focused on the need for a structured way of teaching and learning, shifting from rote method to competency based curriculum, and delved into the NCERT Learning Outcome Framework for the Secondary Stage. A total of 60 subject teachers along with A.P SCERT subject experts participated in the workshop representing English, Mathematics, Social Science, Biology, Chemistry, and Physics. Each subject group consisted of 10 teachers, 1 SCERT expert, and 1 CBSE School Principal acting as a Coordinator. With guidance from CSF and APU, the subject groups prepared one sample lesson plan per subject by the end of the 3-day workshop.
2. Post the workshop, facilitated the expert subject teachers to work on lesson plan development, with virtual support from APU faculty virtually.
3. Organised a Capacity Building workshop from 11th to 14th October 2023 in Vijayawada with expert support of experts from APU. Sessions were held on mapping content to specific learning competencies, designing and using creative Teaching-Learning Materials, adding Check for Understanding questions, using interdisciplinary approach in the lessons, addressing student misconceptions, and creating a diverse range of assessments. The workshop enhanced the ability of the teachers to

[1]Chapter 4 & 5, National Education Policy, 2020 (NEP, 2020)

a. understand the principles and practices underpinning competency-based curriculum as outlined in NEP 2020 and NCF-SE 2023;

b. equip the teachers to analyse the need to effectively align curriculum content, competencies, pedagogical practices, and assessment methods in the classroom;

c. helped them to learn to develop competency-based lesson plans that integrate NCF-SE 2023 guidelines, ensuring that learning outcomes are aligned to the desired competencies with the help of model lesson plans

d. trained them to gain practical insights into designing and implementing both formative and summative assessments that accurately measure students' progress toward achieving the competencies set forth in NCF-SE 2023

4. Held a physical camp for the core team of teachers to develop and quality check the lesson plans for all the subjects in Vijayawada for 12-days, from 20th November to 1st December 2023. APU teachers and Leadership for Equity team provided technical support.

5. In early February 2024 the lesson plans developed for Grade 9 and 10 were vetted and finalised by AP SCERT and sent to the Textbook Press for printing and distribution.

ELEMENTS OF THE STRUCTURED LESSON PLANS

All lesson plans are meticulously organized into detailed period plans, each focusing on a specific topic and its corresponding Learning Outcomes. These period plans are then subdivided into four essential sections:

1. Topic and Learning Outcomes, along with associated Indicators
2. Teaching-Learning Process, highlighting Pedagogical Strategies
3. Assessment Strategies to gauge student understanding and progress
4. Materials required, ensuring all necessary resources are readily available for effective instruction.

Within these sections, the following elements have been covered:

- **Higher order thinking questions** have been added to encourage critical thinking, problem-solving, creativity, and analysis. These questions usually move beyond ‘What’, and ‘When’, and focus on ‘Why’, or ‘How’. Some examples of these are:
  “Explain the twinkling of stars.” [Physics]
  “How does trade help connect the countries in the world?” [History]

"Why can amphibians and reptiles tolerate mixing of blood to some extent?" [Biology]
"Do you think it was right for the farmer to be angry with the postmaster? Why or why not? [English]
"What should India do or achieve to become a developed country?" [Economics]
"Why does a snail change its sex?" [Biology]
"How did Gendhadhur, a backward village in Mysore, Karnataka, become rich in rain water?" [Geography]
"Why can't astronauts see the rainbow from the surface of the moon?" [Physics]

- **Keywords and key concepts** are stated in the beginning of every chapter so that the teacher can be sure to cover them during the course of the lesson
- **Prior knowledge and skills are tested** at the beginning of every period to assess whether students have retained concepts covered in previous lessons, and to gauge the overall level of knowledge on the topic to be covered
- **Prompts and questions to address common misconceptions** about the topic have been given in the plans to clarify any incorrect ideas students may have. For example: "A woman in your neighborhood is blamed for giving birth to a baby girl. Is the sex of the baby determined by her? Remove the misconception through your argument." [Biology]
- **Discussion prompts** for class or group discussions have been given, especially for the humanities subjects. For example:
  "Why do you think men receive higher wages than women for the same job? Discuss." [Economics]
  "Human societies have steadily become more interlinked. Comment." [History]
  "Discuss the benefits and drawbacks of using chemical fertilizers." [Geography]
- **Assessment and remedial periods** have been allocated after every lesson plan to gauge student learning, and revise concepts that students need more clarity or practice in, before moving to the next lesson
- **Inter-disciplinary nature of subjects and topics** has been encouraged in the plans so that students recognize the value of all subjects equally. It also promotes a holistic understanding of the topic and opens them up to thinking about an issue from various lenses
- **Formative and summative assessments, check for understanding questions, and worksheets** are given for every lesson to assess student learning at every stage of the lesson
- **Space for teachers to reflect on every period** has been provided at the end of the plan. The prompts are designed to assist teachers in assessing the alignment of their plan with overarching curricular goals and competencies, evaluating student engagement levels, ensuring effectiveness of assessment strategies in measuring student understanding, and gauging the efficacy of teaching materials, activities, and case studies utilized

HOW TO USE THESE LESSON PLANS

Teachers should have a comprehensive understanding of the curricular goals, competencies, and the nature of the subject they teach. It is essential to thoroughly review the section on "Pedagogical Practices" to gain deeper insight into teaching methodologies. With this groundwork, teachers can then delve into the lesson plans for their subject. It is highly recommended to study the entire lesson plan before initiating the lesson in class. Throughout the lesson, teachers can refer to each period plan and manage class time effectively to cover the elements outlined in the plan. Additionally, teachers are encouraged to modify the plan as needed, incorporating or removing content, questions, or activities to address the specific needs of their students and contextual requirements.

PEDAGOGICAL PRACTICES

Broad Aims of School Education

The Learning Standards are guided by certain widely agreed upon broad Aims of School Education that are articulated in this NCF. These aims have been arrived at from the vision and purpose of education as envisaged by NEP 2020:

1. **Rational Thought and Autonomy:** An individual should have the capacity of rational reasoning and sufficient knowledge to understand the world around them. An individual should be able to make an informed decision. This fundamentally requires knowledge in breadth and depth.
2. **Health and wellbeing**: School education should be a wholesome experience for students. Students should acquire Knowledge, Capacities, and Dispositions that promote mind-body wellness.
3. **Democratic participation:** This requires appropriate knowledge capacities, values, and dispositions so that an individual may be oriented towards sustaining and improving the democratic functions of Indian society.
4. **Economic participation:** Education should work as an enabler for a healthy democracy as well as a healthy economy.
5. **Cultural and social participation:** Along with democracy and economy, society, and culture also play an important role in the mode of associated living. An individual should acquire capacities and a disposition to contribute meaningfully to culture.

For a more detailed explanation, please refer to the National Curriculum Framework: School Education 2023 (p.45-51, p.88-92, p.101-102, p.116-121)

NATURE OF THE SUBJECT: MATHEMATICS

(Adapted from the CBSE Learning Standards document. Please refer to it here: https://cbseacademic.nic.in/cbe/documents/Learning_Standards_Maths.pdf)

“Mathematics, as an expression of the human mind, reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality”- Courant and Robbins

Mathematics has been a part of everyone’s life, be it estimates we make in our routine activities or precise calculations for various transactions and fairness in sharing or in describing objects around us. The relevance of mathematics is more than its utilitarian value. It helps us to think and reason about the world around us and take informed decisions, be it at the individual level to cope with life in various spheres of activity or at the societal level to contribute to technological and socio-economic development.

Given these reasons, it is not surprising that mathematics education has been made compulsory at the school level and is one of the first subjects encountered by the learner entering formal schooling. The focus of school mathematics is developing the problem solving and reasoning skills needed to have an organised and progressing society. This includes reflecting on and studying problems and topics which may be perceived as more of an intellectual exercise and not immediately useful at this stage. However, these have unforeseen far-reaching benefits. It must be emphasized that the selection of such study material must be made in a manner such that mathematics will not be a burden to the learner but an engaging and joyful activity.

Mathematical objects and ideas are abstract – created by humans from the needs of science, economics, statistics and any kind of quantitative analysis needed in daily life. That is, they have no physical properties such as size, colour, smell, taste, texture, sound and so on. Mathematical ideas are formed by classifying similarly related and commonly noticed properties. This leads to the pedagogical challenge of making these ideas experiential. For example, Number, which is a root concept is derived by providing experiences of collections of the same number of objects. The concept of addition is built on the concept of number, and it then becomes the pre-requisite concept for viewing multiplication as repeated addition. This in turn builds on to the understanding of higher concepts. Thus, mathematics builds up from the bottom i.e., from axioms and definitions in a structured and hierarchical way as a vast network of interlinked concepts.

It is well recognized how rigid mathematics is, i.e., $2 + 2 = 4$ and not 5 or 22. However, new mathematics can and has been discovered based on $2 + 2 = 22$ i.e., based on how the rules are modified. At the same time, this ‘rigid’ structure is free from perspectives and subjectivity. Mathematical truth, once established and consistent with existing results, lasts forever.

Therefore, after the meaning of various mathematical objects and ideas are understood, one can engage with these, and discover their properties. Thus, with proper facilitation, a learner can be mostly self-dependent in learning mathematics and can even be given a glimpse of how math progresses or branches off if rules are changed.

To communicate mathematical ideas, mathematicians have, over the years, developed the language of mathematics which has vocabulary, symbols, and sentence structure and is characterised by both precision and concision. Mathematical language supports in communicating mathematical ideas or concepts during discussions in the classroom and leads to representing ideas, observing and generalizing patterns, communicating thought processes and justifying their discoveries and learning. However, it does bring its own pedagogical challenges when learners are not conversant in this language or when the language used is not age appropriate.

Assessment in mathematics has to encompass both the nature of mathematics and the difficulties which the learner faces because of it. When assessment is cognizant of the limitations of the learner and the constraints and affordances of the nature of the subject, it enables the learner to harness the power of mathematics and the teacher to enable the learner to do this.

The structured lesson plans in this book are rooted in the vision of the National Education Policy 2020, operationalized by the National Curriculum Framework: School Education 2023, and based on the Learning Outcomes from NCERT's Learning Outcomes at the Secondary Stage. The following content has been adapted from the original documents to provide context and explanation for the pedagogical practice behind the development of these lesson plans.

NCERT Curricular Expectations for the Secondary Stage:

For detailed Learning Outcomes and suggested Pedagogical Processes, please refer to the **NCERT Learning Outcomes at Secondary Stage**

MATHEMATICS Curricular Expectations

At this stage learners are expected to develop ability and attitude for—

- mathematisation (ability to think logically, formulate and handle abstractions) rather than knowledge of procedures (formal and mechanical).
- mathematical vocabulary.
- consolidation and generalisation of the concepts learnt so far.
- understanding and proving mathematical statements.

- addressing problems that come from other domains such as science and social sciences.
- integration of concepts and skills that the children have learnt into a problem solving ability.
- analysing and constructing the processes involved in mathematical reasoning.
- establishing linkages between mathematics and daily life experiences and across the curriculum.

Aims of Mathematics

Mathematics helps students develop not only basic arithmetic skills, but also the crucial capacities of logical reasoning, creative problem solving, and clear and precise communication (both oral and written). Mathematical knowledge also plays a crucial role in understanding concepts in other school subjects, such as Science and Social Science, and even Art, Physical Education, and Vocational Education. Learning Mathematics can also contribute to the development of capacities for making informed choices and decisions. Understanding numbers and quantitative arguments is necessary for effective and meaningful democratic and economic participation.
Mathematics thus has an important role to play in achieving the overall Aims of School Education. The specific aims of Mathematics Education in this NCF are as follows:

a. Basic Numeracy. Numbers and quantities along with words (language) are the two ways in which human beings understand and interpret the world. Numbers and quantities also play a very important role in day-to-day interactions within a complex society. Fluency in quantifying and performing calculating is essential for basic daily interactions, such as shopping and banking. Mathematics Education in schools should ensure that all students are fluent in basic numeracy. This would include not just fluency in numbers and number operations using Indian numerals, but also the capacities to handle situations that involve space and measurement.
b. Mathematical Thinking. Mathematical thinking involves systematic and logical ways to think about and interpret the world. The capacities for identifying patterns, explaining patterns, quantifying and measuring, using deductive reasoning, working with abstractions, and communicating clearly and precisely are some illustrations of mathematical thinking. Mathematics Education in schools should aim for developing such mathematical thinking in all students.
c. Problem Solving. The capacity to formulate well-defined problems that can be solved through mathematical thinking is an important aspect of learning Mathematics. Clear and precise formulation of problems and puzzles, knowing the appropriate mathematical concepts and techniques that can model the problems, and possessing the techniques and the creativity to solve the problems are core aspects of problem solving. Mathematics Education in schools should aim for developing such problem-solving capacities in all students. Problem solving also develops the capacities of perseverance, curiosity, confidence, and rigour.

d. Mathematical Intuition. Developing an intuition for what should or should not be true in Mathematics is often just as important as the more formal 'paper - pencil' doing of Mathematics. Focusing on the common themes and patterns of reasoning across mathematical areas, guessing correct answers (in terms of, e.g., 'order of magnitude') before working out precise answers, and engaging in informal argumentation before carrying out rigorous proofs are all effective ways of developing such mathematical intuition in students. Developing such mathematical intuition in all students should be one of the aims of Mathematics Education in schools. 270 Part C National Curriculum Framework for School Education

e. Joy, curiosity, and wonder. Discovering, understanding, and appreciating patterns and other mathematical concepts, ideas, and models can require great creativity and often generates great wonder and joy. To see Mathematics as merely calculations and mechanical procedures is very limiting. Mathematics Education in schools should nurture this sense of joy, curiosity, aesthetics, creativity, and wonder in all students.

For more details on the Aims of specific subjects please refer to the NCFSE following pages: English: p234-267; Mathematics: p268-293; Science: p294-319; Social Science: p320-352.

CLASS - 9

Chapter.1 NUMBER SYSTEMS

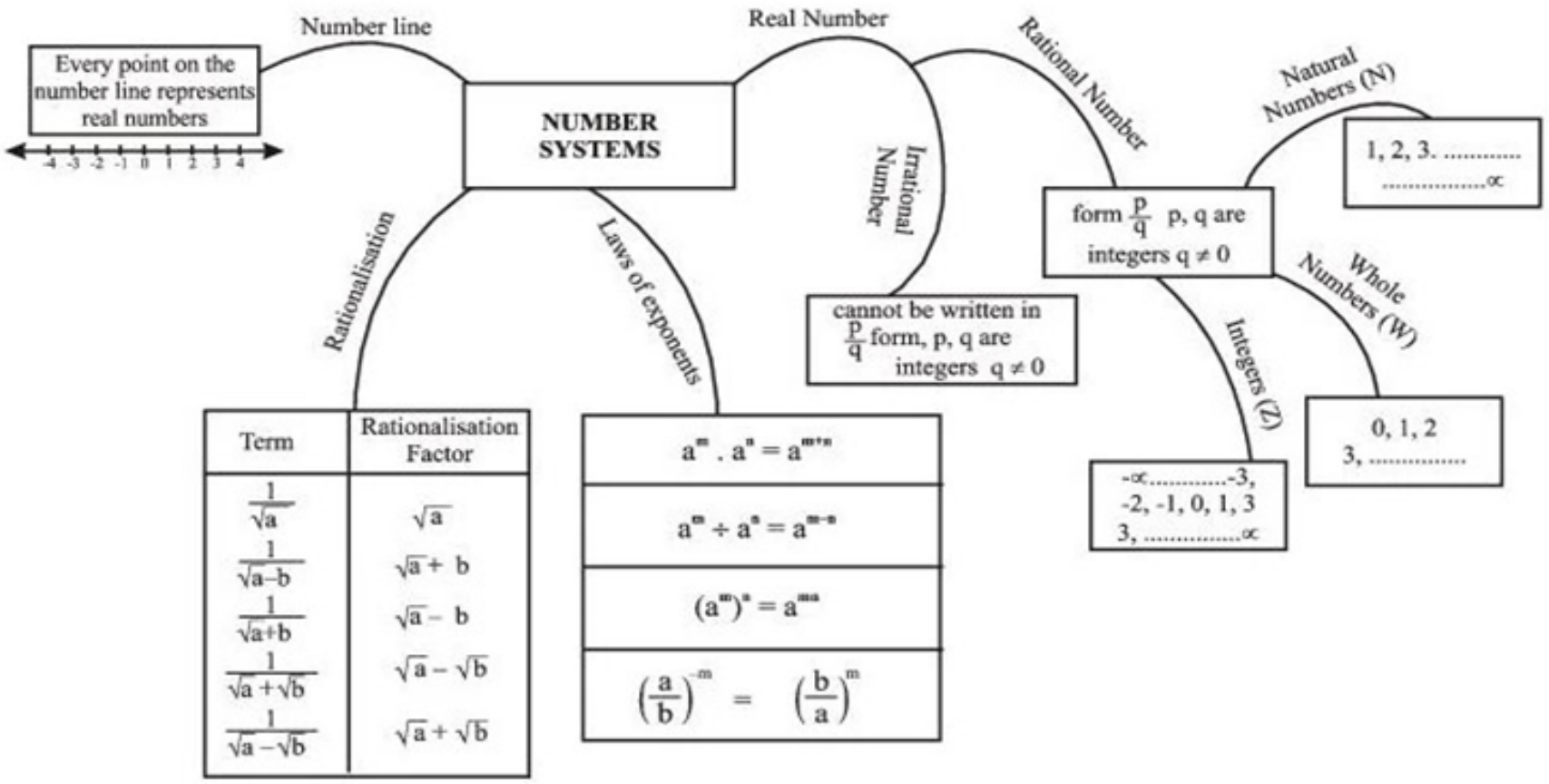
https://epathshala.nic.in/topic.php?id=0962CH01

Introduction

CURRICULAR GOALS	COMPETENCIES
CG-1: Understanding numbers (natural, whole, integer, rational, irrational and real), ways of representing numbers, relationships amongst numbers, and number sets	C-1.1: Develops understanding of numbers, including the set of real numbers and its properties

Key concepts: **1) Rational Numbers 2) Irrational Number 3) Real Numbers and their Decimal Expansions 4) Operations on Real Numbers 5) Laws of Exponents for Real Numbers**

MIND MAP



Term	Rationalisation Factor
$\frac{1}{\sqrt{a}}$	$\sqrt{a}$
$\frac{1}{\sqrt{a}-b}$	$\sqrt{a}+b$
$\frac{1}{\sqrt{a}+b}$	$\sqrt{a}-b$
$\frac{1}{\sqrt{a}+\sqrt{b}}$	$\sqrt{a}-\sqrt{b}$
$\frac{1}{\sqrt{a}-\sqrt{b}}$	$\sqrt{a}+\sqrt{b}$

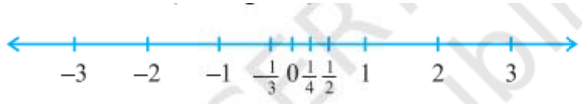
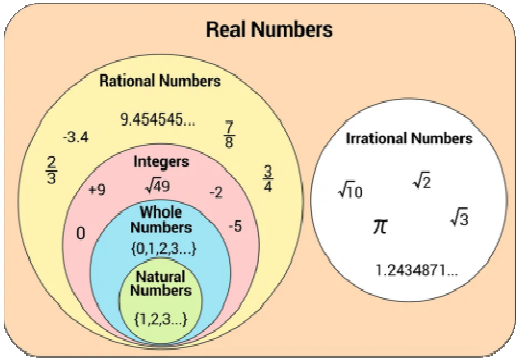
PERIOD WISE PLAN

Period No.	Teaching Topic	Learning Outcomes / Objectives
1	**Rational Numbers**	1. Develop the ability to analyze and differentiate between various types of numbers.
2	**To find numbers between any two given rational numbers**	1. Skill to find numbers between given two rationales/irrationals.
3	**√non a number line**	1. Demonstrate the ability to find numbers between any two given numbers 2. Differentiate andclassify various types of numbers, in collaboration with each other.
4	**Representing √2+√3 on number line**.	1. Able to Design new ways to represent irrational numbers on number line in as many ways as possible. 2. Able to Comprehend that rational numbers and irrationals together form set of Real numbers, through collaborative leaning process.
5	**Real numbers - Decimal expansions to distinguish between rational and irrational numbers**	1. Classify real numbers into rational and irrational numbers based on their decimalrepresentation. 2. Convert rational numbers in the form p/q to decimalform
6	**Rational Numbers in the form of p/q**	1. Classifyrealnumbersintorationalandirrationalnumbersbylookingattheirdecimalrepresentation 2. Convert rational numbers given in their decimal form to the formp/q 3. Find irrational numbers between the given rationalnumbers
7	**Representation of √9. 3 on number line**	1. Represent the given real number on the numberline. 2. Represent √x for any positive integer 'n' on the number linegeometrically.
8	**Operations on real numbers and Rationalization**	1. Able to identify the rationalizing factor. 2. Able to rationalize thedenominator.
9	**Practice Period**	1. Various concepts being applied on number system. 2. Recall the concepts and terms being used in chapter to solve thequestions 3. Critically Apply and solve the questions ofspirals.
10	**Laws of Exponents**	1. Able toExtend laws of exponents for negativepowers. 2. Verify the laws of exponents involving the samebases. 3. Apply the laws of exponents to the realnumbers. 4.Verify the laws of exponents involving different bases but the sameexponents
11	**Application of law of exponents.**	1. Able to understand the Various laws of exponents to operate on real numbers. 2. Critically apply and extend previous knowledge of exponents to irrational numbers
12	**Practice Period**	1. U*nderstand* Various concepts being applied on number system. 2. Recall the concepts and terms being used in chapter to solve thequestions.

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Number System**
Total no. of periods for this chapter:12Period no :1/12
Subtopic:Rational numbers

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materia require**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties Recall of Natural Numbers, Whole Numbers. Integers and Rational Numbers	**(10Min) prerequisite questions** **Teacher asks the following question to test Previous knowledge** **(Teacher note: This is individual work followed by pair sharing and whole group sharing)** Teacher will begin by asking a student to count a specific item in the classroom say fans. As the student counts 1, 2, 3 and so on the teacher will reinforce the concept of counting numbers. Teacher will also ask the students to draw a number line and represent the following: 1) 1+4(reinforcement of natural numbers/counting Numbers denoted by N willbe given) Teacher asks the following question and testing of previous knowledge happens (Teacher note: This is individual work followed by group work) 2) 3-3 (reinforcement of wholenumbers	1) Is every whole number a Natural number? Give reason for your answer 2) Is every integer a rational number? Give reason for your answer	tps://youtu.b ZYYWFeU?s l8uFhvZyxyh **Introductio umber syste min. Byju's v**

Develop the ability to analyze and differentiate between various types of numbers.	importance of adding 0 to natural number system, natural numbers as a part of whole numbers denoted by W) 3) 2-5 (reinforcement of integers, natural numbers, whole numbers as part of integers). Integers are denoted by Z (coming from Greek word Zahlen, meaning tocount). 4) Identify the numbers between -1 and 1?  5. How do we call these numbers? 6.How many such numbers can be identified between -1 and 1? 7.How do we represent these numbers? **(25 mins) Teacher writes the necessaryInstructions on the Board** **(Demonstration / Discussion method)** Teacher reinforces the following concepts by discussion – different types of numbers - Representation of different number sets - Distinguishing the properties of Natural numbers, whole numbers, Integers, rational numbers with suitable examples - Representation of numbers on Number line. Write difference between rational numbers and integers in your own words. Identify the use of rational numbers in your day-to-day	How many more rational numbers can be identified between 3 and 4? How many more rational numbers can be identified between ⅗ and ⅘? Raghu said every natural number is a whole number. Do you agree with him? Give reason with example. Write a number which is a whole number but not an integer?  	

	life? **<u>Activity by Group discussion:</u> (5 mins)** Are there any numbers which cannot be expressed in the form of p/q? Irrational numbers will be introduced.	Flip Learning: Find five rational numbers between 1 and 2.	

Summative assessment plan- only where relevant

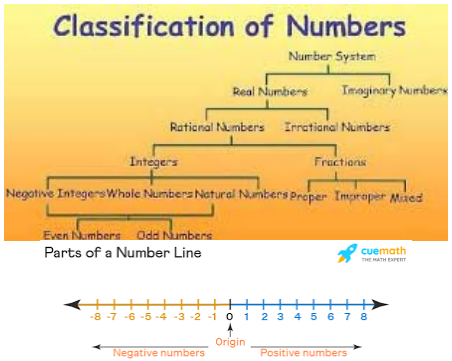
Q1: Are the following statements true or false? Give reasons for your answers.

1. Every whole number is a naturalnumber.
2. Every integer is a rationalnumber.
3. Every rational number is aninteger.

Teachers' reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate them knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: mathematics** **Chapter: Number System** **Total no. of periods for this chapter:12 Period no :2/12** **Subtopic: To find numbers between any two given rational numbers.**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materia require**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties Demonstrate the ability to find numbers between any two given numbers Differentiate and classify various types of numbers, in	**Recapitulation: 5 min** **Brainstorming on the previously taught concept would be done.** **Discussion of topic through Collaborative Learning: 15 min (Critical Thinking, Collaboration)** **An oral quiz will be taken and students will be asked to identify various rational numbers between two given rational numbers and will be able to realize the fact that infinite number of rational numbers can be inserted between two rational numbers and hence like natural numbers and integers there are infinite rational numbers.** **Guided practice: 15 min** **The students, with the help of the facilitator, will solve the questions from NCERT book of Exercise**		tps://youtu.b Eioem7U?si Ai6yTwrARx 6 min. (Tic acLearn Eng ideo relating Operations Real Numbe

collaboration with each other.	**- 1.1 in their notebook in the class with the help of their teacher. The teacher would ensure that each student tries to be independent at the work as well as be under the teacher's guidance.** **Closure: 5 min** **A short oral test would be taken to check proper assimilation of the topic discussed.**		

Summative assessment plan- only where relevant

Q1 :find 6 rational numbers between 3 and 4

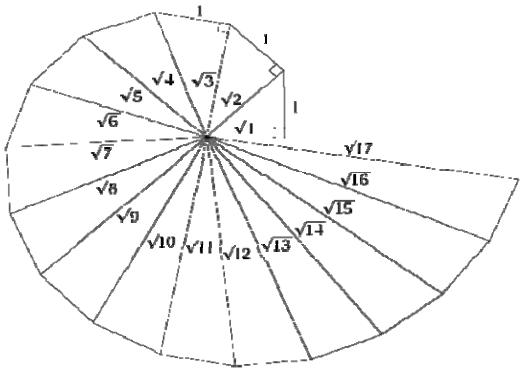
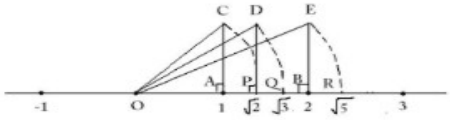
Q 2 :Find five rational numbers between 3/5 and 4/5.

Teachers' reflections and experiences:

i. . Were there any disruptions or behavioral issues that I need to address?
ii. What strategies can I implement to improve classroom management?
iii. Did the students actively participate and show interest in the lesson?
iv. How can I increase student engagement and create a more interactive learning environment?
v. Did I assess student understanding effectively during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Number System** **Total no. of periods for this chapter:12Period no :3/12** **Subtopic:Representation of $\sqrt{n}$on a number line**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties **Able to represent the given real number on the number line.**	**(10 mins)** **Demonstration by Facilitator on Black Board** Ask learners to give the value of $\sqrt{2}$ and learners give its value and reinforcement of irrational numbers will be done. Students will be asked if they can plot it on a number line. Why or why not? The class will begin with an activity on constructing the 'Square Root spiral' on an A4 size colored sheet.	Activity: Each learner will be instructed to follow the following algorithm to construct the square root spiral. 1) Take a point O on a sheet of paper and drawa line segment OA of unitlength. 2) Draw AB perpendicular to OA of unit length. Join OB. 3) Now, draw a line segment BC perpendicularto OB of unit length and joinOC. 4) Again, draw CD perpendicular to OC ofunit length and joinOD.	https://youtu e/IX7rpz2z3A ?si=NKpi82e 4Y50StL **2 min. (Digita Teacher) vide on square roo spiral**

	 **(20 mins) Demonstration by Facilitator on Board** **Interactive Method** Think line: Justify OB = $\sqrt{2}$. Students will be asked to depict $\sqrt{2}$, $\sqrt{3}$, $\sqrt{4}$ on a number line.  **Activity: (10 mins) in class exercise:** The learners will be reinforced to attempt in the notebook. Facilitator will take round and give personal interventions	By continuing in this manner learners will have created a spiral depicting$\sqrt{2}$, $\sqrt{3}$, $\sqrt{4}$… Learners will be asked to show $\sqrt{5}$ on the number line	

Summative assessment plan- only where relevant

Q1 : Represent $\sqrt{3}$ on the number line.

Teachers' reflections and experiences:

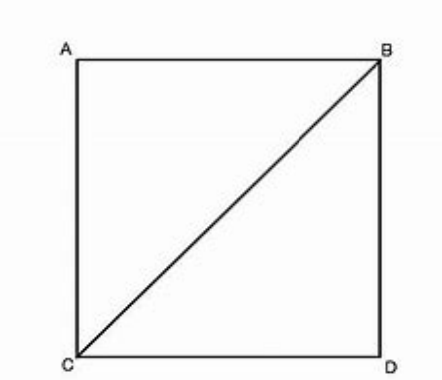
1. Did the students actively participate and show interest in the lesson?
2. How can I increase student engagement and create a more interactive learning environment?
3. Did I assess student understanding effectively during the lesson?
4. Did I provide timely and constructive feedback to guide their learning?
5. How can I improve my assessment and feedback practices?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Number System**

Total no. of periods for this chapter: 12 Period no :4/12

Subtopic:Representing $\sqrt{2}+\sqrt{3}$ on number line.

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.	Material required
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties **Able to Design** new ways to represent irrational numbers on number line in as many ways as possible.	**(15 mins) Warm up** Quick revision on the previous concept would be taken up. Ram says √256 is an irrational number. Do you agree with him? Give reasons. ABCD is a square with 2cm.  Is BC a rational number? Discuss in detail.	The students will solve the questions from NCERT book, solved examples before Ex 1.2 in their notebook in the class with the help of their facilitator. The facilitator would take rounds and help the students in solving the questions. Learners will be asked to show $\sqrt{5}$ on the number line	https://youtu.be/W-466Ek4?si=shxmIdJst7gIjD hin. Khan Academy vic garding 'Square root me number is irration https://youtu.b/IX7rpz2z3Ag?si=NKpi82e_K450StL

Able to **Comprehend** that rational numbers and irrationals together form set of Real numbers, through **collaborative** leaning process.	**(Discussion of topic through Collaborative Learning: <u>25 min</u> (Critical Thinking, Collaboration)** Teacher makes the students into groups and guides the learners to follow the given steps Step1: Represent √2 on number line Step2: Represent √3 on number line Step3: Represent √2+√3 on number line	Represent √5-√2 on number line	**4 min. (Digital Teacher) video on square root spiral**

Summative assessment plan- only where relevant

Q1 : Represent √5 on the number line.

Advanced Learners

Represent √7on the number line

Teachers' reflections and experiences:

1. What were my strengths during the lesson?
2. What areas can I improve as a teacher?
3. How can I continue to develop my teaching skills and practices?
4. Did I encourage self-reflection and metacognition among students?
5. How can I incorporate more opportunities for students to reflect on their learning and assess their own progress?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Number System** **Total no. of periods for this chapter: 12Period no :5** **Subtopic:Real numbers - Decimal expansions to distinguish between rational and irrational numbers**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties • Classify real numbers into rational and irrational numbers based on their	**(10 mins) Warm up** **Demonstration by facilitator on Black Board (Interactive Method)** **Facilitator will ask the following ques fromthe learners** Find the decimal expansions of 10/3, 7/8 and 1/7. Teacher will ask the learners if a rupee is divided among 2 people how much will each get and then the division among four and three people.	The facilitator explains (i) The remainders either become 0 after a certain stage, or start repeatingthemselves. • 1/2 = _____ (terminates after ___ digit) • 3/4 = _____ (terminates after ____ digits) • 5/8 = _____(terminates after ____ digits) (ii) The number of entries in the repeating string of remainders is less than the divisor	https://youtu.b/p-EI9pyMMew?sksei7_rqdnMVA4cR https://youtu.b/6tE5ROMpOo?si=rvfLanfK2AtVk2

decimalrepresentation. Convert rational numbers in the form p/q to decimalform	**(25 min) Demonstration by learners on Board** The facilitator asks some learners to come to the board and ask them to show the division of the above asked rational numbers. Facilitator will ask the learners to do the following questions in their note books **(5 mins) In class Exercise: closure** Look at several examples of rational numbers in the form $\frac{p}{q}$ $(q \neq 0)$, where p and q are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess what property q must satisfy? You know that $\frac{1}{7} = 0.\overline{142857}$. Can you predict what the decimal expansions of $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, $\frac{6}{7}$ are, without actually doing the long division? If so, how?	(in 1/3 one number repeats itself and the divisor is 3, in 1/7 there are six entries 326451 in the repeatingstring of remainders and 7 is thedivisor). (iii) If the remainders repeat, then we get a repeating block of digits in the quotient (for 1/ 3, 3 repeats in the quotient and for 1/ 7, we get the repeating block 142857 in thequotient). • 1/3 = _____- (repeating ___- indefinitely, written as ___) • 2/11 = _____ (repeating ___indefinitely, written as $0.1\overline{8}$) • 7/6 =_____ (repeating ___indefinitely, written as _____) So, on division of rational in the form p by q, two main things happen – either the remainder becomes zero or never becomes zero and we get a repeating string of remainders. - Concept that every rational number has a decimal representation inthe form of terminating decimals ornon-terminating but repeating decimal will be given. iv) An irrational number has a non-terminating and non-recurring decimal representation.eg $\sqrt{2}$	https://youtu.b/SCdhKUkkX?si=QOLjhLoIoi0oYgP **3 to 6 min. (T TacLearn English) video on Decima Expansion of Rational Numbers**

		Write the following in decimal form and say what kind of decimal expansion eac has : (i) $\frac{36}{100}$ (ii) $\frac{1}{11}$ (iii) $4\frac{1}{8}$

Summative assessment plan- only where relevant

Do Q − 1 (iv, v and vi) ,Q − 5 and Q − 9 of Ex 1.3 of NCERT Text Book Class 9

Q.1: Find the decimal expansions of 10/3, 7/8 and 1/7.

Teachers' reflections and experiences:

1. How can I improve my assessment and feedback practices?
2. Was the pacing of the lesson appropriate?
3. Did I cover all the planned content without rushing or leaving gaps?
4. How can I better manage the time allocated for each activity?
5. What were my strengths during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class).

Class: 9th Subject: Mathematics Chapter: Number System

Total no. of periods for this chapter: **12** Period no :6/**12**

Subtopic:**Rational Numbers in the form of p/q**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties • **Classifyrealnumbersintorationalandirrationalnumbersbylookingattheirdecimalrepresentation** • **Convert rational numbers given in their decimal form to**	**(5 mins) Warm up** **Demonstration by facilitator on Black Board** **(Interactive Method)** **Facilitator will ask the following questions from the learners** **To begin with the topic, teacher will ask the learners to find the decimal expansions of 1/3** **In 1/3 one number repeats itself and the divisor is 3** **3) If the remainders repeat, then we get a repeating block of digits in the quotient (for 1/ 3 , 3 repeats in the quotient and for 1/ 7, we get the repeating block 142857 in the quotient).** **So, here on division of *p* by *q*, we get a repeating string of remainders.** **Example 7 :** Show that $0.3333... = 0.\bar{3}$ can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.	Exercise: classify each number as either rational or irrational. 1. 3.25 2. √16 3. 0.333... 4. -5/7 5. 0.525252... 6. √25 7. 0.777...	**https://youtu.b/bSC99nmb1a?si=eATqE3c34AaSQfY** **6 min. Tic TacLearn English video on Converting decimals into p/q form.**

the formp/q **Find irrational numbers** **between the given** **rationalnumbers**	Since we do not know what 0.3 is , let us call it 'x' and so $x = 0.3333...$ Now here is where the trick comes in. Look at $10x = 10 \times (0.333...) = 3.333...$ Now, $3.3333... = 3 + x$, since $x = 0.3333...$ Therefore, $10x = 3 + x$ Solving for x, we get $9x = 3$, i.e., $x = \frac{1}{3}$ **(30 min) Demonstration by facilitator on Board** **What if the decimal form of a number is given and we are supposed to convert it in the form p/q of a rational number. Teacher will explain the topic onblackboard** 5 MINS EXERCISE: classify each number as either rational or irrational Teacher writes some real numbers on the black board and ask the students to classify them as rational or irrational at glance and give reason	8. 2/3 9. π (pi) 10. √10 Classification: 1. 3.25 - Rational (terminating decimal) 2. √16 - Rational (√16 = 4, a whole number) 3. 0.333... - Rational (repeating decimal, 0.333... = 1/3) 4. -5/7 - Rational (fraction) 5. 0.525252... - Rational (repeating decimal, 0.525252... = 52/99) 6. √25 - Rational (√25 = 5, a whole number) 7. 0.777... - Rational (repeating decimal, 0.777... = 7/9) 8. 2/3 - Rational (fraction) 9. π (pi) - Irrational (non-repeating, non-terminating decimal) 10. √10 - Irrational (non-repeating, non-terminating decimal)	
Summative assessment plan- only where relevant			

1 Write three numbers whose decimal expansions are non-terminating non-recurring.

2. Find three different irrational numbers between the rational numbers $\frac{5}{7}$ and $\frac{9}{11}$.

Teachers' reflections and experiences:

1. How well did I manage the classroom during the lesson?
2. Were there any disruptions or behavioral issues that I need to address?
3. What strategies can I implement to improve classroom management?
4. Did the students actively participate and show interest in the lesson?
5. How can I increase student engagement and create a more interactive learning environment?

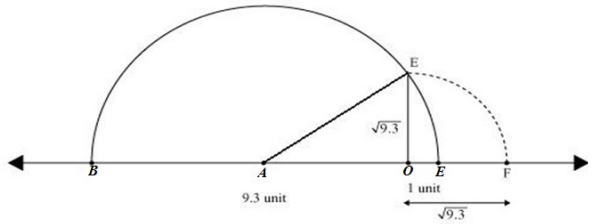
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: Number System

Total no. of periods for this chapter: **12.** Period no :7/**12**

Subtopic:**Representation of√9. 3 on number line**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties Represent the given real number on the numberline. Represent √x for any positive integer 'n' on the number linegeometrically.	**(5 mins)** **Demonstration by facilitator on Black Board (Interactive Method)** Learners will recall different visualization representing √x on the number line. Like Pythagoras theorem and spiral method. They will now observe another visualization. Represent √x on the number line **(25 min) Demonstration by facilitator on Board** Learners will be given following algorithm to find the square root of a positive real number on the number line 1. **Draw a line segment of lengthx.** 2. **From the point B, mark a distance of 1unit and mark the new point asc.** 3. **Find the midpoint of AC and markthat point asO.** 4. **Draw a semicircle with center O and radius OC.** 5. **Draw a line perpendicular to AC passing through B and intersecting the semi-circle atD.**	Here are some other examples of Pythagorean triples: 1. $(5, 12, 13)$: $5^2 + 12^2 = 13^2$ 2. $(8, 15, 17)$: $8^2 + 15^2 = 17^2$ 3. $(7, 24, 25)$: $7^2 + 24^2 = 25^2$ $a^2 + b^2 = c^2$ (3,4,5) (6,8,10) (7,24,25) (5,12,13) (20,21,29) (8,15,17) (20,99,101) (48,55,73) (17, 144, 145) Pythagorean Triples	https://youtu.be/TIxmNNg74?si=POFH0tENIK9SP **4 min. SH SIR CLASSES video on How to represent root 9.3 on numbe line**

	6. **Length BD =$\sqrt{x}$** 7. **With b as center and BD as radius draw an arc which cuts the number line at point E. NowBE=$\sqrt{x}$.** **The teacher will also prove how BD=$\sqrt{x}$ on the BB using Pythagoras theorem.** Activity: (10Minutes) Represent geometrically the following number on the number line: $\sqrt{5.6}$	

Summative assessment plan- only where relevant

Represent v11.4 and $\sqrt{10.6}$ on the number line.

Teachers' reflections and experiences:

1. Was the pacing of the lesson appropriate?
2. Did I cover all the planned content without rushing or leaving gaps?
3. How can I better manage the time allocated for each activity?
4. What were my strengths during the lesson?
5. In what areas can I improve as a teacher?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: Number System

Total no. of periods for this chapter: **12** Period no :8/12

Subtopic:**Operations on real numbers and Rationalization**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties **Able to identify the rationalizing factor.** **Able to rationalize thedenominator.**	**(10 mins) Warm up** **Demonstration by facilitator on Black Board (Interactive Method)** Teacher will reinforce the concept of rational numbers being closed w.r.t addition, subtraction, multiplication and division. Also, rational numbers satisfy commutative, associative and distributive laws for addition and multiplication. However, the sum, difference, product, quotients of irrational numbers are not always irrational though they also satisfy the commutative, associative and distributive laws of addition and subtraction, which will be done via interaction with learners. **(20 min) Demonstration by facilitator on Board** Can we represent $\frac{1}{\sqrt{2}}$ on number line? Can we convert the denominator of the above fraction into a rational number? Rationalizing the denominator Teacher explains the process of rationalizing the denominator and proves $\frac{1}{\sqrt{2}}=\frac{\sqrt{2}}{2}$ Now make the students understand how to represent	**Through examples the following facts will be derived** 1) **The sum or difference of a rational number and an irrational number isirrational.** 2) **The product or quotient of a non-zero rational number with an irrational number is irrational.** 3) **If we add, subtract, multiply or divide two irrationals, the result may be rational or irrational.** **Learners will give quick response to** $\sqrt{a}$ **/**$\sqrt{b}$ **=_____,** $\sqrt{a}$ **x**$\sqrt{b}$**=** **_____,(**$\sqrt{a}$ **+** $\sqrt{b}$**)(** $\sqrt{a}$ **-** $\sqrt{b}$**)=_____** **(**$\sqrt{a}$**+** $\sqrt{b}$**)²=_____,** **(** $\sqrt{a}$ **-** $\sqrt{b}$**)²=___** **Teacher will then explain that Rationalization is the process to remove the surds in the denominator of a fraction.**	**https://youtu.b /DSN4CetgtE ?si=Jt9pVKbQ e_vrxQy** **10 min. (Topp class 8-10) Video relating to rationalize the denominator**

	it on number line The same process can be continued to rationalize denominators of (i) $\frac{1}{2+\sqrt{3}}$ (ii) $\frac{1}{7+3\sqrt{2}}$ **(10 mins) In class Exercise: closure** **Teacher asks students to rationalize the denominator of 5/(√7-√2) and submit it within given time** **Think line:** **Why do we rationalize the denominator?**	Rationalise the denominator of $\frac{1}{2+\sqrt{3}}$. **2.** Simplify each of the following expressions: (i) $(3+\sqrt{3})(2+\sqrt{2})$ (ii) $(3+\sqrt{3})(3-\sqrt{3})$ **5.** Rationalise the denominators of the following: (i) $\frac{1}{\sqrt{7}}$ (ii) $\frac{1}{\sqrt{7}-\sqrt{6}}$	

Summative assessment plan- only where relevant

Rationalize: 1/ (√5 + √3)

Teachers' reflections and experiences:

1. What strategies can I implement to improve classroom management?
2. Did the students actively participate and show interest in the lesson?
3. How can I increase student engagement and create a more interactive learning environment?
4. Did I assess student understanding effectively during the lesson?
5. Did I provide timely and constructive feedback to guide their learning?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: **Number System**

Total no. of periods for this chapter:12 Period no :9/12

Subtopic**Practice Period**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties 1. Various concepts being applied on number system. 2. Recall the concepts and terms being used in chapter to solve thequestions 3. **Critically Apply** and	**Teacher makes the students into groups, ask them to solve the following questions and present the solutions in front of the class** If x= $2+\sqrt{3}$, find the value of $(x-\frac{1}{x})^2$ If a=1- $\sqrt{5}$, find the value of $a^2 - 1/a^2$ Simplify: $$\frac{6}{2\sqrt{3}-\sqrt{6}}+\frac{\sqrt{6}}{\sqrt{3}+\sqrt{2}}-\frac{4\sqrt{3}}{\sqrt{6}-\sqrt{2}}$$ Express each of the following recurring decimals as a rational number p/q i. 0.127 ii. 0.3578 iii. 0.7435 Show that: $$\frac{1}{3-\sqrt{8}}-\frac{1}{\sqrt{8}-\sqrt{7}}+\frac{1}{\sqrt{7}-\sqrt{6}}-\frac{1}{\sqrt{6}-\sqrt{5}}+\frac{1}{\sqrt{5}-2}=5$$	. If a,b and c are rational numbers, find their values in each of the following i. $\frac{5+2\sqrt{3}}{7+4\sqrt{3}}=a+b\sqrt{3}$ ii. $\frac{\sqrt{2}+\sqrt{3}}{\sqrt{18}-\sqrt{12}}=a-b\sqrt{6}+c\sqrt{3}$ Simplify: $\sqrt[4]{81}-8\sqrt[3]{216}+15\sqrt[5]{32}+\sqrt{225}$	https://youtu.be/L! JCll5cnk?si=6s1p4 Nkuf7kjXS **4 min. BYJU'S vid on Visualizing Square Roots**

solve the questions ofspirals.			

Summative assessment plan- only where relevant

Represent square root of 7 and 9 by constructing a square root spiral.

Teachers' reflections and experiences:

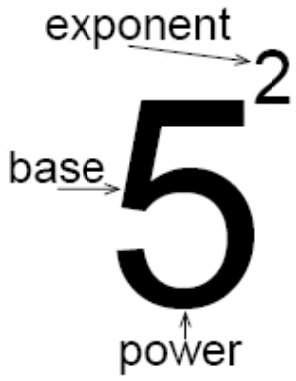
1. How can I better manage the time allocated for each activity?
2. What were my strengths during the lesson?
3. In what areas can I improve as a teacher?
4. How can I continue to develop my teaching skills and practices?
5. Did I encourage self-reflection and metacognition among students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: **Number System**

Total no. of periods for this chapter:12 Period no :10/12

Subtopic:**Laws of Exponents**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties Able to • **Extend laws of exponents for negativepowers.** • **Verify the laws of exponents involving the samebases** • **Apply the laws of exponents to the realnumbers.** • **Verify the laws of**	**(5 mins) Warm up** **Demonstration by facilitator on Black Board (Interactive Method)** 2^3 is read as "2 raised to the power of 3" or "2 cubed" and means $2\times2\times2=8$ 5^2 is read as "5 raised to the power of 2" or "5 squared" and means $5\times5=25$ **(30 min) Demonstration by facilitator on Board** The facilitator explains the to the learners and ask them to give suitable examples **$6^1 = 6$** **$7^0 = 1$** **$4^{-1} = ¼$** **$x^2x^3 = x^{2+3} = x^5$** **$x^6/x^2 = x^{6-2} = x^4$** **$(x^2)^3 = x^{2\times3} = x^6$** **$(xy)^3 = x^3y^3$** **$(x/y)^2 = x^2 / y^2$**	 **Through examples the following laws will be derived** **Laws of Exponents** **$x^1 = x$** **$x^0 = 1$** **$x^0 = 1$**	 **https://youtu.b/EjpIG3hrz1E?=WzIQfKY4Gnc03ID** **6 min. Byju's video relating to visualizatio of exponents and powers**

exponents involving different bases but the sameexponents	$x^{-3} = 1/x^3$ **And the law about Fractional Exponents:** **Activity: (5 minutes)** **Question 1:** Simplify the following expressions: **(i) $(3/4)^8 \times (4/3)^5$ (ii) $(5/7)^5 \times (5/7)^{-6}$** **Question 2:** Express each of the following as rational numbers: **(i) $(4/5)^4$ (ii) $(64/81)^{3/2}$ (iii) $(-2/5)^{-4}$**	$x^m x^n = x^{m+n}$ $x^m/x^n = x^{m-n}$ $(x^m)^n = x^{mn}$ $(xy)^n = x^n y^n$ $\cdot (x/y)^n = x^n/y^n$ $x^{-n} = 1/x^n$ $x^{\frac{m}{n}} = \sqrt[n]{x^m}$ $= (\sqrt[n]{x})^m$	

Summative assessment plan- only where relevant

Find : (i) $64^{\frac{1}{2}}$ (ii) $32^{\frac{1}{5}}$ (iii) $125^{\frac{1}{3}}$

Simplify : (i) $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$ (ii) $\left(\frac{1}{3^3}\right)^7$ (iii) $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$

Teachers' reflections and experiences:

1. Did the students actively participate and show interest in the lesson?
2. How can I increase student engagement and create a more interactive learning environment?

3. Did I assess student understanding effectively during the lesson?
4. Did I provide timely and constructive feedback to guide their learning?
5. How can I improve my assessment and feedback practices?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: **Number System**

Total no. of periods for this chapter:12 Period no :11/12

Subtopic:**Application of laws of exponents.**

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties - Able to understand the Various laws of exponents to operate	**Recapitulation: 5 min** Oral Test would be taken up. **Discussion of topic through Collaborative Learning: 15 min** Application of law of exponents. **Independent Practice:15 mins** Students will complete the remaining HW parts given in the	The students, with the help of the facilitator, will solve the questions from NCERT book of Exercise – 1.5 in their notebook in the class with the help of their teacher. Simplify: $\frac{6}{2\sqrt{3}-\sqrt{6}}+\frac{\sqrt{6}}{\sqrt{3}+\sqrt{2}}-\frac{4\sqrt{3}}{\sqrt{6}-\sqrt{2}}$.	https://www.youtu com/live/bn1H99J5 c?si=tjrmPERYAv5 5Uf **34 min. BYJU'S video on Operatio on Real Number and Laws of Exponents**

on real numbers. - **Critically** apply and extend previous knowledge of exponents to irrational numbers.	monthly planner of Exercise 1.5 in their Math HW notebook. **Closure: <u>5 min</u>** Summarization would be taken to check proper assimilation of the topic discussed.		

Summative assessment plan- only where relevant

1. Find: (i) $64^{\frac{1}{2}}$ (ii) $32^{\frac{1}{5}}$ (iii) $125^{\frac{1}{3}}$
2. Find: (i) $9^{\frac{3}{2}}$ (ii) $32^{\frac{2}{5}}$ (iii) $16^{\frac{3}{4}}$ (iv) $125^{\frac{-1}{3}}$
3. Simplify: (i) $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$ (ii) $\left(\frac{1}{3^3}\right)^7$ (iii) $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$ (iv) $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$

Teachers' reflections and experiences:

1. How can I better manage the time allocated for each activity?
2. What were my strengths during the lesson?
3. In what areas can I improve as a teacher?
4. How can I continue to develop my teaching skills and practices?
5. Did I encourage self-reflection and metacognition among students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: **Number System**

Total no. of periods for this chapter:12 Period no :12/12

Subtopic: Practice Period

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
C-1.1: Develops understanding of numbers, including the set of real numbers and its properties *Understand* **3.** Various concepts being applied on number system. **4.** Recall the concepts and terms being used in chapter to solve thequestions	**Recapitulation: 5 min** Oral Test would be taken up. **Discussion of topic through Collaborative Learning: 20 min** With out actual division decide which of following rational numbers have terminating decimal representation? (i) 33/375 (ii) 15/28 (iii) 16/45 (iv) 12/35 (v) 80/27 (vi) 123/1250 Represent $\frac{8}{5}$ and $\sqrt{20}$ on a number line. (a) Represent $\sqrt{5.2}$ on a number line. (b) Visualize 0.436 on the number line Insert 6 rational numbers between $-\frac{2}{3}$ and $\frac{3}{4}$ Find two irrational numbers between $\sqrt{3}$ and 2. Rationalise the denominator of $\frac{1}{1-\sqrt{7}}$ **Closure: 15 min** Summarization, preferably by a student, would be taken to check	**Independent Practice:** Students would try Level 2 questions from the spiral. Simplify the following: (i) $\sqrt{45}-3\sqrt{20}+4\sqrt{5}$ (ii) $\frac{\sqrt{24}}{8}+\frac{\sqrt{54}}{9}$ (iii) $\sqrt[4]{12}\times\sqrt[7]{6}$ (iv) $4\sqrt{28}\div3\sqrt{7}\div\sqrt[3]{7}$ (v) $3\sqrt{3}+2\sqrt{27}+\frac{7}{\sqrt{3}}$ (vi) $\left(\sqrt{3}-\sqrt{2}\right)^2$ (vii) $\sqrt[4]{81}-8\sqrt[3]{216}+15\sqrt[5]{32}+\sqrt{225}$ (viii) $\frac{3}{\sqrt{8}}+\frac{1}{\sqrt{2}}$ (ix) $\frac{2\sqrt{3}}{3}-\frac{\sqrt{3}}{6}$	https://youtu.be/vLSI5_HKQ 3 min. BYJU'S video Exponents and Pow

5. Critically Apply and solve the questions ofspirals.	proper assimilation of the topic discussed.		

Summative assessment plan- only where relevant

1. If $x = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ and $y = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$, find the value of $x^2 + y^2 + xy$.

2. If $x = \frac{2-\sqrt{5}}{2+\sqrt{5}}$ and $y = \frac{2+\sqrt{5}}{2-\sqrt{5}}$, find the value of $x^2 - y^2$.

Teachers' reflections and experiences:

1. Did I assess student understanding effectively during the lesson?
2. Did I provide timely and constructive feedback to guide their learning?
3. How can I improve my assessment and feedback practices?
4. Was the pacing of the lesson appropriate?
5. Did I cover all the planned content without rushing or leaving gaps?

WORKSHEETS

CHAPTER.1 NUMBER SYSTSEMS – WORK SHEET.1

CHAPTER.1 NUMBER SYSTSEMS – WORK SHEET.2

CHAPTER.1 NUMBER SYSTSEMS – WORK SHEET.3

Reference: NCERT Exemplar

Remedial Teaching:

The following topics has reviewed by taking reteaching classes:

1. Introduction to number system.
2. Irrational Number.
3. Real Number and Their Decimal Expansion.
4. Square root spiral
5. Representation of Real Number on Number Line.
6. Operations on Real Number.
7. Laws of Exponents for Real Number

with explanation of problems and examples.

2.POLYNOMIALS

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https://epathshala.nic.in/topic-d.php?id=0962CH02

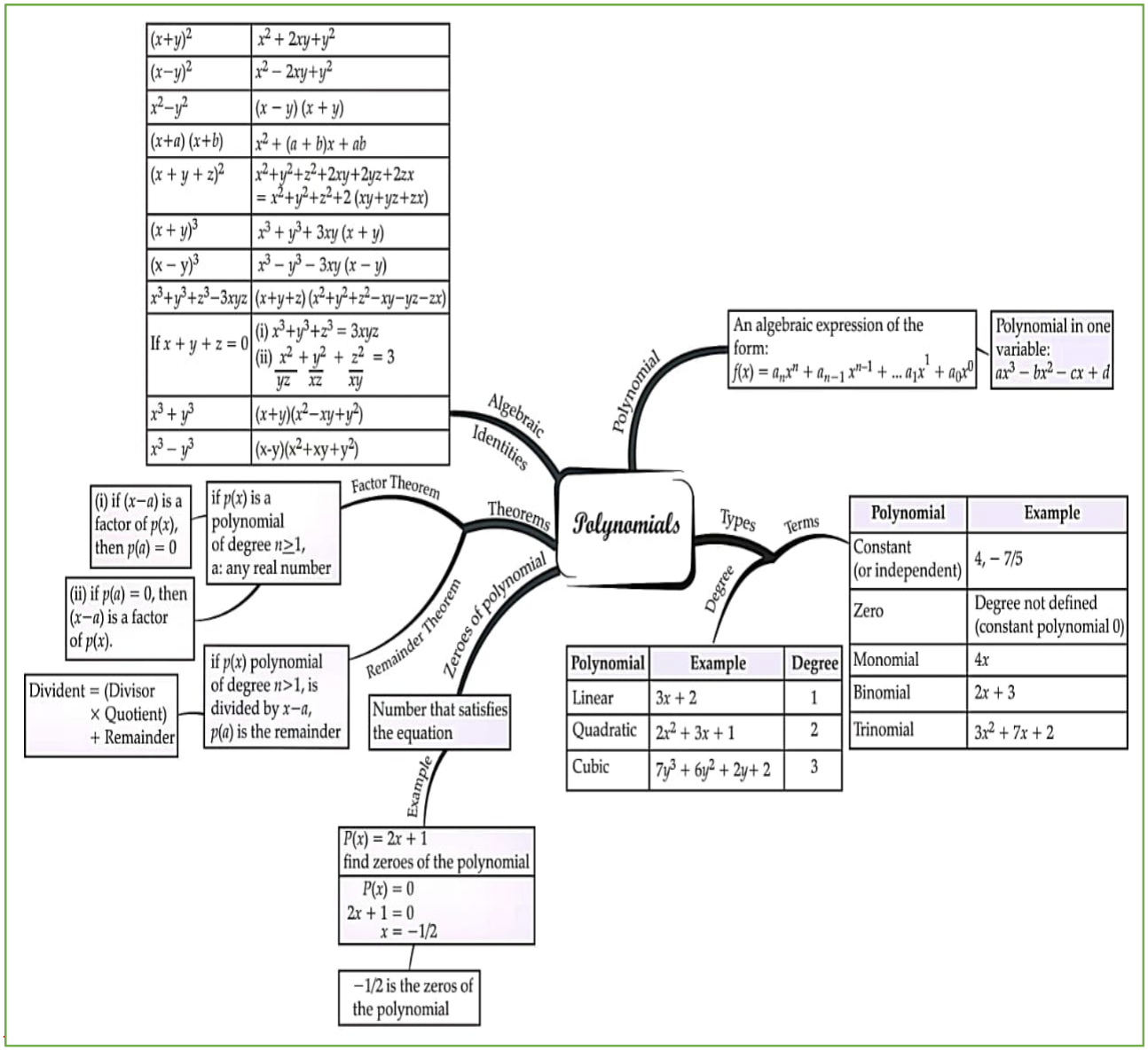
THE FOLLOWING CURRICULAR GOALS (CG) AND COMPETENCIES (C) WILL BE DEVELOPED THROUGH THIS CHAPTER

CURRICULAR GOALS(CG)	COMPETENCIES (C)
CG-3: Discovers and proves algebraic identities and the models real- life situations in the form of equations to solve them	3.1: States and motivates/proves remainder theorem, factor theorem, and division algorithm C-3.2: Models and solves context utilized problems using equations (e.g., simultaneous linear equations in two variable single polynomial equations) and draws conclusions about a situation being modelled

Key concepts: 1. Introduction to Polynomial 2. Polynomials in one variable 3. Zeroes of a polynomial

4.Factorization of a polynomial 5. Algebraic identities

MIND MAP



$(x+y)^2$	$x^2 + 2xy + y^2$
$(x-y)^2$	$x^2 - 2xy + y^2$
x^2-y^2	$(x - y)(x + y)$
$(x+a)(x+b)$	$x^2 + (a + b)x + ab$
$(x + y + z)^2$	$x^2+y^2+z^2+2xy+2yz+2zx$ $= x^2+y^2+z^2+2(xy+yz+zx)$
$(x + y)^3$	$x^3 + y^3 + 3xy(x + y)$
$(x - y)^3$	$x^3 - y^3 - 3xy(x - y)$
$x^3+y^3+z^3-3xyz$	$(x+y+z)(x^2+y^2+z^2-xy-yz-zx)$
If $x + y + z = 0$	(i) $x^3+y^3+z^3 = 3xyz$ (ii) $\frac{x^2}{yz} + \frac{y^2}{xz} + \frac{z^2}{xy} = 3$
$x^3 + y^3$	$(x+y)(x^2-xy+y^2)$
$x^3 - y^3$	$(x-y)(x^2+xy+y^2)$

PERIOD WISE PLAN

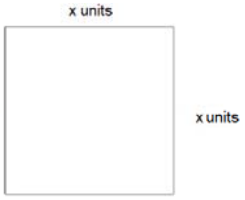
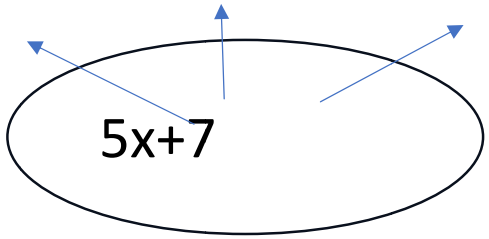
Learning Outcome: **Demonstrates strategies of finding roots and determining the nature of roots of a quadratic equation.**

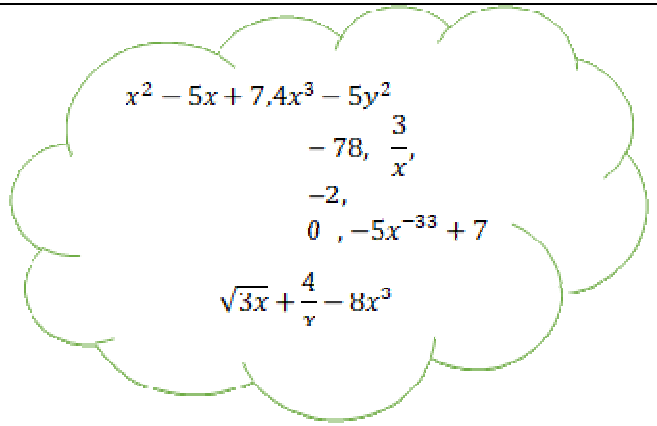
PERIOD NO.	TEACHING TOPIC	LEARNING OUTCOMES/Objectives
1	1.Introduction to Polynomial 2. Polynomials in one variable 3. Zeroes of a polynomial	Differentiates between general algebraic expressions and polynomials. Classifies polynomials on the basis of terms and degree: linear, quadratic and cubic and number of terms: monomial, binomial, trinomial.
2	Types of polynomials (based on number of terms and based on degree)	1.Find the degree of any polynomial and classifies the polynomials as linear, quadratic and cubic 2.Identifies degree of a polynomial
3	Zeroes of a polynomial (linear)	1) Finds the value of polynomial 2) Find the zero of a linear polynomial 3) Verify the given value is zero or not
4	Problems related to zeroes of polynomials	1) Finds the value of polynomial 2) Find the zero of a linear polynomial 3) Verify the given value is zero or not
5	Practice period for the above concepts	Solve Higher order and competency based and value-based questions.
6	Introduction to Remainder theorem and Factor theorem	Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a)
7	Remainder theorem and Factor theorem	Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder Relates the factor theorem to the remainder theorem. Division of polynomial with linear polynomial Understanding Remainder theorem and Factor theorem.

		Solving questions using Remainder theorem and Factor theorem
8	Problems on Remainder theorem and Factor theorem	Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a) and verify using long division. Relates the factors of a polynomial with its zeroes and vice versa Uses given information about the zero or factors of a polynomial to factories it
9	Problems on Remainder theorem and Factor theorem	Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them
10	Remainder Theorem Practice/Remedial Class	Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a) and verify using long division.
11	Finding the value of 'k' type questions	Application of Remainder theorem and Factor theorem
12	Expanding and factorizing using Algebraic Identities	Identifies/ classifies polynomials among algebraic expressions and factors them by applying appropriate algebraic identities. Derives proof of algebraic identities $(x + y + z)^2$; $(x+y)^3$; $(x- y)^3$Applies algebraic identities to factories polynomials
13	Algebraic identities: $(x+y)^3$ and $(x – y)^3$	Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.
14	Algebraic identities – $(x^3 + y^3)$ and $(x^3 – y^3)$	Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities. Apply the concept of factorization to solve daily life situations Derive the proofs of identities of algebraic expressions. Factorizes a polynomial using the appropriate identity

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: polynomials** **Total no. of periods for this chapter:14 Period no :1/14** **Subtopic: (i) Introduction to Polynomials (ii) Polynomials in one variable (iii) Zero of a polynomial**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. **C 3.1:** States and motivates/proves remainder theorem, factor theorem, and division algorithm Differentiates between general algebraic expressions and polynomials. Classifies polynomials on the basis of terms and degree: linear, quadratic and cubic and number of terms: monomial, binomial,	**Teacher asks the following question and testing of Previous knowledge happens (Teacher note: This is individual work followed by pair sharing and whole group sharing) (10 min)** 1. Write a mathematical expression for the following: a. Ram is making packets of buttons. He has packed 2 packets and 3 extras are left. b. Shamla packs lunch box for a company. She packs 3 rotis in one lunch box. At end shed finds 1 roti less for a box. 2. In above expression find the terms. 3. Give some examples of terms. 4. Write 5 algebraic expressions of your own. 5. Identify the constants in the following expressions? $2x + 5{,}3x + 9{,}4x^2 - 8x^3 - 4$ **(Teacher introduce the topic through asking questions) (10 min)** In pairs, write: 1. Two expressions with (a constant) X (a variable), where constant is a number.	**1.5x+8y-12** Identify the variables in the above expression 2.Write any 5 algebraic expressions?	**https://youtu.be/VlW9E59uUy4?si=1hOnMd6**

trinomial.	2. Two expressions with (a constant) X (a variable), where constant takes a fixed value that is known. Teacher draws the below figure:  1. What is the area of a square with the side 'x' unit? Is x^2 an algebraic expression? **(Teacher asks the students to take any 2D figure and prepare algebraic expression using it)** (10 min) **2.** Identify the constants, coefficients, and variables in the expression. $C = 2\pi r$ **Do the following activity:** | | terms | Number of terms | |---|---|---| | 4x | | | | 8x-9p+10 | | | | $7y^2$-8z-10w-20 | | | | 2y-$10x^3$ | | | What do you call a constant that is multiplied by a variable. what is the coefficient of x in 3x. observe the following box and answer the following questions	 Observe the above figure and identify the following 1. Algebraic expression 2. Terms 3. Number of terms 4. Coefficient of x 5. constant Formative Assessment: 1. Write 3 algebraic expressions which are not polynomials?2. 2. Write the coefficient of each term $-x^3 + 7x^2 - 8x + 9$ 3. How can you justify that 9 inthe above polynomial is a constant? 4. Why x^{-5} is not a polynomial?	**K891BF** **Teache can use 12 mi videoma by Tut Mate a referen (or to explain) intro c Polynon s in det**

	 1. Identify the expressions whose powers are whole numbers? What are such expressions called? 2. Identify the expressions whose powers are not whole numbers? What are such expressions called? **Activity** (10 min) 1. Identify polynomials in the following: $x^2 - 5x + 7, \sqrt{2}t + \frac{1}{t}, 3x^3 - 5y^2 + 7,$ $t^3 - t^2 - t, x^{50} + y^{100} - t^0$ Write which among them are polynomials in one variable. 2. Write the 3 examples for **-** Binomial, Polynomial, monomial, trinomial	1. Match polynomial to its type: Set A – $2x^3 + 5x + 3$, - 4x, y + 2, $3y^3 + 2y^2$ - 7y – 2 Set B - Binomial, Polynomial, monomial, trinomial 2. Write any five polynomials. Share it with your friend next to you. Tell the type of polynomials that your friend has framed. **Assignment:** 1. 1Give examples of polynomials.	

		2. Is 2, –5, 7, Are they polynomials? If so, what do you call such polynomials? 3. Is 0 a polynomial? Explain	

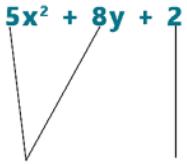
Summative assessment plan- only where relevant

1. Write any 3polynomials with 4 terms.
2. In the polynomial $a_3y^3 + a_2y^2 + a_1y + a_0$, Identify the constant term and coefficient of y^3.
3. Write a polynomial whose sum of coefficients is 0.

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**	
Total no. of periods for this chapter:14 Period no :2/14			
Subtopic: Types of polynomials (based on number of terms and based on degree)			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. **C 3.1:** States and motivates/proves remainder theorem, factor theorem, and division algorithm **Learning outcome:**	**Testing of Prerequisite knowledge** **5 min** **Whole class discussion** **identify the polynomials** $x^2+5x+6, 5x^7-8x^4+9x+8, x+\frac{1}{x}, x^{-10}, 0,3,4x^{-1}$ **What is the coefficient of x^2 in the polynomial** x^3-5x^2-6x-9 **What is the leading coefficient in the polynomial** $2x^5-3x^4-7x^3+9$ **Identify coefficients and constant in the following figure and also write number of terms**	Types of polynomials both terms and based on degree slips flash cards	https://youtu.be/bhHmc_YOIEc?si=csJ2MfiEyKgQaRSG

Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities. Learning objectives: 1.Find the degree of any polynomial and classifies the polynomials as linear, quadratic and cubic 2.Identifies degree of a polynomial	 **Introduction of the topic: whole class activity (30 minutes)** Look at the following polynomials: $p(x) = 3x^7 + 4x^6 - 2x^2 + 5x - 3.$ $r(y) = 5y^6 - 4y^3 + y^2 + 1$ $f(t) = 3 - 2t^2 + 5t^3$ $q(m) = 7$ $f(x) = 5 + 3x - 9x^2$ $p(z) = 2z - 5$ What is the term with the highest power of x? What is the exponent in that term?	Look at the polynomial and answer $5x^4y^3 + 3x^2 - 4y^8 - 2x^2y$ ·Degree of each term ·Leading term ·Degree of polynomial Coefficients Leading Coefficient Complete the table	**Teacher can use t 7 min. video to explain/r force the topic typ of polynom prepared by Let's**

The teacher introduces the degree of polynomials, non – zero constant polynomials and zero polynomials

What is the degree of a non-zero constant polynomial?

What is the degree of the zero polynomial?

Activity:

Given the polynomial, identify the coefficients and degree of each term:

$4x^4 + 5x^2 + 8 - 3x - x^3$

First term: degree= coefficient =

Second term: degree= coefficient =

Third term: degree= coefficient =

Fourth term: degree= coefficient =

Fifth term: degree= coefficient =

What is the leading coefficient?

What is the degree of the leading term?

What is the degree of the polynomial?

Now observe the polynomials

$p(x) = 4x + 5$,

$q(y) = 2y$,

Name of the polynomial	No.of Terms	Example
Monomial		
Binomial		
Trinomial		

Fill the table and write your observation

Degree	Maximum No. of Terms in the Polynomial
1	
3	
7	

	$r(t) = t + 2$ $s(u) = 3 - u$. Do you see anything common among all of them? What is the degree of each polynomial? The teacher introduces linear polynomials. In pairs, write three linear polynomials. Would you be able to find linear polynomials in x with 3 terms? Write the general form of a linear polynomial. Now consider the polynomials $2x^2 + 5, 3x^2 - 3x - \pi, x^2, x^2 + \frac{5}{2}x$ Do you see anything common among all of them? What is the degree of each polynomial? The teacher introduces quadratic polynomials. Can you write a quadratic polynomial in one variable with four different terms?	1. Write 3 linear polynomials? 2. Write 3 monomials? 3. Give an example which is a multinomial but not a polynomial? In the general form of a linear polynomial $ax + b$, where a and b are constants and $a \neq 0$ Why $a \neq 0$? Verify the following given polynomials are quadratic or not. $5 - y^2$, $4y + 5y^2$ $6 - y - y^2$.	

	Write the general form of a quadratic polynomial. Teacher Note: Teacher should ensure that the students to identify the general form of the quadratic polynomial Is $ax^2 + bx \quad + c$(a≠0) Now consider the following polynomials $3x^3 + 2x^2 + 5, 4x^3 - 3x^2 - 3x - \pi, x^2, x^3 + \frac{5}{2}x^2 - 9$ What is the degree of each polynomial? How many terms do you think a cubic polynomial in one variable can have? Write a general form of a cubic polynomial. Teacher Note: Teacher should ensure that the students to identify the general form of the cubic polynomial Is $ax^3 + bx^2 + cx + d$ where (a≠0) Recapitulation: (5 minutes)	Classify the polynomials by degree and number of terms Polynomial / Degree / Classify by degree / Classify by number of terms 5 $2x - 4$ $3x^2 + x$ $x^3 - 4x^2 + 1$ $3x^4 - 4x^3 + 6x^2 - 7$ $8x^7 - 7x - 9$ * Formative assessment: 1.what is the degree of zero polynomial? 2. Write the coefficients of x^2 in each of the following: (i) $2 + x^2 + x$ (ii) $2 - x^2 + x^3$ (iii) $\frac{\pi}{2}x^2 + 5$ 3. Give one example each of a binomial of degree 35, and of a monomial of degree 100. By observing linear, quadratic and cubic polynomial write general form of a nth degree polynomial	
Summative assessment plan- only where relevant			

1.what is the degree and coefficient of x^3 the polynomial $7x^5 - 4x^3 + 3x^2 + 2x - 5$

2. Classify the following as linear, quadratic and cubic polynomials.

(i) $x^2 + x$ (ii) $x - x^3$ (iii) $y + y^2 + 4$ (iv) $1 + x$

(v) $3t$ (vi) r^2 (vii) $7x^3$

3. Sheetal says she could write a binomial with degree 2. Do you agree with her. Explain with an example.

Value based question: Dr.BR Ambedkar gurukulam karapudi students wanted to donate some amount to old people. So, in class IX $\frac{1}{8}$ times the square of the total number of students plan to donate to people above the age of 80, $\frac{7}{8}$ the time the number of students pan to donate only to women while 15 students plan to donate for differently-abled people.

Based on the above information, answer the following questions.

1. Using the above information, express the number of students donated as a polynomial p(x) if the total number of students is x.
2. Find the coefficient of x in the polynomial.
3. Name the type of polynomial based on degree and based on terms.
4. Value of p(x) at x = 40

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Class: 9th **Subject: Mathematics** **Chapter: Polynomials**

Total no. of periods for this chapter:14 Period no: 3/14

Key concepts: 1. Introduction to polynomial 2. Types of polynomials 3. zeroes of a polynomial

4.Reminder Theorem 5. Factor Theorem 6. Algebraic identities

Subtopic: Zeroes of a polynomial (linear)

<table>
<tr><th>Learning Outcomes & Indicators/micro-competencies</th><th>Teaching-Learning Process
This should include activities to facilitate learning along with broad time duration</th><th>Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.</th><th>Material required</th></tr>
<tr><td>CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them.

C 3.1: States and motivates/proves remainder theorem, factor theorem, and division algorithm</td><td>Teacher asks the following question and testing of Previous knowledge happens (Teacher note: This is individual work followed by pair sharing and whole group sharing

1. Individually complete the table. (10 min.)
<table><tr><td>Degree</td><td>Name</td><td>Example</td><td>Number of terms</td></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td></tr></table></td><td>Find p(0), p(1) and p(2) for each of the following polynomials:
(i) $p(y) = y^2 – y + 1$ (ii) $p(t) = 2 + t + 2t^2 – t3$
(iii) $p(x) = x^3$ (iv) $p(x) = (x – 1)(x + 1)$</td><td></td></tr>
</table>

Learning outcome:

Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.

Learning objectives:

4) Finds the value of polynomial
5) Find the zero of a linear polynomial
6) Verify the given value is zero or not

a. Share it with your friend next to you.
b. Check the table filled by your friend. Do you agree with the examples given by your friend? Explain.

[Teacher's note: Teacher could get the students to pick up one of the examples and explain their agreement or disagreement.]

Zeros of a polynomial

Teacher presents this context: (15 min.)

An experiment is set up. The temperature of the solution is 2 degrees more than the room set up temperature. Which is represented as p(x) = x + 2.

Complete the table to know the temperature of the solution.

Room temperature (in ^{0}C)	10			-4			0
Solution temperature (in ^{0}C)							

[Teacher Note: Teacher to get initial values orally and later to demonstrate how to find value of a polynomial for the values given the table. Later students to take x value of their choice and find the value of p(x).]

Get students to think on what value of x will make p(x) =

$If\ p(x) = x^2 - 4\ then\ P(2) = 0\ and \quad P(-2) = 0$

Justify? What do you say about zeroes of the given polynomial?

https://y
u.be/NP
MIZb68?
t9G3fmz
DuejCX

Teacher can use above 5 min. BIJ video to explain/r force the concept zeros of polynom

	0. Teacher introduces zero of the polynomials. In general, we say that a zero of a polynomial p(x) is a number c such that p(c) = 0. Students individually work on the following problems and share their work with their friends next to them. 1. If P(x)=x-1 then find the value of p (1) and p (-1). 2. Consider the polynomial p(x)=$5x^3 - 2x^2 - 3x + 2$ find the value of p(1) ,p(-1) and p(0). 1. For what values of x, p(x)=x- 1 becomes "0" 2.For what values of y, q(y)=2y-5 becomes zero. 3.Check if 2 is a zero of q(x), where q(x) = x – 2. 4.Verify whether x = - 1, 2 are zeros of the polynomial p(x) = (x – 1) (x – 2) **How do you get zero of the polynomials: (15 min.)** The teacher demonstrates: 1. The zero of the polynomial p(x) = x– 1 is obtained	Complete the table | Linear polynomial	Zero of the polynomials | |---|---| | x | | | $x + a$ | | | $x - a$ | | | ax +b | | | $bx - a$ | | Formative assessment: 1.find the value of $p(0), p(1), P(2)$ of the	

by equating it to 0,

P(x) = 0

i.e., $x - 1 = 0$, which gives $x = 1$.

Teacher introduces, $p(x) = 0$ is a polynomial equation and 1 is the *root of the polynomial* equation $p(x) = 0$.

So, 1 is the zero of the polynomial $x - 1$, or a *root* of the polynomial equation $x - 1 = 0$.

Find the zero of the polynomial equation $2x + 1 = 0$.
$2x = -1$
$x = -1/2$
Consider the constant polynomial 9. Can you tell what its zero is?
If $p(x) = ax + b$, $a \neq 0$, is a linear polynomial, how can we find a zero of p(x)?
Follow the above instructions i.e.,

$$p(x) = 0 \Rightarrow x = -\frac{b}{a}$$

So, $-\frac{b}{a}$ is the zero of $p(x) = ax + b$, $a \neq 0$

In pairs do the activity given below:

Linear polynomial	simplification	Zero of the polynomials
3x		
x-2		
3x+2		

polynomial $p(t) = t^3 - 1$

2. Check whether –2 and 2 are zeroes of the polynomial $x + 2$.

3. If 2 is a zero of the polynomials

$p(x) = 2x^2 - 3x + 7a$, find the value of a.

$5.x^2 + 1$ has no zeros. Why?

<u>Quiz (oral)</u>

Can a zero of a polynomial need to be 0?

Can 0 be a zero of a polynomial.

How many zeros does a linear polynomial have?

Can a polynomial have more than one zero?

How many zeroes does a zero polynomial have?

2x-3			
$\sqrt{2}x + 5$			

Observe and discuss with your partner:

a. How many zeros does a linear polynomial have?
b. Can a zero polynomial need to be 0?
c. Can 0 be a zero of a polynomial?

Guided practice:10min

Exercise 2.2. 1 to 3

Recapitulation: (5 minutes)

Summative assessment plan- only where relevant

1. Identify x = – a/b is zero of which polynomial p(x) = ax + b or q(x) = ax – b.
2. Show that m = -2 is zero /root of the polynomial q(m) = m + 2.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Polynomials**

Total no. of periods for this chapter:14 Period no :4/14

Subtopic: Problems related to zeroes of polynomials

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. **C 3.1:** States and motivates/proves remainder theorem, factor theorem, and division algorithm **Learning outcome:**	<u>Testing Prerequisite Knowledge:</u> 5 minutes I - In pair answer and share: 1. What is the zero of the Polynomial x-2? 2. What is the zero of the Polynomial a x + b? 3. What are the zeroes of the polynomial (x-2) (x-3)? 4. At most how many zeroes does a linear polynomial have? 5. If $p(x)=x^2-3$ then find p (3) and P (0). 6. How do you verify given values are zeroes are not for quadratic and cubic polynomials? II- Activity (Individual): Check if the given zero satisfies the given polynomial	Complete the table x | x^2-x-2 | x^2-6x+9 -1 | | | 0 | | | 2 | $2^2-2-2=0$ |	

Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.

Learning objectives:

Solve problems related to zeroes both higher order and lower order thinking-based questions.

Zero	x-2	X^2-4	X^3-8
2			
-2			
0			

Discuss with your friend:

When do we say a given value of x is zero of a polynomial?

Summarize:

If 'a' is zero of the polynomial p(x), then p(a) = 0.

Teacher orientation:

(25min)

The teacher extends this in finding unknown.

If 5 is the zero of linear Polynomial x- t, what is the value of t?
P(x) = x – t
Since 5 is the zero of x -t,
P(5) = 0
5 – t = 0
t = 5

Students work in pair:

1. If '- 2' is a zero of the polynomial x - m. Find m.
2. If 3 is a zero of the polynomial 2y - c. Find c.

Complete the table

polynomial	Value of x	Verify zero or not
$p(x) = x^2 - 1$	$x = \pm 1$	
$p(x) = 5x - \pi$	$x = -\frac{3}{2}$	

	Higher order thinking question 1. $f(x) = x^3 - 6x^2 + 11x - 6$ 2. Find $f(1), f(-1), f(2), f(-2), f(3), f(-3), f(6) and f(-$ 3. Observe which of the above are equal to zero. 4. Write these values as integral roots. 5. why 1,2 and 3 are zeroes of f(x) Guided practice and recapitulation: (10min) Exercise 2 .2 - 4	$p(x) = 2x - 1$ | $x = -\frac{1}{2}, \frac{1}{2}$ |	

Summative assessment plan- only where relevant

1. *Find the zeroes of the polynomial* $(x+2)^2 - (x-2)^2$
2. *If* $x = 2$ *is a root of the polynomial* $ax^2 - 3x - 10$, *find the value of* a
3. **Find the zeroes of the polynomial** $x^3 + 6x^2 + 11x + 6$.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**	
Total no. of periods for this chapter:14	**Period no :5/14**		
Subtopic: Practise Period – (All types questions non textual questions competency-based questions value-based questions)			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
Learning outcome: **Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.** **Learning objective:** **Solve Higher order and competency based and**	1.if degree of the polynomial $x^3 + 4x^{\alpha-4} + 8x - 7$ is 4. Find the value of α. Here what is the degree off polynomial? Is there any term does have exponent as 4? So $\alpha - 4$ must equal to which value? So, what is the value of α? 2. Find the sum of coefficients of $x^3 and\ x^2$ of the polynomial $4x^7 + 5x^3 - 9x^2 + 4$ 3.what is the degree of polynomial $\sqrt{2}$	Give examples of each of the following. Monomial Binomial Trinomial Linear polynomial Quadratic polynomial Cubic polynomial	

value-based questions.

Complete the table

Name of the polynomial	degree	example
Monomial	100	
Binomial	35	
Trinomial	2	

4.Length and breadth of a rectangle are zeroes of the polynomials x-5 and 2x-8 and respectively are length and breadth of rectangle

Find the area of rectangle

First find zeroes of x-5 and 2x-8.

Now take length and breadth as a zero of the given polynomials and find area of rectangle.

5. If $f(x) = 2x^3 - 13x^2 + 17x + 12$ then find the value of $\frac{f(-3)}{f(-2)}$.

First find the value of $f(-2)$

Then find $f(-3)$.

Find the coefficient of x^2 n the following polynomials.

$$1.\ (x+4)(x+4)(x+4)$$

2. $(2x-5)(2x^2-3x-1)$

Assignment:

1. $If\ g(x) = x^2 - 2\sqrt{2}x + 1$, then find the value of $p(2\sqrt{2})$.

2. show that x=1, x=2 and x=3 are zeroes of the

polynomial $x^3 - 6x^2 + 11x - 6$

3.Verify whether the following are zeroes of the polynomials indicated against them.

$i)\ p(x) = 2x^3 - 13x^2 + 17x + 12$ at x=2, -3

$$ii) p(x) = x^2 + x - 6\ at\ x = -3$$

4. Show that degrees of the following

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rEBKxw
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	Now find $\frac{f(-3)}{f(-2)}$ 6. Charity of the humanitarian act of giving something good to needy people. While doing charity we should not accept anything return. As an act of charity to distribute fruits in an orphanage, Krishna buys x kg apples at the rate of Rs.80 and orange at the rate of Rs.40 per kg for charity. Along that he buys 10kg pomegranate at the rate of Rs.120 per kg. The quantity of oranges is equal to the square of the apple quantity. On the above information answer the following questions. 1.Equation of the total cost of the quantity is? $p(x) = 80x + 40x^2 + 10 \times 120$ $=40x^2 + 80x + 1200$ 2.Equation of total cost of quantity of fruits is? $x^2 + x + 10$ 3.Find the degree of an equation of total cost of quantity 2? 4.find the coefficient of x in equation of the total quantity. 1?	polynomials are Pythagorean triplet. $x^3 + x^2 - x + 1, x^4 - x + 5, x^5 - 7$ 5.Give 2 examples of algebraic expressions 1) polynomial 2) not a polynomial.	**idea on factorisation of quadratic polynomial (made by Learning Notebook).**

	Find the total cost when x=5.		

Summative assessment plan- only where relevant

1.If x=3 and x=0 are the zeroes of the polynomial $2x^3 - 8x^2 + ax + b, then\ find\ the\ values\ of\ a\ and\ b.$

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

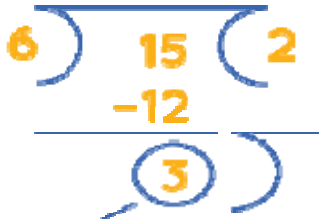
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

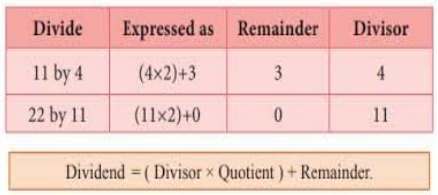
PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Polynomials**

Total no. of periods for this chapter:14 **Period no :6/14**

Subtopic: Introduction to Remainder theorem and Factor theorem

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	TLM
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. **C 3.1:** States and motivates/proves remainder theorem, factor theorem, and division algorithm **LEARNING OUTCOMES** **Identifies/classifies**	**Testing of Prerequisite knowledge (10 min)** **Whole class discussion:**  1) Observe the above long division and identify Divisor, Quotient, Remainder and Dividend. Write a mathematical relation between them. 2) What is the relation between Divisor, Dividend and Remainder?	- When do we call a divisor as a factor? - What will be the remainder when divisor is the factor of dividend? - Are all the divisors' factors of the dividend? - What is Euclid's Division Algorithm?	https://youtu.be/bl 7l1cP0MlU?si=hw/ M3RBhqrh1ooqy This 7 min. video explains remainde theorem and facto theorem in simple way made by

polynomials among algebraic expressions in order to apply appropriate algebraic identities to factorise them	 **II – Teacher extends the concept of division to polynomials. (10 min)** Divide polynomial $p(m) = 2m^3 - m^2 + 4m$ by $t(m) = m$ $(2x^3 + x^2 + x) \div x = \frac{2x^3}{x} + \frac{x^2}{x} + \frac{x}{x}$ $= 2x^2 + x + 1$ Teacher should extend the knowledge of division and division algorithm of numbers to the topic of Polynomials by step-by-step instructions (following Whole Class Activity followed by Group activity). (20 min.) Teacher should make the students to understand the degree of remainder is always less than the degree of devisor.	$(5x^6-2x^4+11x^3+4x) \div x$ Check the Division algorithm. Find the remainder. 1. Here, what do polynomials p(m) and t(m) represent? 2. What is quotient q(m) and remainder r(m)? 3. What is the degree of quotient and remainder?	LearnFatafat. Teacher can use the video to make students understand or reinforce the concept

	Generalisation of the concept: $p(m) = t(m) \times q(m) + r(m)$ Degree{r(m)} < Degree{t(m)} Teacher should reinforce the concept using several examples. E.g. $(7x^2 + 14x) \div (x + 2)$	$(5x^3-3x+4) \div x$ Check the Division algorithm Practice Worksheet 1. p (-2) is – 2. Is x + 2 is a factor of $x^2 + 7x + 12$? Explain. 2. p(5) is 0. Is x – 5 is a factor of 2x – 10? Explain.	Note: Images collected from NCERT text book and Google Images from Creative Common licence

Summative assessment plan- only where relevant

Teacher makes the students into groups and ask them to present before class.

Examine if x – 1 is a factor of which of the following polynomial:

1. $2x^3 – x^2 + x – 1$
2. $x^3 – x^2 + x – 1$

$x^3 – x^2 – (2 + \sqrt{2})x + \sqrt{2}$

Teacher Reflection and Experience:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to student

PERIOD PLAN (40min)Class: 9th Subject: Mathematics Chapter: polynomials

Total no. of periods for this chapter:14 Period no :7/14

Sub Topic: Remainder Theorem (Proof & Problems)

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. **C 3.1:** States and motivates/proves remainder theorem, factor theorem, and division algorithm **LEARNING OUTCOMES** **Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them** **LEARNING OBJECTIVES** **Using the Remainder theorem to calculate remainder when p(x) is divided by a linear**	Recall from previous Students individual work and share it with their friend next to them. (10 min.) 1. what is the remainder when we divide $p(x)=3x^3-x^2-x-4$ with x-1? 2. Check if the remainder when we divide $p(x)=3x^2-x+1$ with x+1 is non -zero number. Teacher extends it to generalise the Remainder theorem and Factor theorem. (10 min.) Can you tell me the remainder when we divide p(x) with x-a? Teacher should generalise the fact in the form of the remainder		https://youtu.be/p1ISRAeEMR0?si=C5C970KaerBNW5f6 10 min. video made by JG on Remainder theorem and Synthetic division of Polynomials

polynomial Relates the factor theorem to the remainder theorem. Division of polynomial with linear polynomial Understanding Remainder theorem and Factor theorem. Solving questions using Remainder	theorem and let's prove it. Presentation Remainder theorem (10 min.) When a polynomial p(x) of degree greater than or equal to 1 is divided by a linear polynomial (x - a), then the remainder is equal to p(a). Proof is derived Here, p(x) is the dividend. And f (x) = (x – a) is divisor. When we divide p(x) by f(x) we get quotient as q(x) and remainder as r(x). Discuss the degree of f(x). Substitute 'a' in place of 'x' p(x) = (x- a) . q(x) + r(x). What do you arrive at? Suppose r(a)=0 in the above context what would be the relation between (x-a) and p(x). **Factor Theorem** (10 min.)	Write division algorithm for expressing p(x) in terms of f(x), q(x) and r(x). 3) Find the remainder when x^3+4x^2+4x-3 is divided by x. 4)What number should be added to $x^2 + 5$ so that the resulting polynomial leaves the remainder 3 when divided by x + 3? Find the remainder when p(x) is divided by mx – n.	

theorem and Factor theorem	In whole class activity teacher should explain the theorem by discussion. Practice questions 1. Find the remainder when $x^4+x^3-2x^2+x+1$ is divided by $x-1$. Write the degrees of the dividend, divisor and remainder?	Discuss Dividend, Divisor Compare the degrees of the dividend, divisor and remainder **Assignment:** Check whether the polynomial $q(t)=4t^3+4t^2-t-1$ is a multiple of $2t+1$	

Summative assessment plan- only where relevant

S.A. Questions: 1) Write the remainder when the polynomial $f(x)=x^3+x^2-3x+2$ is divided by $x+1$.

2) Find the remainder when x^{15} is divided by $x+1$.

3) Find the remainder when $f(x)=4x^3-3x^2+2x-1$ is divided by $2x+1$

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Polynomials**

Total no. of periods for this chapter:14 Period no :8/14

Sub topic: problems on Remainder theorem and Factor theorem

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	Material required
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **LEARNING OUTCOMES**	Recapitulation (15 min) 1. Check whether -2 and 2 are zeroes of the polynomial x+2. 2. Check if (y – 2) and (y + 3) are factors of $y^2 + 5y + 6$. In pair share your response and justify. 3. Factorise $12x^2-7x+1$, $2x^2+7x+3$, $6x^2+5x-6$, 3x2-x-4 **Activity 1:** (10 min) Teacher extends application of factor theorem to find unknown	How do we get the value of 'y' to substitute in p(y)? Rita says taking to check if y – 2 is a factor of p(y), we have to plug in y = 0 and find p(0). Do you agree with here? Why or why not? If x – a is a factor of p(x), then	

Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories them **LEARNING OBJECTIVES** **Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a) and verify using long division.** **Relates the factors of a polynomial with its zeroes and vice versa** **Uses given information about the zero or factors of a polynomial to factorise it**	values. Find the value of k, if y – 2 is a factor of $y^2 + 2y – k$. [teacher note: Group Activity: Make students into groups, ask them to solve and present before class] In pairs solve the following: 1. If (m- 1) is a factor of the polynomial $p(m) = m^2 + 5m - 3k$ Students individually work on Exercise 2.3 **Activity 2:** (10 min) In pairs students to, examine which of these (m + 3), (m- 3), (m+2) and (m +4) are the factors of the polynomial $q(m) = m^2 + 7m + 12$. Verify by multiplying the factors. Factorisation using factor theorem	what is the value of p(a)? What is the condition for x – a to be a factor of p(x)? What is the condition for m +3) to be a factor of $q(m) = m^2 + 7m + 12$? check weather -2 and 2 are zeroes of the polynomial; x+2 factorise $i)\ 12x^2 - 7x + 1\ \ ii)\ 2x^2 + 7x + 3$	

	Y^2-5y+6 (5 min.)	$iii)\ 6x^2$+5x-6 iv) $3x^2$ -x-4	
Summative assessment plan			
Teacher Reflection and Experience: 1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment? 2.How well did the pedagogical Strategies engage students and promote active participation in the learning process? 3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes? 4.How effective were the Materials and resources used in the lesson? 5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?			

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: polynomials**

Total no. of periods for this chapter:14 **Period no :9/14**

Sub topic: Problems on Remainder theorem and Factor theorem

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	TLM
CG: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **LEARNING OUTCOMES** **Identifies/classifies polynomials among algebraic expressions in**	Recap:(5 min) The factor theorem tells: • if we are told that p(y)=0, then we can state that (y−a) _____of p(a) • if we are told that (y - a) is a factor of p(y), then we can state p(a)=_____. Teacher extends factorization of cubic polynomials using factor theorem. (15 min.) 1) https://youtu.be/R-7kD8bAzjQ?si=LBMTAzmoLPo11bxF 2) https://youtu.be/qRznHzKLYxE?si=WoU3hrEASK0HRl6	If (m-2) is factor of f(m), What is the value of f(2)? [Teacher could include few more such question] .	

order to apply appropriate algebraic identities to factories them **LEARNING OBJECTIVES** **Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a)**	P The above two videos (1st one 6 min. and 2nd one 3 min.) explains how to factorise cubic polynomial using factor theorem (made by Tic TacLearn English). Teacher can display the videos to build concept. Group Activity: Teacher make students into groups, ask them to solve a few questions and present before class. (20 min.) Factorise $x^3 - 23x^2 + 142x - 120$ $X^3+13x^2+32x+20$	On factorisation of cubic polynomials, what is the maximum number of factors it can have? Formative assessment: 1. if f(1)=0 then what is the factor of f(x). 2. if f(-3)=0 then what is the factor of f(x). 3. if x-3 is a factor of f(x) then what is the value of (3). 4. factorise $y^2 - 5y + 6$ 5. Factorise the following. $i)x^3 - 2x^2 - x + 2$ $ii)2y^3 + y^2 - 2y - 1$	
Summative assessment plan- only where relevant summative: factorise$i)x^3 - 3x^2 - 9x - 5$ $ii)x^3 + 13x^2 + 32x + 20$			
Teacher Reflection and Experience:			

PERIOD PLAN

Class: 9th Subject: Mathematics Chapter: Polynomials Sub Topic: Remainder Theorem (Practice/Remedial Class)

Total no. of periods for this chapter:14 Period no :10/14

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **LEARNING OUTCOMES** **Identifies/classifies polynomials among algebraic expressions in order to apply appropriate algebraic identities to factories**	Group Work/Individual Work (10 min) Exercise 2.3 1) Find the remainder when x^3+3x^2+3x+1 is divided by (i) $x+1$ (ii) $x-\frac{1}{2}$ (iii) x (iv) $x+\pi$ (v) $5+2x$ 2)Find the remainder when x^3-ax^2+6x-a is divided by $x-a$ 3)Check whether $7+3x$ is a factor of $3x^3+7x$ Additional Practice Questions for	Basic Find the remainder when $p(x)=4x^2-12x^2+14x-3$ is divided by $g(x)=x-\frac{1}{2}$ Lower Order Thinking Skills If the polynomials ax^3+3x^2-13 and $2x^3-5x+a$, when divided by $(x-2)$ leave the same remainder, find the value of a. Higher Order Thinking If $f(x)=x^4-2x^3+3x^2-ax+b$ is a polynomial such that when it is divided by $x-1$ and $x+1$, the remainders are respectively 5 and	

them **LEARNING OBJECTIVES** **Using the Remainder theorem, calculate division of p(x) by a linear polynomial 'x-a' and find the remainder is p(a) and verify using long division.** Division of polynomial with linear polynomial Solving problems using Factor theorem and Remainder theorem	higher order thinking (30 min) 4)What must be subtracted from $4x^4-2x^3-6x^2+x-5$ so that the result is exactly divisible by $2x^2+x-1$? 5)If (ax^3+bx^2+x-6) has $(x+2)$ as a factor and leaves remainder 4, when divided by $(x-2)$, find the values of a and b. 6)If (x^2-1) is a factor of ax^3+bx^2+cx+d, show that arc=0	19. Determine the remainder when f(x) is divided by (x-2).	

Summative assessment plan- only where relevant

1. Find m, if $(x+2)$ is the factor of $x^3+3x^2-2mx+8$
2. Using the factor theorem, show that $(x+1)$ is a factor of $x^{19}+1$.

Teacher Reflection and Experience:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to student.

Period Plan **Class: 9th** **Subject: Mathematics** **Chapter: polynomials**
Total no. of periods for this chapter:14 Period no :11/14
Sub topic: FINDING THE VALUE OF "K" TYPE QUESTIONS

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	Material Required
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them.	**Whole class discussion:** **(15 min)** **Whole class activity:** State the steps of Factorizing x^2-2x+1 using factor theorem. Matching the polynomial to its factor	**QUIZ** 1. Find k if x+1 is a factor of x^2-k.	
C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm. C-3.2: Models and solves contextualised problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **LEARNING OUTCOME:** **Identifies /classifies polynomials among**	Polynomial factor 1.x^2-2x+1 ( ) a. x - 2 2.x^2+2x+1 () b. x +1 3.x^2-4x+4 () c. x – 1 4. Is x=3 a root of x^2-4x+4? Justify 5. What is the value of k if x-1 is a factor of $2x^3+kx^2+8x-5$? Students work in pairs to do the following: (25 min) Use the suitable identities to expand the following: 1. $(2m + 3)^2$ 2. $(2m – n)^2$ 3. 105^2 4. 97^2 5. (m + 2n) (m – 2n) 6. 102 × 98 7. (2m + 3n) (m – 5n)	**GRAPH BOOK** Expand the identities: $(x + y)^2$ = _____ $(x - y)^2$ = _____ (x + y) (x - y) = _____ (x + a) (x + b) = _____ [Teacher notes: After students have shared the expanded form. Encourage students to make note of the identities to refer to while solving problems] How would you split 105 to apply the identities to calculate? How would you rearrange 102 ×	

Algebraic Expressions and factories them by applying appropriate algebraic identities **LEARNING OBJECTIVES:** Maps a polynomial to known identity/identities. Selects appropriate identity to simplify a calculation. **Applies algebraic identities to factorise polynomials**	8. $(y^2 + 3/2)(y^2 - 3/2)$ **Application of identities to factorise polynomials** The teacher, through guided conversion shows factorization of polynomials using identities. Factorise $4m^2 - 12mn + 9n^2$. Here, $4m^2 - 12mn + 9n^2$ is seen as $(2m)^2 - 2(2m)(3n) + (3n)^2$ Taking $x = 2m$ and $y = 3n$, we can compare it with expression $x^2 - 2xy + y^2$. And $x^2 - 2xy + y^2 = (x - y)^2$. So, $4m^2 - 12mn + 9n^2 = (2m - 3n)^2 = (2m - 3n)(2m - 3n)$ Students individually work on Exercise 2.4 – Q.3 and share their working with their friend next to them. The graph of quadratic polynomial x^2-2x-k find k from the graph?	98 to apply the identities to calculate? How many terms are there in the given expression? Identify how many square terms are there in them. The expression also has a negative term. On comparing, which of the identity can it be mapped to? FORMATIVE ASSESSMENT 1.Find the value of k if x-1 is a factor of $P(X)=KX^2-2X+1$? 2. Find the value of k if x-1 is a factor $P(X)=KX^2-3X+K$?	

Summative assessment plan- only where relevant

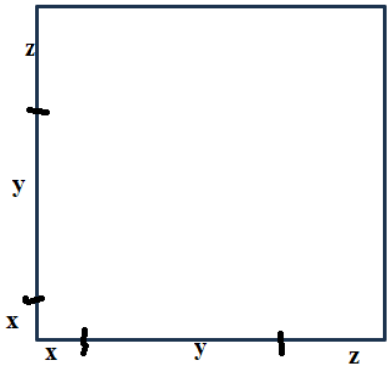
The area of a square is given by $9y^2 + 30y + 25$. Find the lengths of its side

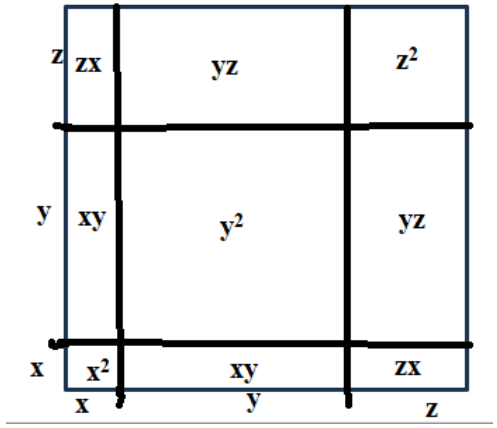
Teacher Reflection and Experience:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to student

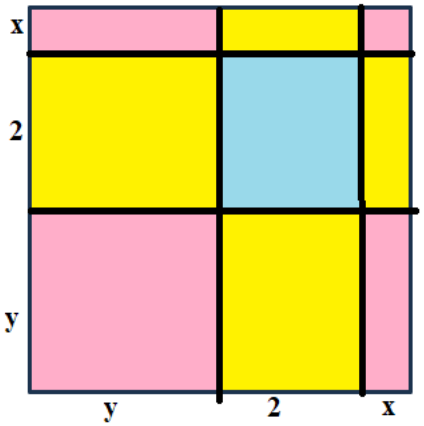
Chapter Plan (Unit Plan/Lesson Plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**	
Total no. of periods for this chapter:14Period no :12/14			
Subtopic: Expanding and factorizing using Algebraic Identities			
learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiment s/assignments/self-assessment checklists/etc.**	**Material required**
CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them. C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualized	**Testing of prerequisite knowledge:** **In pairs do the following: (5 min)** 1. **Find the product of algebraic expressions (3x + 5) × 4x** 2. **Find the product of two binomials (5x - 7) (6x + 8)** **Now, in small groups of 4, students to expand the following identities:** i. **$(x + y + z)^2$** **Let us consider y + z = t,** **then $(x + y + z)^2$ becomes (x**	What is the degree of the products obtained on multiplication? i. In, x + y + z, how many terms are there? What is the expansion of $(x + t)^2$	

problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled Identifies/ classifies polynomials among algebraic expressions and factors them by applying appropriate algebraic identities. Derives proof of algebraic identities $(x + y + z)^2$; $(x+y)^3$; $(x- y)^3$ **Applies algebraic identities to factorise polynomials**	**$+ t)^2$** **Now, substitute the value 't' in $x^2 + 2xt + t^2$** **$(x + y + z)^2 = x^2 + 2x(y+z) + (y+z)^2$** **Activity: (20 min)** **Get students to generalize,** **$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$** **Students do geometric modelling of the $(x + y + z)^2$ done by following the instruction given by the teacher.** **Step 1- Take a square sheet and mark lengths x, y and z along its sides.**  	What is the identity used to expand of $(y + z)^2$ How many terms are there in the product? What is the degree of this identity? How many square terms and product terms? How many smaller square areas are formed? What are those? And what are they called? How many rectangular areas are formed? What are those? And what are they called? 1. Expand: $(¼ a - ½ b + 1)^2$. a. How many terms are there	https://yo .be/hgXK qQ_0?si= 58ntLLe1 PUx **4 min. T**

	Step 2- Draw lines of length x, y and z horizontally and vertically. Find the area of each slice/tile and add them to show the whole area.  **Using the identity $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$ find:** **1. $(-2x + 3y + 2z)^2$** **2. $(m + 2n + 5m)^2$** **3. $(3p – q + 2r)^2$** **4. $(-2x + 5y - 3z)^2$** **[Teacher note: Teacher to illustrate one example and following which children work in pairs.] (15 min)** **The teacher introduces identity $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$ could be used to factorise as well.**	in this expression? b. State the identity you would use to find the product. Assignment- Exercise 2.4 - 4 and 5	**TacLearn video on algebraic identities can be used to revise all formulas**

	1. **Factorise $4a^2 + b^2 + 9^2 – 4ab – 6bc +12ca$.** **The expression has 6 terms with 3 square terms and 3 product terms.** **$4a^2 + b^2 + 9^2 – 4ab – 6bc +12ca = (2a)^2 + (-b)^2 + 3^2 + 2(2a) (- b) +2(– b) (3c) +2(3c)(2a)$.** **On comparing this is of the form $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$, where $x = 2a$; $y = -1$ and $z = 3c$.** **Hence, $4a^2 + b^2 + 9^2 – 4ab – 6bc +12ca = (2a – b + 3c)^2$.** **Using the identity $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$ factorize:** 1. **$a^2 + b^2 + c^2 – 2ab + 2bc - 2ca$** 2. **$2m^2 + n^2 + 8p^2 – 2\sqrt{2}\,mn + 4\sqrt{2}\,np – 8mp$**		
Summative assessment plan- only where relevant 1. **Write the polynomial representing area of this figure. How many terms does it have? What is the degree of this polynomial?**			



Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

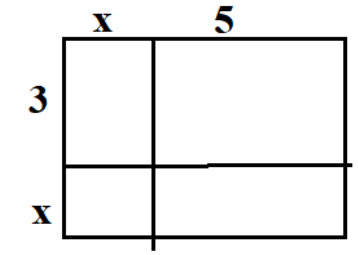
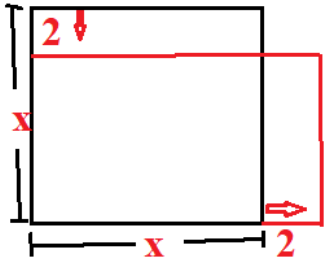
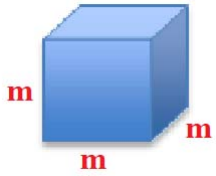
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

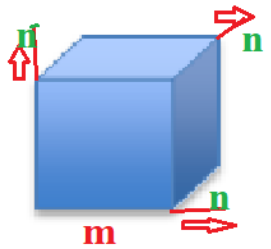
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**	
Total no. of periods for this chapter:14	**Period no :13/14**		
Subtopic:Algebraic identities: $(x + y)^3$ and $(x – y)^3$			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
Learning outcome: **Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.** **CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to**	Testing of pre requisite knowledge (10 min) 1. Find the product of (x+y)(x+y) 2. By using suitable identity find the product of $a.(3 + 2y)(3 + 10y)$ $b.$ (p + m – n)^2 Write a polynomial that represents the area of the following: (15 min)	What should be added to $(x+y)^2$ to make $(x-y)^2$?	

solve them. C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualised problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled Derives proofs for algebraic identities. Maps a polynomial to known identity/identities. Factorises a polynomial using the appropriate identity.	a.  b.  If area of a square field is given by $y^2 + 2y + 1$. What is length of each side? Students work in pairs: Write a polynomial that represents the volume of the following: a.  	1. State the identity used to find the product. 2. What is the degree of the product? 3. How many terms are there in the product?	https://youtu.be/MRZB2dvQzeY?si=NttabQNPLRoWaKKA

b.



Activity: (15 min)

(Students work in small groups of 4 members)

Here is a cube of side x units which is extended by y units in all the dimensions.

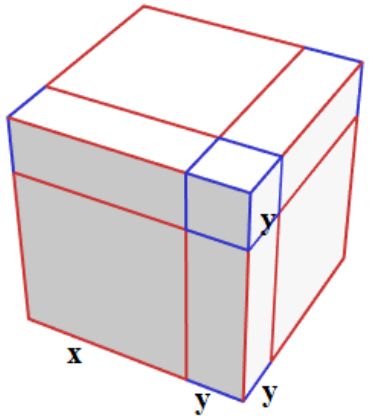
Guess the number of cubes and cuboids added because of this extension.

Represent them algebraically.

7 min vid (made b Mr Creatior on Algebra Identitie workin model

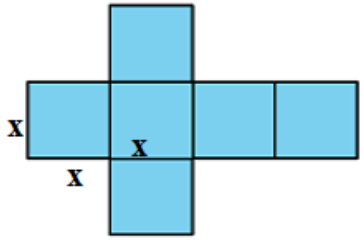
https://yc u.be/RBn L3RHKI? lb9YRBL MkNHv

11 min video (made b

	 Teacher then demonstrates the proof of the identity $(x + y)^3$ I. $(x + y)^3$ II. $(x – y)^3$ Using the identity $(x + y)^3 = X^3 + y^3 + 3xy\ (x + y)$ expand: 1. $[3/2\ x + 1]^3$ 2. $[m + 2]^3$ 3. $[2p + 3]^3$ Using the identity $(x - y)^3 = X^3 - y^3 - 3xy(x - y)$ find: 1. $[3/2\ x - 1]^3$ 2. $[m - 2]^3$ 3. $[2p - 3]^3$	1. On expanding, how terms do the polynomial have? How many of them are cube terms? 2. What is the degree of the polynomial? Assignment: Exercise 2.4 - 6	**Learning Notebook) on $(a+b)^3$** **and $(a-b)^3$**

Summative assessment plan- only where relevant

1. Rohit has a net of a dice. He wants to make a bigger dice by increasing all its dimensions by 1 cm. What would be the volume of the bigger dice?



2Use suitable identity find the product of (x + 8) (x-10)

3. Evaluate

4.103×107 without multiplying directly.

5.Use suitable identity find the product of (6y+5)(6y+8)

6.Evaluate 504×503 without multiplying directly.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

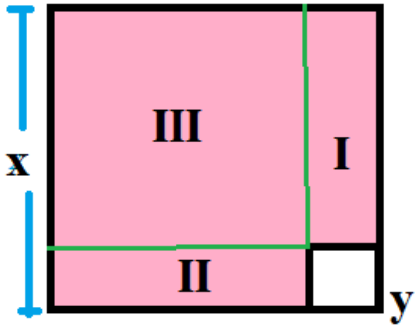
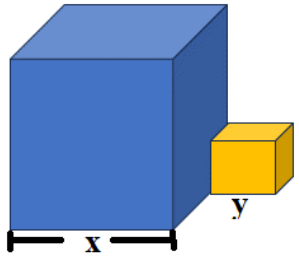
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

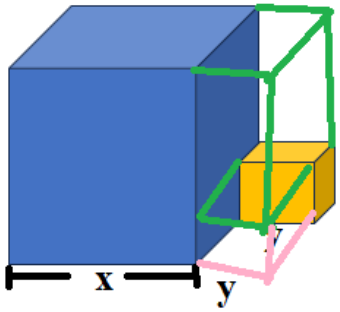
4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**	
Total no. of periods for this chapter:20	**Period no :14/14**		
Subtopic: Algebraic identities: $(x^3 + y^3)$ and $(x^3 - y^3)$			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
Learning outcome: **Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.** **CG3: Discovers and proves algebraic identities and models real life situations in the form of equations to solve them.**	Testing of previous knowledge (15 min.) 1. A square plot of side x feet is increased by 10 feet on each side. a. Represent its area algebraically. b. Which identity would you use to find its area? Write two binomials whose product is $m^2 - 6m + 9$. The figure shows a square of side y unit cut off from a square of side x unit. (15 min)		

C-3.1: States and motivates/proves remainder theorem, factor theorem and division algorithm C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **Apply the concept of factorization to solve daily life situations**	 c. Write the algebraic expression of the remaining 3 parts. d. What is the common factor of the three terms? e. Express in factor form. Teacher demonstrates geometric proof of $x^3 + y^{3:}$ (15 min) 1. Here are 2 cubes with sides x and y units that are joined side to side. a. What is the volume of each cube? b. Write combination of the cubes in algebraic form. (Which is $x^3 + y^3$)  2. Now to express this in product form, we will complete the figure to form a single solid.	What is solid formed now? How many cuboids were added to form a bigger cuboid? What are the common factor in [xy(x - y) + y^2(x-y)]? 8 and 125 are cube of which numbers? Students individually work Exercise 2.4 -	a3 + b3- long.pptx - Google Drive [Teacher could refer to this link.] **https://www.youtube.com/watch?v=9RHJt0GXL**

Derive the proofs of identities of algebraic expressions. Factorizes a polynomial using the appropriate identity	 3. Write the volume of cuboids added. 4. To know what is $x^3 + y^3$, we should take away volume of filled in shapes from the bigger cuboid. $X^3 + y^3 = (x+y)x^2 – [xy(x -y) + y^2(x-y)]$ $= (x+y)x^2 – y\ (x -y)\ [x + y]$ Now taking (x + y) common we have, $x^3 + y^3 = (x + y)\ [x^2 - y(x-y)] = (x+y)\ (x^2 – xy + y^2)$ Students in pairs verify $x^3 + y^3 = (x+y)\ (x^2 – xy + y^2)$ Teacher extends it to factorisation of $8m^3 + 125$. $8m^3 + 125 = (2m)^3 + (5)^3$ $= (2m + 5)\ (4m^2 – 10m + 25)$ Students in pairs verify $x^3 - y^3 = (x- y)\ (x^2 + xy + y^2)$ Teacher plays given video to visualise **$(x-y)^3$** geometrically.	10	cY **[Teacher can use the 6 min. video to explain $(x-y)^3$ geometrically made by Mathsmart**

Summative assessment plan- *only* where relevant

1. Simplify $27x^3 - (3x - y)^3$
2. Factorise $24\sqrt{3}x^3 - 125y^3$

Teachers' reflections and experiences:

POLYNOMIALS

WORK SHEET -1

Multiple choice Questions:

Write the correct answer in each of the following:

1. The value of the polynomial 5x – 4x2 + 3, when x = –1 is

(A) – 6 (B) 6 (C) 2 (D) –2

2. $\sqrt{2}$ is a polynomial of degree

(A) 2 (B) 0 (C) 1 (D) 1 2

3. Degree of the polynomial 4x4 + 0x3 + 0x5 + 5x + 7 is

(A) 4 (B) 5 (C) 3 (D) 7

4. Degree of the zero polynomial is

(A) 0 (B) 1 (C) Any natural number (D) Not defined

5. If p(x)= x^2 -2$\sqrt{2}$+1,, then p(2$\sqrt{}$ 2) is equal to

(A) 0 (B) 1 (C) 4 $\sqrt{2}$ (D) 8$\sqrt{2}$+ 1

Answer the following questions:

1. $f(x) = x^3 - 6x^2 + 11x - 6$
2. Find $f(1), f(-1), f(2), f(-2), f(3), f(-3), f(6) and f(-6)$
3. Observe which of the above are equal to zero.

POLYNOMIALS

WORK SHEET -2

Answer the following questions:

1. Which one is not a polynomial

(a) $4x^2 + 2x - 1$

(b) $y + \frac{3}{y}$

(c) $x^3 - 1$

(d) $y^2 + 5y + 1$

2. The polynomial $px^2 + qx + rx^4 + 5$ is of tyep

(a) linear

(b) quadratic

(c) cubic

(d) Biquadratic

3. Identify the polynomial

(a) $x^{-2} + x^{-1} + 5$

(b) $x^2 + 5\sqrt{x} + 7$

(c) $\frac{1}{x^3} + 7$

(d) $3x^2 + 7$

4. The zero of the polynomial $p(x) = 2x + 5$ is

(a) 2(b) 5(c) $\frac{2}{5}$(d) $-\frac{5}{2}$

5. The number of zeros of $x^2 + 4x + 2$

(a) 1(b) 2(c) 3(d) none of these\

Answer the following questions:

1. Write these values as integral roots.
2. why 1,2 and 3 are zeroes of f(x).
3. Factorize $x^3 - 6x^2 + 11x - 6$

POLYNOMIALS
WORK SHEET -3

Answer the following questions:

1. If a +b +c = 9, and ab + bc + ca =26 Find $a^2 + b^2 + c^2$?
2. Find the values of a , b so that the polynomial $x^4 + ax^3 – 7x2 +8x +b$ is exactly divisible by (x + 2) as well as (x + 3)
3. Find the value of p, if (2x -1) is a factor of $2x^3 + px^2 + 11x + p + 3$

1) Amit and Rahul are friends who love collecting stamps. They decide to start a stamp collection club and contribute funds to purchase new stamps. They both invest a certain amount of money in the club. Let's represent Amit's investment by the polynomial $A(x) = 3x^2 + 2x + 1$ and Rahul's investment by the polynomial $R(x) = 2x^2 – 5x + 3$. The sum of their investments is represented by the polynomial S(x), which is the sum of A(x) and R(x).

Q1. What is the coefficient of x^2 in Amit's investment polynomial A(x)?
(a) 3(b) 2(c) 1(d) 0
Q2. What is the constant term in Rahul's investment polynomial R(x)?
(a) 2(b) -5(c) 3(d) 0
Q3. What is the degree of the polynomial S(x), representing the sum of their investments?
(a) 4(b) 3(c) 2(d) 1

Q4. What is the coefficient of x in the polynomial S(x)?
(a) 7(b) -3(c) 0(d) 5

Q5. What is the sum of their investments, represented by the polynomial S(x)?
(a) $5x^2 + 7x + 4$(b) $5x^2 – 3x + 4$(c) $5x^2 – 3x + 5$(d) $5x^2 + 7x + 5$

INTRODUCTION

3.COORDINATE GEOMETRY

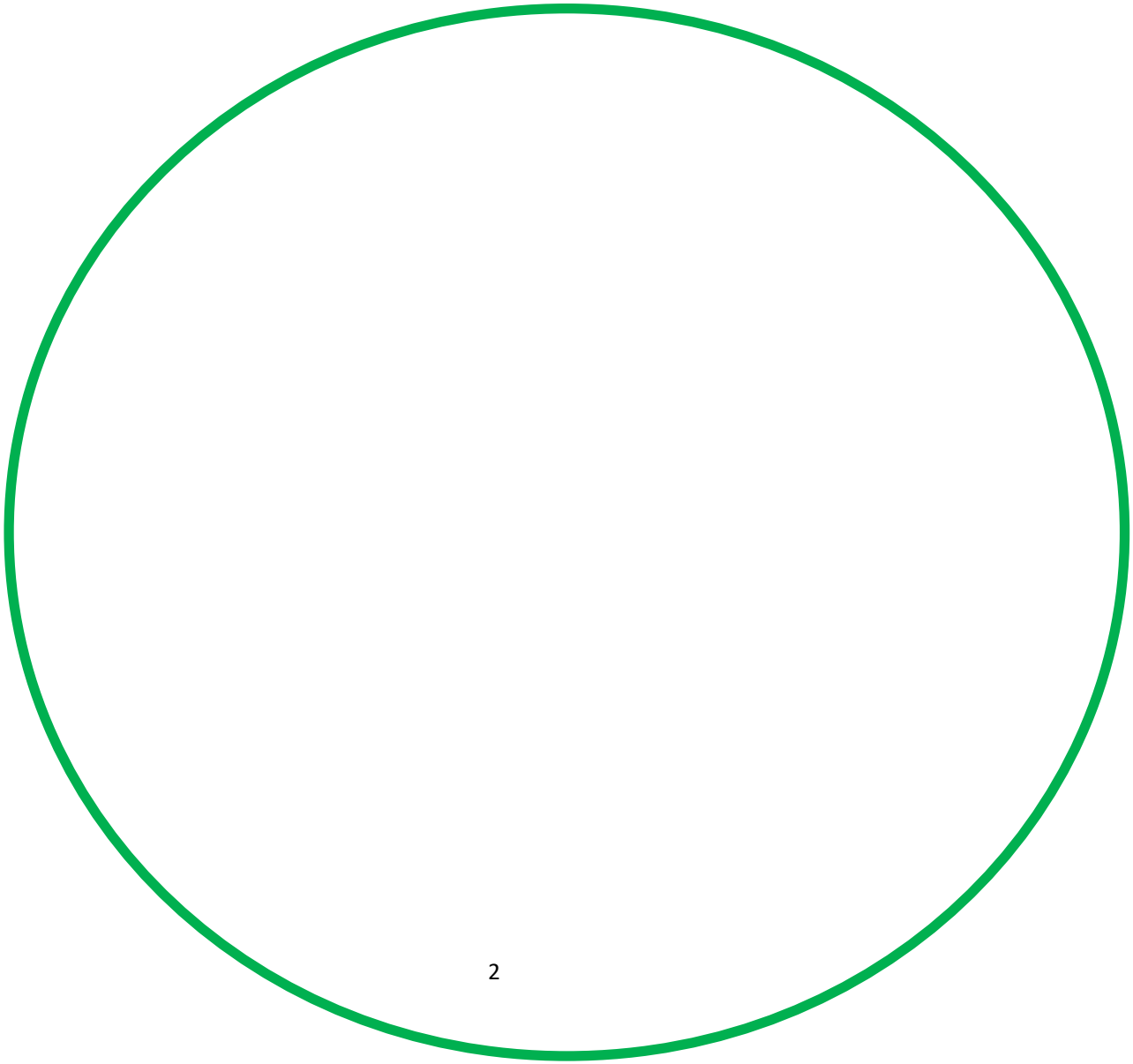
[Goto https://epathshala.nic.in]

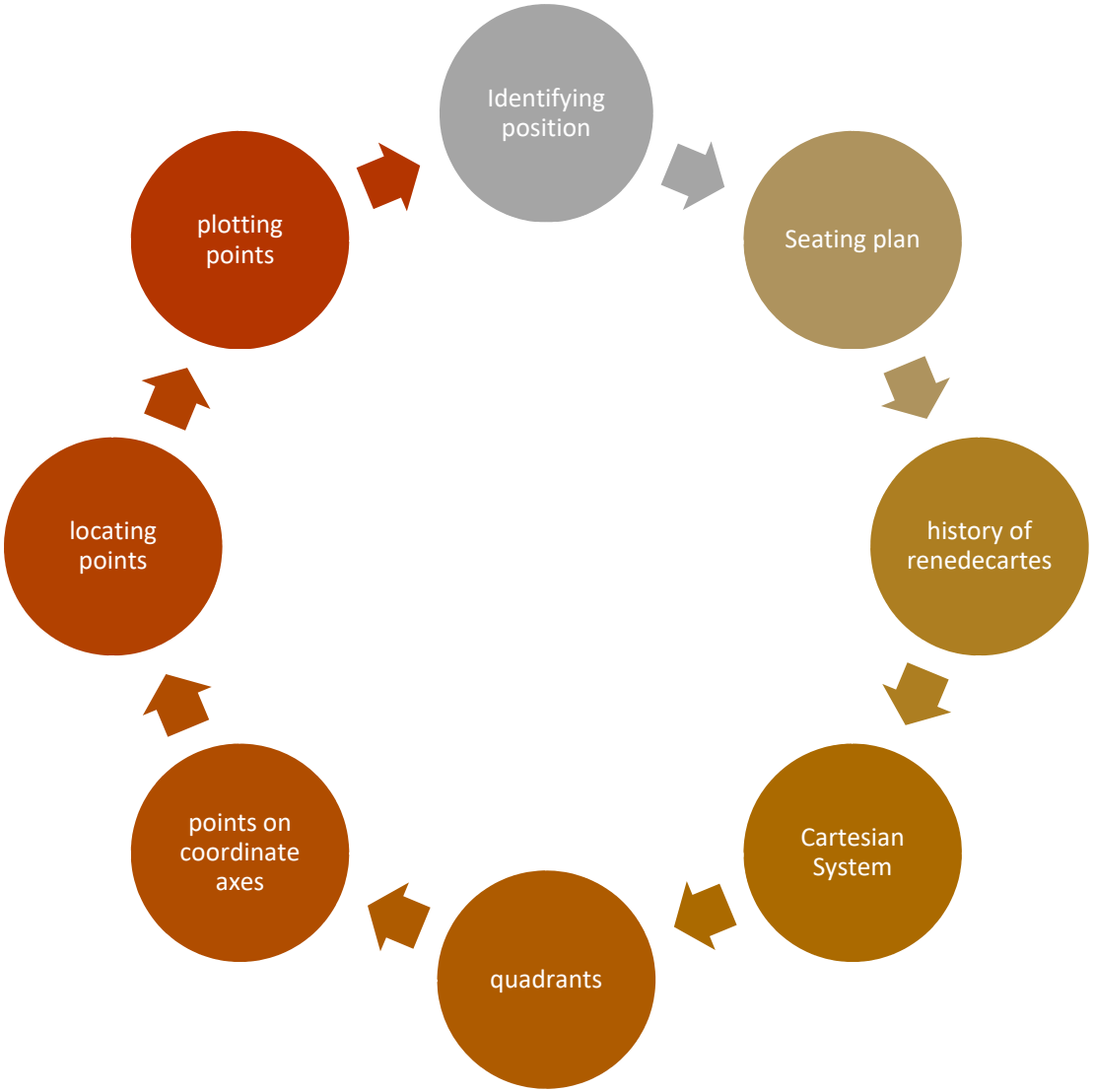
https://epathshala.nic.in/topics.php?ln=en

THE FOLLOWING CURRICULAR GOALS (CG) AND COMPETENCIES (C) WILL BE DEVELOPED THROUGH THIS CHAPTER

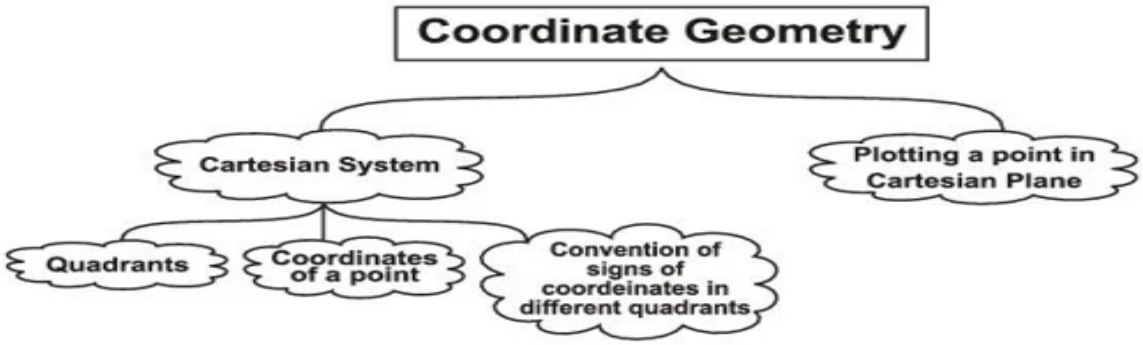
CURRICULAR GOALS	COMPETENCIES
CG-4: Analysis characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships. **CG-10: Knows and appreciates important contributions of mathematicians from India and around the world.**	**C-4.5: Specifies locations and describes spatial relationships using coordinate geometry, e.g., plotting a pair of linear equations and graphically finding the solution, or finding the area of triangle with given coordinates as vertices.** **C-10.1: Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as evolution of members, geometry, algebra)**

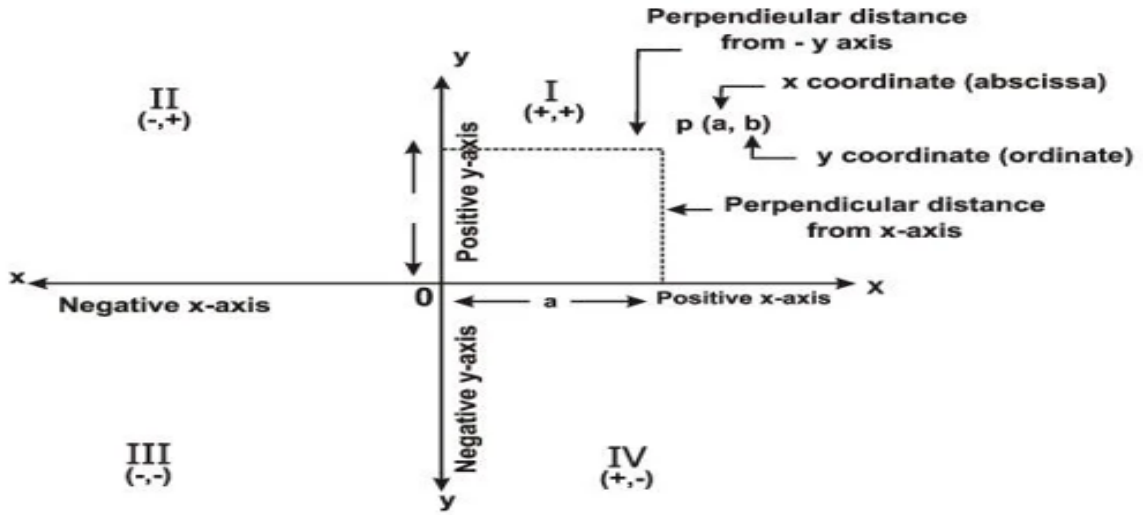
MIND MAP




Identifying position
Seating plan
history of renedecartes
Cartesian System
quadrants
points on coordinate axes
locating points
plotting points

CHAPTER-3
COORDINATE GEOMETRY
MIND MAP



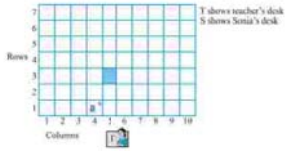


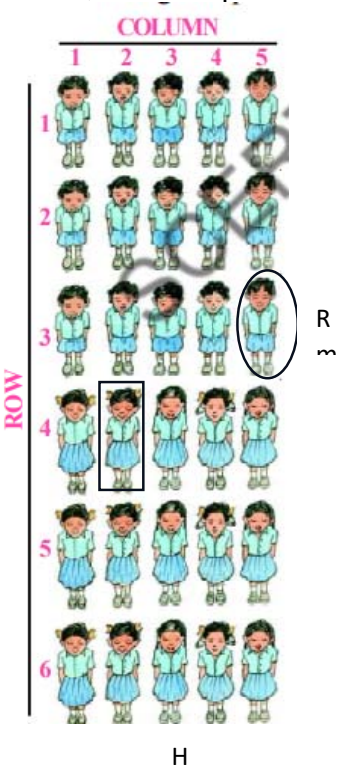
PERIOD WISE PLAN

PERIOD NO.	TEACHING TOPIC	LEARNING OUTCOMES
1	Activities to introduce coordinate geometry	Identify the position of object
2	Cartesian System	Know about history of Rene Descartes and know about coordinate axes
3	abscissa, ordinate, identifying the points on a plane.	Find abscissa ordinate of a point
4	Relationship between the signs of the coordinates of a point and the quadrant of a point in which it lies.	Locating points in different quadrants
5	Plotting the points on Cartesian Plane	Polotting the given points

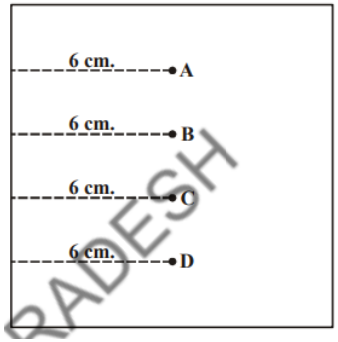
Key concepts: Introduction to coordinate geometry, Cartesian plane, plotting the points on a plane

Chapter Plan(Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: COORDINATE GEOMETRY** **Total no. of periods for this chapter: 5 Period no 1/5** **Sub topic: Activities to introduce coordinate geometry**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
CG-4: Analysis characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships **CG-10: Knows and appreciates important contributions of mathematicians from India and around the world**	**Testing of Pre requisite knowledge :20min** **Activity:1** **(Seating Plan):** Draw a plan of the seating in your classroom, pushing all the desks together. Represent each desk by a square. In each square, write the name of the student occupying the desk, which the square represents. Position of each student in the classroom is described precisely by using two independent information. (i) The column in which she or he sits. **(ii)** The row in which she or he sits.  If you are sitting on the desk lying in the 5th column and 3rd row	Check your position as per seating plan.	**Graph sheet**

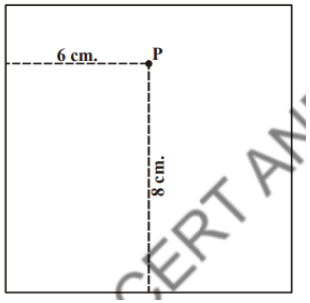
C-10.1: Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as evolution of members, geometry, algebra) Identify the position of object	How can we represent your position? [Note: your position could be written as (5, 3), first writing the column number, and then the row number] Write down the names and positions of other students in your class. For example, if Nani is sitting in the 4th column and 1st row, write his position.  1.Sudha is sitting in 4th column ;3rd row. Then write her position. 2. Name the position of Mr. R who was in the circle. 3. write the position of the girl in the rectangle box?	Write the position of H? Write the positions of your friends?	
	Activity.2:: **20min** A teacher asked her students to mark a point on a sheet of paper. The hint given by the teacher is “the point should be at a distance of 6 cm from the left edge.” Some of the students marked the point as		

shown in the figure.

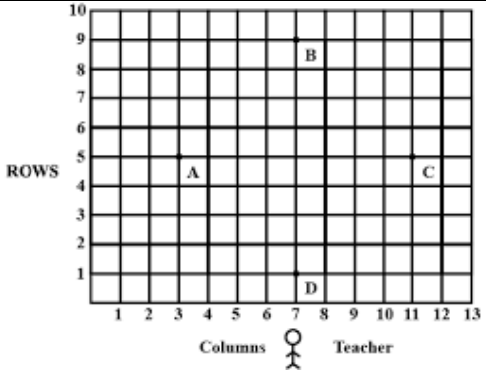


In the figure which point do you suppose is correct? To fix the exact position of the point what more information is needed?

Suppose the teacher says that the point is at a distance of 6 cm from the left edge and at a distance of 8 cm from the bottom edge, now how many points with this description can be marked?



So, how many references do you need to fix the position of a point?



Write the positions of A, B C and D in the above given figure?

How many references do you need to fix the position of a point?

Describe the seating position of any five students in your classroom.

Complete the following table

Object	Column	Row	Position
Purse	3	4	(3,4)
Match box	.....	3	(,3)
Clip	.....	.....	.....
Teddy	.....	.....	.....
Soap	.....	.....	.....

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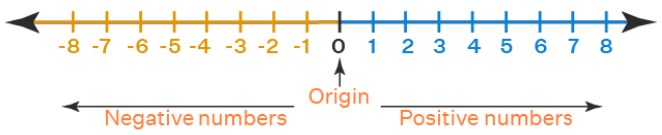
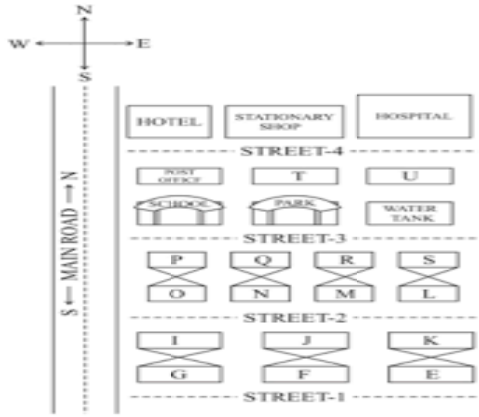
Summative assessment plan- only where relevant

Teachers' reflections and experiences: 1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment? 2.How well did the pedagogical Strategies engage students and promote active participation in the learning process? 3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes? 4.How effective were the Materials and resources used in the lesson? 5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

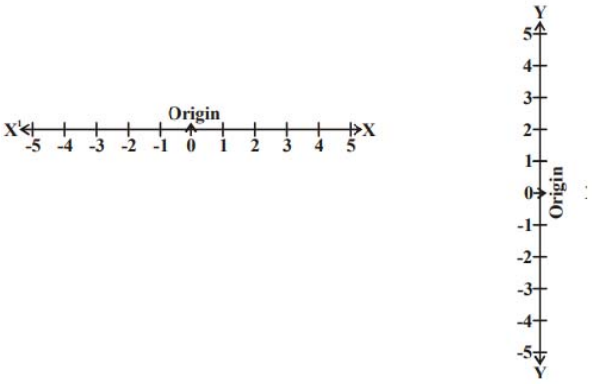
Class: 9th **Subject: Mathematics** **Chapter: COORDINATE GEOMETRY**
Total no. of periods for this chapter: 5 Period no :2/5
Sub topics: Abscissa, Ordinate, Identifying the points on a plane.

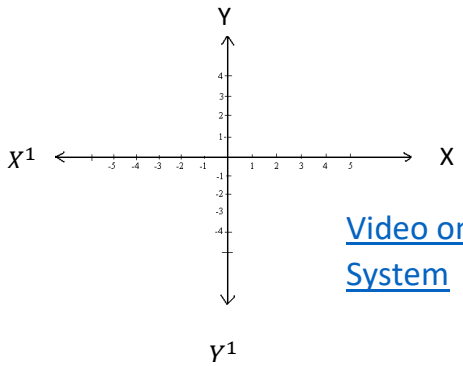
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
.	**Whole class discussion: 15 minutes**1. How much information we need to locate any object in a plane? 2. Do you know Parallel and intersecting lines? 3. Which type of lines has a common point? 4.Do you know about perpendicular lines? 5.Are the all-intersecting lines perpendicular? **[Teacher Note: Teacher should explain the contribution of Rene Descartes that he combined plane geometry with algebra for developing coordinate geometry]** **History of Rene Descartes 10 minutes** Draw a Real number Numbe line?  	1. In a locality, there is a main road along North-South direction. The map is given below. With the help of the picture answer the following questions.  i)What is the 3rd object on the left side in street no. 3 while going in east direction?	Diksha a video History Rene Descart

Whole Activity:25 minutes

Teacher makes the students into pairs and ask them to follow the instructions.

1. Take two Real Numbers and put together arrange perpendicularly and they will meet at O. Arrange like following manner.
   [Teacher introduces coordinate axes}





Video on Cartesian System

1.How do you call horizontal number line?
2. How do you call Vertical Number line?

What do you call the intersecting point of X and Y

(ii) Find the name of the 2nd house which is in right side of street 2 while going in east direction.

(iii) Locate the position of Mr. K's house.

(iv) How do you describe the position of the post office?

(v) How do you describe the location of the hospital?

Match the following.

Line	Representation

History of R
Descarte
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QRi0HK5(
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ube.com/@t
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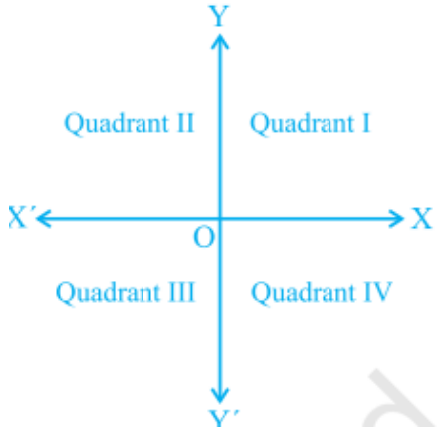
	axis? What X-axis and Y-axis together called? <u>Teacher introduces about Quadrants in Cartesian Plane</u>  By observing the figure identify number of parts that coordinate axis divided?	$\overleftrightarrow{XOX1}$ Y-axis $\overrightarrow{OX}$ X-axis $\overleftrightarrow{YOY^1}$ negative Y-axis $\overrightarrow{OY}$ Positive X-axis $\overrightarrow{OY^1}$ negative X-axis $\overrightarrow{OX^1}$ Positive Y-axis How does coordinate axes useful?	https://www ube.com/wa =lh8_Q29ugv ist=PL4EcHZ gd8TTkjRtfHJ N2bBGln&in 4 Source:: https://www ube.com/@T LearnEngli Cartesi systen

Summative assessment plan- only where relevant

1. **What are some examples of coordinate geometry in our real life?**

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

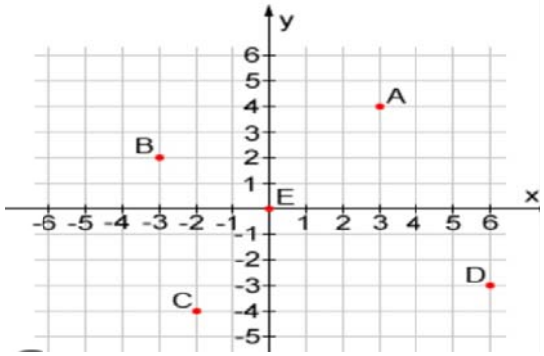
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: COORDINATE GEOMETRY**
Total no. of periods for this chapter: 5 **Period no :3/5**
Sub topic: Abscissa, Ordinate,Identifying the points on a plane.

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	Materi requir
. Define Abscissa and ordinate . Describe the points on a plane. Understands coordinates as distances. Learning Outcomes: Student able to locate /identify a point in cartesian plane	Testing of Pre requisite knowledge : 5min What are called horizontal line and vertical line in a plane? What are called the negative directions of X-axis and Y-axis? Do you know how to identify the points in a plane? Teacher orientation: 20min	1.How will you describe the position of a table lamp on your study table to another person? 2.what is the general form of the points which lie on the X-axis? 3. How many coordinates does any point in a plane have? 4.What is called the second coordinate of the point?	https://you e/K_fsXEB g?si=g2KD 7WmFkxT SOURCE https://ww utube.com/ obalShiksh ia Video regardin Cartesian p

Teacher explains how to locate /identify a point in cartesian plane



Teacher makes the students into groups and ask them to answer the following questions

seethe above coordinate plane,

What is the position of A?

What is the perpendicular distance from A to x-axis?

What is the perpendicular distance from A to Y-axis?

Using these distances, how can we describe the points so that there is no confusion?

Write the coordinates of A?

How to represent the point B in 2nd Quadrant?

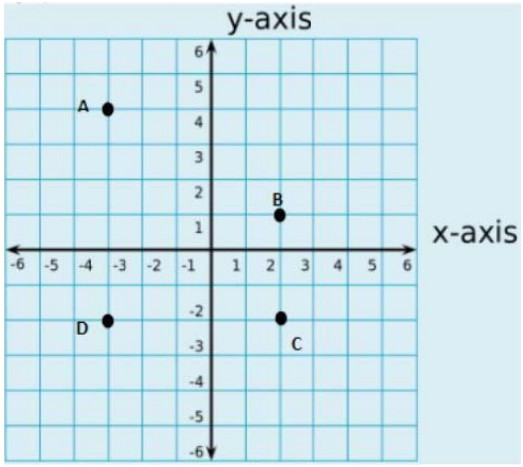
[The perpendicular distance of the point B from the Y-axis measured along the negative direction of the x-axis. So, the x coordinate is -3. The perpendicular distance of the point B from X-axis measured along the positive direction of the Y-axis is 2 units.]

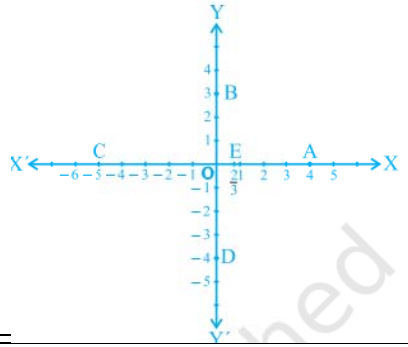
Complete the table

Point	abscissa	Ordinate
(5, -4)		
(-3,2)		
(-4, -5)		
(2,3)		

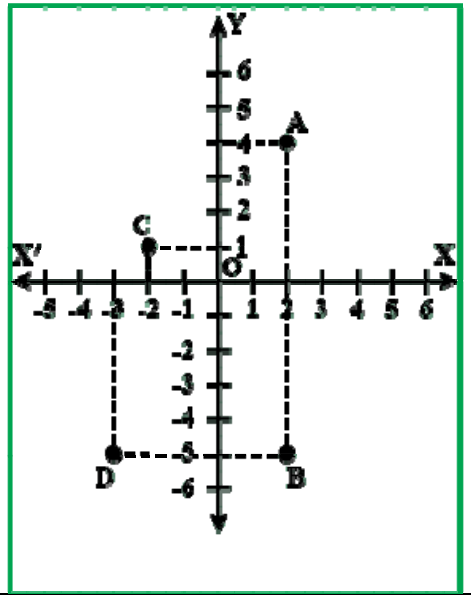
How do we call x and y in the point (x,y)?

Do you identify the points on X-axis or Y-axis, how to represent it?
what are the coordinates of the origin?

	What are the coordinates of B? **In the point (5,3) How do we call 5?** **In the point (5,3) How do we call 3?** **ACTIVITY :: 15 MINUTES**  **1.Find the coordinates of points A, B, C and D?** **2. write abscissa and ordinate of each point?** **3. identify the points A, B, C, D in which quadrant they belong to?** 1.Write the coordinates of the points marked on the axes in the figure.	Write the coordinates of A? (ii) The coordinates of B are (0, 3). Why? (iii) The coordinates of C are (– 5, 0) Why? (iv) The coordinates of D are (0, – 4). Why?	



Summative assessment plan- only where relevant



Identify the points in the given graph.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

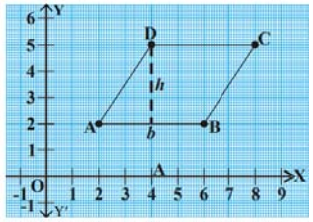
Class: 9th **Subject: Mathematics** **Chapter: COORDINATE GEOMETRY**

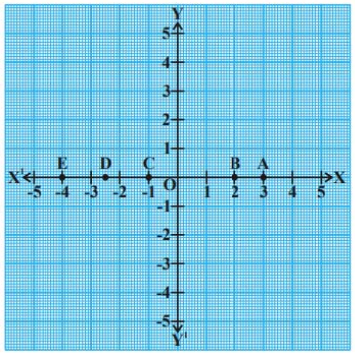
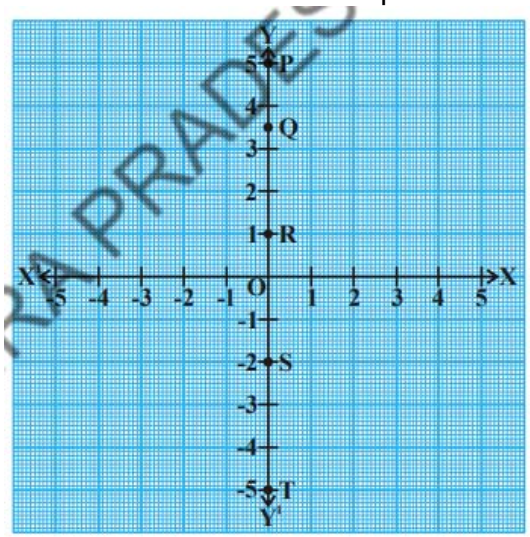
Total no. of periods for this chapter: 5 **Period no :4/5**

Sub topic: Relationship between the signs of the coordinates of a point and the quadrant of a point in which it li

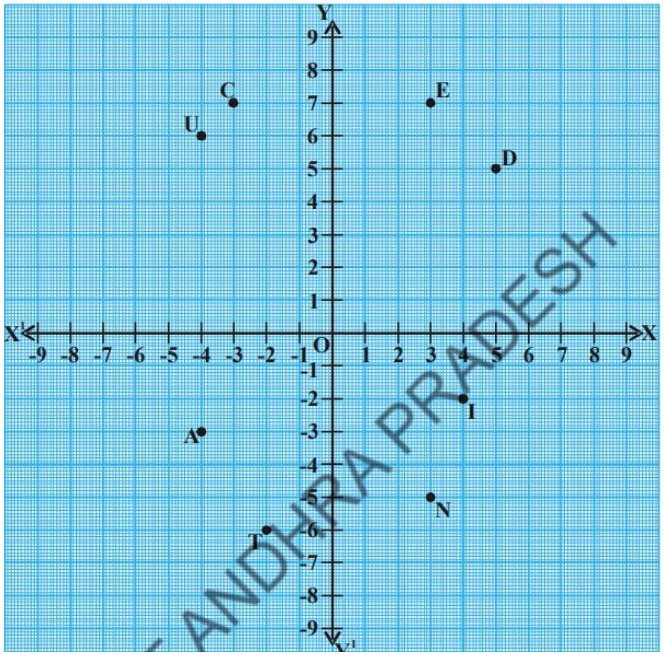
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
. Define Abscissa and ordinate **. Describe the points on a plane.** **Understands coordinates as distances.** **Learning Outcomes:** **Student able to locate /identify a point in cartesian plane**	**Testing of Pre requisite knowledge : 5min** What are cordinates of origin? Complete the table Identify the vertices of a parallelogram ABCD Relationship between the signs of the coordinates of a point and the quadrant of a point in which it lies.		https://www tube.com/w v=Nhd5sH3f t=613s

Point	abscissa	ordinate
(4,3)		
(-4,3)		
	-5	-6
(4,-8)		



	Write the coordinates of the points marked in the graph.  **Write** What do you notice? Are these points lie on the same line? Write the coordinates of the points marked in graph  What do you notice? Are these points lie on the same line?	What is the general form of a point lie on X-axis? What is the equation of X-axis? Do this Among the points given below some of the points lie on X-axis. Identify them. (i) (0,5) (ii) (0,0) (iii) (3,0) (iv) (-5,0) (v) (-2,-3) (vi) (-6,0) (vii) (0,6) (viii) (0,a) (ix) (b,0) What is the general form of a point lie on Y-axis? What is the equation of Y-axis?	SOURCE https://www tube.com/@ SClass91 concept a MCQs Prac

Complete the table based on the following graph



Point	Abscissa	Ordinate	Co-ordinates	Quadrant	Signs of co-ordinates
E	3	7	E (3,7)	Q_1	(+, +)
D	.....	.....	.....	.....	.....
U	–4	6	U (–4,6)	.....	(–,+)
C	.....	.....	.....	.....	.....
A	–4	–3	A (–4, –3)	.....	(–,–)
T	.....	.....	.....	.....	.....
I	4	–2	I (4, –2)	.....	(+,–)
O	.....	.....	.....	.....	.....
N	.....	.....	.....	.....	.....

By observing the above table answer the question?
What is the relationship between the signs of the coordinates of a point and the quadrant of a point in which it lies.

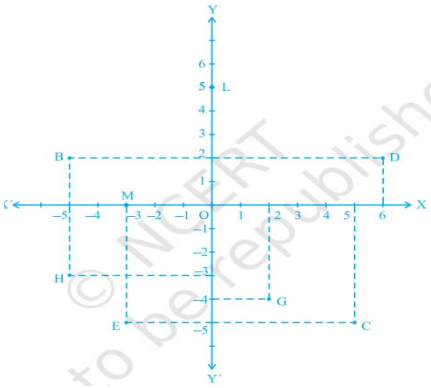
Write the quadrant in which the following points lie?

i) (–2, 3)
ii) (5, –3)
iii) (4, 2)
iv) (–7, –6)
v) (0, 8)

		vi) (3, 0) vii) (–4, 0) viii) (0, –6) Which of the following points lie on the axes? Also name the axis. i) (–5, –8) ii) (0, 13) iii) (4, –2) iv) (–2, 0) v) (0, –8) vi) (7, 0) vii) (0, 0)	

Summative assessment plan- only where relevant

1. See Fig. and write the following:
2. The coordinates of B.
3. The coordinates of C.
4. The point identified by the coordinat
5. The point identified by the coordinat
6. The abscissa of the point D.
7. The ordinate of the point H.
8. The coordinates of the point L.
9. The coordinates of the point M

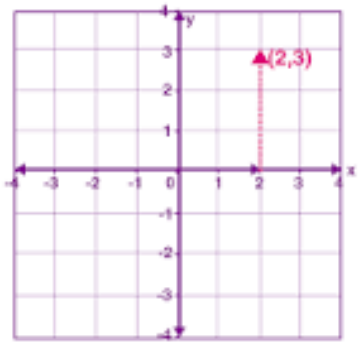


Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: COORDINATE GEOMETRY** **Total no. of periods for this chapter: 5 Period no :5/5** **Sub topic: Plotting the points on Cartesian Plane**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
. Define Abscissa and ordinate **. Describe the points on a plane.** **Understands coordinates as distances.**	**Whole class Activity: 20 minutes** Teacher explains how to plot the given point on the cartesian plane. 1.plot a point (4, 6). 2. Can you say in which quadrant the point P lies? Teacher instructed to the learners to follow the process. Draw two number lines perpendicular to each other meeting at their zeroes on a graph paper. Name the horizontal line as X-axis and the vertical line as Y-axis and locate the meeting point of both the lines as Origin 'O'. • Keep the x-coordinate in mind, start from zero, to from the Origin. • Move 4 units along positive part of X-axis i.e., to its right side and mark the point A. • From A move 6 units upward along a line parallel to positive part of Y-axis . • Locate the position of the point 'P' as (4, 6). The above process of marking a point on a Cartesian plane using their co-ordinates is called "plotting the point"	1.Plot the following points in the Cartesian plane (i) M (–2, 4), (ii) A (–5, -3), (iii) N (1, –6)	**GeoGeb** Graph Maker A3 Graph sheet **https://w.youtu com/live hd5sH3f ?si=XXL AE4U2c e8** **Total concep**

	2.Plot the following point on graph sheet A (2,0) B (4,5) C (-2,4) D (0,4) E (-3, -5) **ACTIVITY: 20 minutes**  **How to Plot the points in the Cartesian plane?** First, identify the abscissa (x-value) and ordinate (y-value) from the given ordered pair. Here, Abscissa = 2 and ordinate= 3. Next, plot the value of x (i.e.) “2” on the x-axis. ... Next, plot the value of y, (i.e.) “3” on the y axis. Two more problems of the same type has to give for practice.	1. Identify the abscissa? 2. Identify the ordinate? 3. What is 2? 4. What is 3? 5. Plot 2 on the graph 6. Plot 3 on the graph.	**and MCQs Practice**

Summative assessment plan- only where relevant

In a graph Sheet Plot each pair of points, join them by line segments

i. (2, 5), (4, 7) ii. (–3, 5), (–1, 7) iii. (–3, –4), (2, –4)

iv. (–3, –5), (2, –5) v. (4, –2), (4, –3) vi. (–2, 4), (–2, 3) vii. (–2, 1), (–2, 0)

Now join the following pairs of points by straight line segments, in the same graph.

viii. (–3, 5), (–3, 4) ix. (2, 5), (2, –4) x. (2, –4), (4, –2)

xi. (2, –4), (4, –3) xii. (4, -2), (4, 7) xiii. (4, 7), (–1, 7) xiv. (–3, 2), (2, 2)

Now you will get a surprise figure. What is it?
Teachers' reflections and experiences:

Work sheet

COORDINATE GEOMETRY

Write the correct answer in each of the following:

1. Point (–3, 5) lies in the

(A) first quadrant (B) second quadrant (C) third quadrant (D) fourth quadrant

2. Signs of the abscissa and ordinate of a point in the second quadrant are respectively

(A) +, + (B) –, – (C) –, + (D) +, –

3. Point (0, –7) lies

(A) on the x –axis (B) in the second quadrant (C) on the y-axis (D) in the fourth quadrant

4. Point (– 10, 0) lies

(A) on the negative direction of the x-axis (B) on the negative direction of the y-axis (C) in the third quadrant (D) in the fourth quadrant

5. Abscissa of all the points on the x-axis is

(A) 0 (B) 1 (C) 2 (D) any number

6. Ordinate of all points on the x-axis is

(A) 0 (B) 1 (C) – 1 (D) any number COORDINATE GEOMETRY 25

7. The point at which the two coordinate axes meet is called the

(A) abscissa (B) ordinate (C) origin (D) quadrant

8. A point both of whose coordinates are negative will lie in

(A) I quadrant (B) II quadrant (C) III quadrant (D) IV quadrant

9. Points (1, – 1), (2, – 2), (4, – 5), (– 3, – 4)

(A) lie in II quadrant (B) lie in III quadrant (C) lie in IV quadrant (D) do not lie in the same quadrant

10. If y coordinate of a point is zero, then this point always lies

(A) in I quadrant (B) in II quadrant (C) on x - axis (D) on y - axis

11. The points (–5, 2) and (2, – 5) lie in the

(A) same quadrant (B) II and III quadrants, respectively (C) II and IV quadrants, respectively (D) IV and II quadrants, respectively

12. If the perpendicular distance of a point P from the x-axis is 5 units and the foot of the perpendicular lies on the negative direction of x-axis, then the point P has

(A) x coordinate = – 5 (B) y coordinate = 5 only (C) y coordinate = – 5 only (D) y coordinate = 5 or –5

13. On plotting the points O (0, 0), A (3, 0), B (3, 4), C (0, 4) and joining OA, AB, BC and CO which of the following figure is obtained?

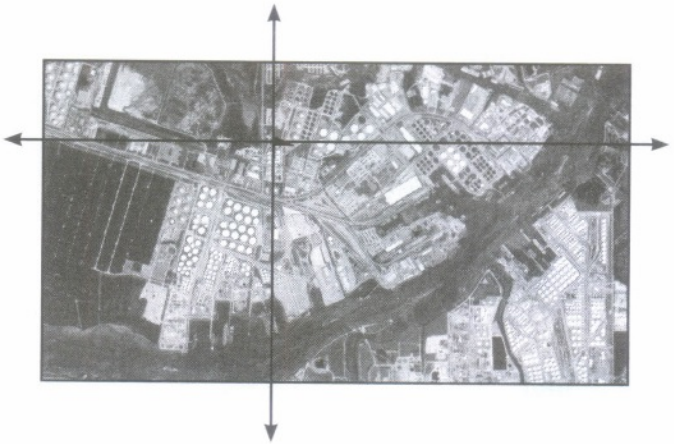
Work Sheet-2

Coordinate Geometry

(Case Based Questions)

A satellite image of a colony is shown below. In this view, a particular house is pointed out by a flag, which is situated at the point intersection of the x and y-axes. If we go 2 cm east and 3 cm north from the house, then we reach a Grocery store. If we go 4 cm west and 6 cm south from the house, then we reach an Electrician's shop. If we go 6 cm east and 8 cm south from the house, then we reach a food cart. If we go 6 cm west and 8 cm north from the house, then we reach a bus stand.

Scale
x-axis : 1 cm = 1 unit
y-axis : 1 cm = 1 unit



Based on the above information, answer the following questions.

(i) The distance between the grocery store and food cart is

(a) 12 cm	(b) 15 cm	(c) 18 cm	(d) none of these

ii) The distance of the bus stand from the house is

(a) 5 cm	(b) 10 cm	(c) 12 cm	(d) 15 cm

iii) If the grocery store and electrician's shop lie on a line, the ratio of the distance of house from grocery store to that from electrician's shop, is

(a) 3.2	(b) 2.3	(c) 1.2	(d) 2.1

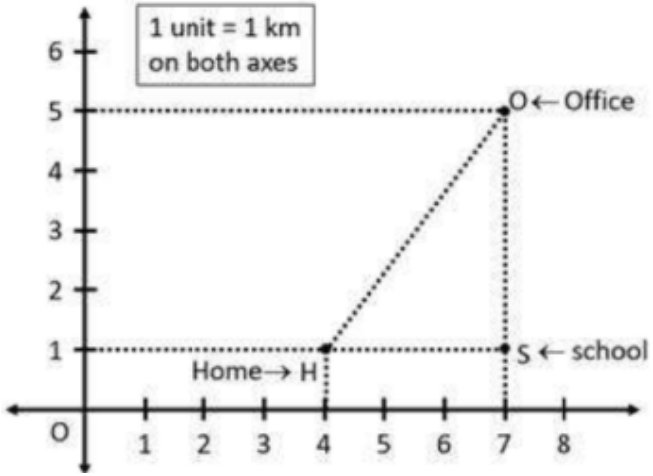
(iv) The ratio of distances of the house from the bus stand to the food cart is

(a) 1.2	(b) 2.1	(c) 1.1	(d) none of these

(v) The coordinates of positions of bus stand, grocery store, food cart, and electrician's shop form a

(a) rectangle	(b) parallelogram	(c) square	(d) none of these

2) Saumya has to reach her office every day at 10:00 am. On the way to her office, she drops her son at school. Now, the location of Saumya's house, her son's school and her office are represented by the map below. Using the details given, answer the following questions.



Q1. Find the coordinates of Saumya's home.
(a) (1, 4) (b) (4, 1) (c) (7, 1) (d) (1, 7)

Q2. Find the coordinates of Saumya's office.
(a) (7, 5) (b) (5, 7) (c) (7, 1) (d) (1, 7)

Q3. Find the coordinates of Saumya's son's school.
(a) (1, 4) (b) (4, 1) (c) (7, 1) (d) (1, 7)

Q4. Find the distance between Saumya's home and her son's school.
(a) 7km (b) 4km (c) 3km (d) 1km

Q5. Find the distance between Saumya's office and her son's school.
(a) 7km (b) 4km (c) 3km (d) 1km

WORKSHEET 3

Practice the questions given in the worksheet on coordinate point. The questions are based on coordinate graph and how to locate the position of a point in a plane.

1. In which quadrant do the following points lie?

(i) A (3, 5)

(ii) B (-2, 1)

(iii) M (-1, -7)

(iv) N (4, -5)

(v) P (-1, 1)

(vi) Q (-5, 3)

(vii) R (7, -3)

(viii) S (4, 7)

2. State which of the points lie on x-axis. Give a common reason.

(i) (0, 2)

(ii) (4, 0)

(iii) (0, 0)

(iv) (0, -3)

(v) (-5, 0)

(vi) (-1, 5)

(vii) (3, -1)

(vii) (2, 0)

3. State which of the points lie on y-axis. Give a common reason.

(i) (0, 4)

(ii) (7, 0)

(iii) (-5, 0)

(iv) (0, -3)

(v) (-1, 2)

(vi) (0, 0)

(vii) (0, 4)

(viii) (-6, -6)

4. Mark the following points on the graph.

(i) E (3, 7)

(ii) F (4, 0)

(iii) M (1, -3)

(iv) N (-2, 5)

(v) P (-1, -6)

(vi) Q (0, 8)

(vii) A (-4, 4)

(viii) B (2, -2)

5. XOX' and YOY' are the co-ordinate axes. Find out the co-ordinate of points, P, Q, R, S, T, U and V. Also write abscissa and ordinate in each case.

6. Plot the point P (4, 0), Q (4, 4), R (0, 4). Now join OP, PQ, QR, OR. What figure do you get?

7. On which axis do the following points lie.

(i) A (0, 4)

(ii) B (-5, 0)

(iii) C (2, 0)

(iv) D (0, 3)

(v) E (0, 0)

LESSON PLAN / PERIOD PLAN

Class : 9

Subject : Mathematics

Chapter No. : 4

Chapter Name : LINEAR EQUATIONS IN TWO VARIABLES

https://epathshala.nic.in/topic-d.php?id=0962CH04

CURRICULAR GOALS & COMPETENCIES

The following curricular goals and competencies are relevant to the chapter:

Curricular Goals:

CG-3: Discovers and proves algebraic identities and the models real- life situations in the form of equations to solve them.

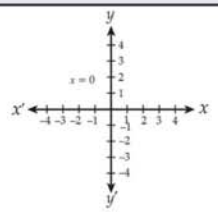
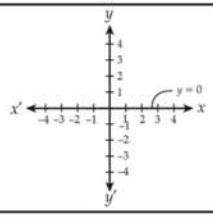
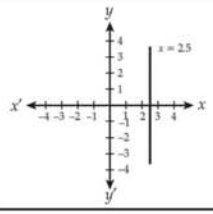
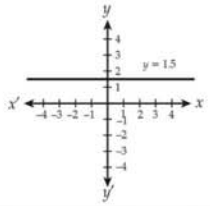
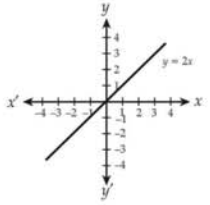
CG-8: Builds skills such as visualisation, optimisation, representation, and mathematical modelling along with their application in daily life.

Competencies:

C-3.2: Models and solves contextualised problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled

C-8.1: Models daily-life phenomena and uses representations such as graphs, tables and equations to draw conclusions

MIND MAP

Equation	Interpretation	Graphical representation
$x = 0$	Equation of y-axis	
$y = 0$	Equation of x-axis	
$x = K$	Straight line parallel to y-axis	
$y = K$	Straight line parallel to x-axis	
$y = mx$	Line passing through origin	

Linear Equation in Two Variables

Linear equation

Equation of the form $ax + by + c = 0$

Where a, b, c - constants, $(a,b) \neq (0,0)$; x, y - variables

Example: $4x + 3y + 7 = 0$

Graphical Representation

Steps to find solution

Step 1: Write the equation in two variables, if not present

Step 2: Reduce it to one variable by putting an arbitrary value of any variable, to find a pair of solution.

Step 3: Repeat step 2 for another arbitrary value of variable to find another pair of solution.

It can have one, no or infinitely many solutions.

Example - Graph of Linear Equation

Linear equation: $2x + 3y + 12$

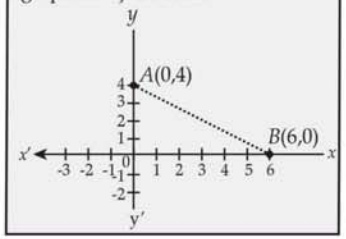
Step 1: From equation, we get

$$y = \frac{12 - 2x}{3}$$

Step 2: Put arbitrary value of x, y.

x	0	0
y	4	6

Step 3: Plot (0,4) and (6,0) on the graph and join them.



PERIOD WISE PLAN

PERIOD NO.	TEACHING TOPIC	LEARNING OUTCOMES
1	Recall of previous knowledge, Introduction to Linear Equations in Two Variables	Student is able to recall linear equations in one variable, identifies variable in real life problems, eplains linear relationship in daily life situations
2	General form of linear equations , reduction to general form, finding coefficients	Student is able to explain linear relationship, identify variable and coefficient's, compute to general form
3	Expressing Linear Equation in One Variable into Two Variable general form	Student is able to express algebraically One variable equation into Two variable equation, shows graphically the solutions
4	Solutions to Linear Equations in Two Variables – meaning, finding solutions and number of solutions	Student is able to use algebraic substitution to find solutions, reads graph of line.
5	Applications of Linear Equations in Two Variables	Student is able to use algebraic substitution to find solutions, reads graph of line, creates linear equation in two variables in daily life situation
6	Applications of Linear Equations in Two Variables	Student is able to use algebraic substitution to find solutions, reads graph of line, creates linear equation in two variables in daily life situation

Chapter Plan(Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: Linear Equations in Two Variables **Total no. of periods for this chapter: 6 Period no :1/6** **Sub Topic:Recall of previous knowledge – Linear Equation in One Variable** **Introduction to Linear Equation in Two Variables**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.**	**Material required**
CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them. **C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions**	**Teacher makes the students recall the concept of Linear Equations in one variable through the following activity.** **ACTIVITY 1 (Pair Game): Fingers Game** 10min Teacher groups the students in pairs and makes them play game. Teacher asks one student to take five (5) fingers of left hand and show it to the other student and keeping right hand backwards (hides) takes one (1) finger and says, I have taken 5 fingers +? many fingers = 6 fingers. The other student has to guess and answer. The first students repeat it with hidden fingers varying. This process is repeated by switching the roles of the students.		

about a situation being modelled	  5+?=6 5+?=7 5+?=8 5+?=9 Teacher makes the students that "?" plays the role of a variable, x,y,z are used to symbolize the variables, and the questions may be expressed as 5+x=6 (or 7,8,9 as per the questions). Teacher makes the students recall that such expressions are called linear equations in one variable. **<u>Teacher introduces the Linear Equations in Two variables through the following activity.</u>** **<u>ACTIVITY 2</u>:<u>PARKING SPACE(Group)** 30min In a parking space all 20 parking spaces are filled. Some are occupied by motorcycles, and others by cars. How many cars and how many motorcycles	1. What is variable? 2. What is equation? 3. What is a linear equation? 4. What is general form of linear equation?	**Studen involve group activity**

	have invaded my territory? [Teacher note: The solution to this can be approached in multiple ways. As there are several very different strategies that lead to a solution.] Teacher divides the class into groups. Group 1, Group 2 and Group 3 work on **Approach 1**. Group 4, Group5 and Group 6 work on **Approach 2.** **Approach 1: (Group 1, Group 2 and Group 3)** **Guess and test:** Guess a solution and test whether the answer matches all the conditions. **Approach 2: (Group 4, Group 5 and Group 6)** **Draw a picture:** Hint - Visualizing the parking space. Knowing the fact that there are 20 vehicles, we focus on the number of wheels. First draw 20 spaces. 1 2 3 4 5 6 7 8 9 10 _ _ _ _ _ _ _ _ _ _	1. What assumptions do you make about the number of wheels? 2. What do you know about the number of vehicles? 3. Take a guess! Now test the guess.	**Linear Equations in Two Variables** **https://www.youtube.com/watch?v=B96Tf3ao4Lw** **4 min. video made by Tic TacLearn on Meaning of Linear Equation part 1**

11	12	13	14	15	16	17	18	19	20

[Teacher note:
Approach1: If one guess is 10 cars and 10 motorcycles and tested these values, you wrote (10 x 4) + (10 x 2) = 40 + 20 = 60 wheels. This value is too low so there must be more cars.
If second guess is 13 cars and 7 motorcycles, we get the solution: (13 x 4) + (7 x 2) = 66 wheels.
Approach 2:
Put two wheels in each space.

1	2	3	4	5	6	7	8	9	10
oo	oo	oo	oo	oo	oo	oo	oo	oo	oo
11	12	13	14	15	16	17	18	19	20
oo	oo	oo	oo	oo	oo	oo	oo	oo	oo

We arrive at 40 wheels. So, we put two more wheels in each space as long as you can, until you reach 66 wheels.

1	2	3	4	5	6	7	8	9	10

o o o o	o o o o	o o o o	o o o o	o o o o	o o o o	o o o o	o o o o	o o o o	o o o o
11	12	13	14	15	16	17	18	19	20
o o o o	o o o o	o o o o	o o	o o	o o	o o	o o	o o	o o

By this diagram we have 13 cars and 7 motorcycles.]

Whole group activity- Teacher demonstrates the third approach – Use of algebra.

Teacher shows this table and ask them to observe the pattern seen in the table and continue to fill in the next two rows.

Let's begin by looking at a table to give us a better understanding of how the quantities are changing. Observe the pattern that will help us to choose what the variable should represent.

# of Cars	Car Wheels	Motorcycles	Cycle Wheels	TotalVehicles	# of Wheels
20	4(20)	20 - 20	2(20 - 20)	20 + (20-20)	4(20)+2(0)
19	4(19)	20 - 19	2(20 - 19)	19 + (20-19)	4(19)+2(1)
18	4(18)	20 - 18	2(20 - 18)	18 + (20-18)	4(18)+2(2)
17					
16					
.					4(_) +2(__) =66
.					

1. What are 2 equations of this situation?
2. What should be the value of x and y?
3. How many ways can you find answer this question?
4. If the number of parking spaces is changed as 30, what will be the passivity?

	[Teacher Note: Teacher should make sure that the intention of this activity is to create linear equations in two variables and not to emphasis on system of equations, as it covered in Class 10]		

Summative assessment plan- only where relevant

1. Identify the variable in the equation 3x-5=0
2. What is the general form of linear equation in one variable?
3. The cost of a pen is Rs. 10 and the cost of a pencil is Rs. 5. If Ramesh purchased few pens and few pencils for a total cost of Rs. 60 then create a linear equation to represent the data.

Teachers' reflections and experiences:

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Linear Equations in Two Variables** **Total no. of periods for this chapter: 6** **Period no :2/6** **Key concepts: Linear Equations in Two Variables** **Sub Topic: General form of linear equation in two variables** **Comparing with the general form and finding coefficients**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.**	**Material required**
CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them. **C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled**	**Teacher makes the students recollect about format of linear equations in two variables with more examples through activity.** **ACTIVITY 1 (Pair Work) (20 min)** Teacher groups the students in pairs and ask to frame equations for situation announced and the other student is to create a different situation for the same equation. [Teacher Note: Teacher may announce a situation such as "During the Independence Day, Rahul and Sheela thought to contribute to the event. Rahul plans to bring flag stickers and Sheela plans to bring flag bands. A total of 100 flag stickers and flag bands are required."]	1. What are the variables needed to assume here? 2. What equation do we get here? 3. If there are 200 flags needed, what equation do we get? 4. Can you give more examples of linear	**Students involve in group activity**

	[Teacher Note: Teacher may conduct this activity with more situations to bring to the students an idea that we may get equations with numeric coefficients.] **<u>Teacher makes the students express linear equations in general form and compare through series of questions:</u>** **(20 min)** 1. Jonathen has fruits in the form of few boxes of apples and few boxes of oranges. Each box of apples has 3 apples and each box of oranges has 5 oranges. If a total of 50 fruits are available with Jonathen, then write an equation representing the data. 2. In the first question if we do not know the total number of fruits, but it is given that the boxes of oranges are 4 more than the boxes of apples, then how do you frame an equation? 3. Compare the two equations obtained in the Q1 and Q2. Describe few similarities and few dissimilarities. Teacher draws the student's attention that both are the equations but are not	equations? 1. What equation do we get here? 2. What is the variable used and what are their unknowns? 3. What equation do we get here? 4. What is the variable used and what are their unknowns? 5. Express the equation in Q2 in general form and state the values of a, b and c.	**Linear Equations in Two Variables** **https://www.youtube.com/watch?v=8rJdZbhvihc** **4 min. video made by Tic**

	in a common format. Teacher states the general form of linear equation and expresses the equation obtained in Q1 in general form and states the values of a, b, c.		**TacLearn on Meaning of Linear Equation part 2**

Summative assessment plan- only where relevant

4. What are the variables in the linear equation 5x+3y-6=0 and compare with standard form and find a, b, c.
5. Is the equation $y = \frac{3}{x}$ expressible in general form of linear equation in two variables? Give reasons in support of your answer.

Teachers' reflections and experiences:

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Linear Equations in Two Variables** **Total no. of periods for this chapter: 6** **Period no :3/6** **Sub Topic:Expressing Linear Equations in One Variable into Linear Equations in Two Variables**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.**	**Material required**
CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them. **C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled**	**Teacher makes the students recollect the concept of linear equations in two variables and its standard form through series of questions.. 10min** 1. There are a total of 5 doors and windows in Shyam's house. What are the unknowns in it? Let's express it algebraically. 2. There are some cars and some bikes in a parking zone. If a total of 70 wheels are observed, then express it algebraically. 3. Express the situations in Q1 and Q2 in general form ax+by+c=0. **Teacher makes the students identify that Linear Equations in One Variable may be generalized as the Linear Equations in Two Variables using the discussion and**	1. An equation is given as 5x+8=9y. What are the variables involved? 2. Give 2 examples of equations which are not linear equations in two variables.	**Students involve in computational activity**

	computational activity. 30min 1. Teacher gives a linear equation 2x=3-5y and asks the students to express it in general form. [Teacher should ensure that students are able to do the transpositions properly, if not necessary inputs on equalities may be given] 2. Teacher invites a student of the class to give a linear equation in one variable such as 4x=7 and asks the students to look at it as in two variables. (?) x + (?) y + (?) = 0 [Teacher Note: Teacher should ensure that students are able to assume the absence of y as its presence with zero (0) coefficient. 3. Teacher gives an equation on his / her own and asks the students to express it in two variables.	6. What equation do we get here? 7. What is the variable used and what are the coefficients? 8. What equation do we get here? 9. What is the variable used and what are the coefficients? 10. Write an example of linear equation in one variable and express it in the form of linear equation in two variables. And state the values of a, b, c.	**Linear Equations in Two Variables** https://www.youtube.com/watch?v=mZqQZf0kHO0 **4 min. video made by Tic TacLearn on Meaning of Linear Equation part 3**

Summative assessment plan- only where relevant

6. What are the variables in the linear equation 5y-6=0 and express it in standard form and find a,b,c .
7. Is the equation $x = 0$ expressible in general form of linear equation in two variables? Give reasons in support of your answer.

Teachers' reflections and experiences:

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

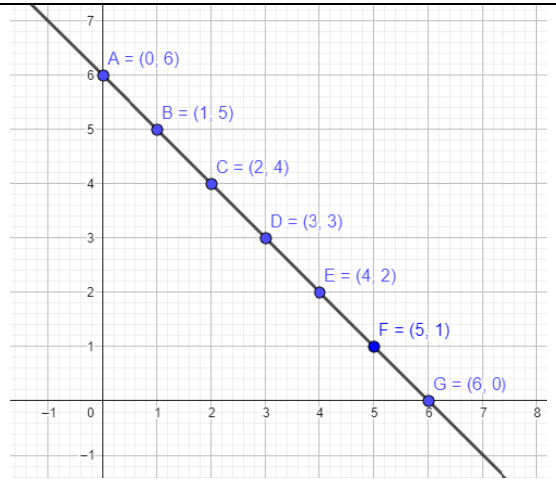
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

<table>
<tr><td colspan="4">Class: 9th Subject: Mathematics Chapter: Linear Equations in Two Variables
Total no. of periods for this chapter: 6 Period no :4/6
Sub Topic:Meaning of Solution to a Linear Equations in Two Variables.
Finding solutions to Linear Equations in Two Variables.</td></tr>
<tr><td>Learning Outcomes & Indicators/micro-competencies</td><td>Teaching-Learning Process
This should include activities to facilitate learning along with broad time duration</td><td>Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.</td><td>Material required</td></tr>
<tr><td>CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them.
CG-8: Builds skills such as visualization, optimization, representation, and mathematical modelling along with their application in daily life.</td><td><u>Teacher makes the students understand the meaning of solution to a linear equation.</u>
10min
Teacher groups the students in pairs and follow an activity:

Teacher asks one student to create a linear equation in two variables and ask the other student to replace the variables with some values and check for its correctness and repeat it until it is found correct.
<table><tr><td>Equation</td><td>Value to first variable, x</td><td>Value to second variable, y</td><td>Left Hand Side</td><td>Right Hand Side</td><td>Is the equation satisfied? (Y/N)</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>1. Do you get a pair of values for the variables for sure to satisfy a given linear equation?
2. Find a solution to the equation x-y=5.</td><td>Students involve in computational activity</td></tr>
</table>

C-3.2: Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **C-8.1: Models daily-life phenomena and uses representations such as graphs, tables and equations to draw conclusions**	Teacher asks the students to swap their roles and repeat the activity. [Teacher Note: Teacher should ensure that student is able to check the equality between the two sides Teacher conveys that the pair of values of for the variables, x and y in this case, written as (x,y) is a solution to the equation. **<u>Teacher makes the students learn the method of finding solutions to linear equations in two variables. 30min</u>** Teacher makes the students in group 3 students (A, B and C) and asks them to involve in computational task to find the solutions. Teacher announces a linear equation in two variables, say, x + y=6. Teacher asks "A" to choose a value for x and asks "B" to replace x with the value and compute value of y. Teacher asks "C" to take the value of (x,y) and show graphically. Teacher may swap the roles of A and B to get more points.	1. What is value of y if x=0? 2. What is value of x if y=0? 3. If x=y what is (x,y)= ? 4. How many solutions do we get for the equation given? 5. How many solutions a linear equation in one variable has?	**Students use stationary to tabulate in books.** **Tic TacLearn 4 min. video link below on Solution to Linear Equations in Two Variables** **https://www.youtube.com/watch?v=QW**

	 After some computations, teacher may ask to observe the graph and comment. Teacher imparts the process of finding solution to linear equations in two variables and its graph is a set of collinear points forming a line.	6. Choose a point on the line (graph) different from the values obtained and check whether it is solution or not. 7. Choose a point not on the line (graph) and check whether it is solution or not. 8. What do you conclude from the results of Q6 an Q7 ?	MbC---huA

Summative assessment plan- only where relevant

8. Write 4 solutions to the equation x+y=8.
9. Is (2,0) a solution to the equation y=5-x ?
10. Show the graph of x=7 on a number line.
11. Draw the graph of the linear equation 2x-y=-1.

Teachers' reflections and experiences:

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Linear Equations in Two Variables** **Total no. of periods for this chapter: 6** **Period no :5/6** **Sub Topic:Applications of Linear Equations in Two Variables**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.**	**Material required**
CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them. **CG-8: Builds skills such as visualization, optimization, representation, and mathematical modelling along with their application in daily life.** **C-3.2: Models and**	**Teacher makes the students involve in problem solving activity 10min** Teacher engages the students in problem solving activity: 1. Write each of the following equations in the form ax + by + c = 0 andindicate the values of a, b and c in each case: (i) 2x + 3y = 4.37 (ii) x – 4 = 3 y (iii) 4 = 5x – 3y (iv) 2x = y [Teacher Note: Teacher should ensure that the students are able to use the transposition rules taught in previous classes.] 2. Write four solutions for each of the	Assignment: Write the equation 3x-7y=2.5 in the form of ax+by+c=0 and find the values of a,b,c. Assignment:	**Paper, stationary, graph.** **Students involve in computational activity** **6 min and 2 min Tic TacLearn videos on**

solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **C-8.1: Models daily-life phenomena and uses representations such as graphs, tables and equations to draw conclusions**	following equations: (i) 2x + y = 7 (ii) πx + y = 9 (iii) x = 4y [Teacher Note: Teacher should ensure that the students are able to compute and tabulate the results and recollect the value of π.] 3. Find the value of k, if x = 2, y = 1 is a solution of the equation 2x + 3y = k. [Teacher has to make the students that solution satisfies the equation and hence we have to substitute the values of x and y given and create equation in k and solve it to find k.] 4. Find 5 different solutions to the equation 2x-y=1 and draw graph. [Teacher Note: Teacher should make sure that the students recollect the usage of graphs]	Write five solutions for the equation x+2y-4=0. Assignment: If x=4 and y=-1 is a solution to the equation px+qy=r then find the relation between p, q and r. Assignment : The Distance(y) in meters and Time(t) in seconds relevant to a uniform motion may be modelled by the equation y=4t. Draw its graph.	**Solution to Linear Equations in Two Variables part 2&3** **https://www.youtube.com/watch?v=NIG3R1XWFy4** **https://www.youtube.com/watch?v=yrpZ456BbhE**

Summative assessment plan- only where relevant

12. Write 4 solutions to the equation x+y=8.
13. Is (2,0) a solution to the equation y=5-x ?
14. Show the graph of x=7 on a number line.
15. Draw the graph of the linear equation 2x-y=-1.

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Linear Equations in Two Variables** **Total no. of periods for this chapter: 6** **Period no :6/6** **Sub Topic:Applications of Linear Equations in Two Variables**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/ self-assessment checklists/etc.**	**Material required**
CG-3: Discovers and proves algebraic identities and the models real-life situations in the form of equations to solve them. **CG-8: Builds skills such as visualization, optimization, representation, and mathematical modelling along with their application in daily life.** **C-3.2: Models and**	**Teacher makes the students involve in problem solving activity** Teacher engages the students in problem solving activity: 1. If (1, -2) is a solution of the equation 2x – y = p, then find the value of p. 2. Cost of a pen is two and half times the cost of a pencil. Express this situation as alinear equation in two variables. 3. Express x in term of y : x/7 + 2y = 6. 4. How many linear equations in x and y can be satisfied by x = 1 and y = 2?	Assignment: 1. If (2, -3) is a solution of the equation 2x – y = p, then find the value of p. 2. Cost of a pen is three and half times the cost of a pencil. Express this situation as a linear equation in two variables. 3. Express y in term of x : x/7 + 2y = 6. 4. How many linear equations in x and y can be satisfied by x = 2 and y = 1?	**Paper, stationary etc** **Students involve in computational activity**

solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or single polynomial equations) and draws conclusions about a situation being modelled **C-8.1: Models daily-life phenomena and uses representations such as graphs, tables and equations to draw conclusions**	5. In aone-day international cricket match, Raina and Dhoni together scored 198 runs. Express the statement as a linear equation in two variables. 6. In some countries temperature is measured in Fahrenheit, whereas in countries like India it is measured in Celsius. Here is a linear equation that converts Fahrenheit to Celsius: F=[9/5]C+32. If the temperature is – 40°C, then what is the temperature in Fahrenheit?	5. In an one day international cricket match, Kohli and Rohit together scored 146 runs. Express the statement as a linear equation in two variables. 6. In international system angles are measured in radians. It is known that π radians = 180^0. The relationship between degree measure of an angle and its radian measure is modelled by the equation $\frac{D}{180} = \frac{R}{\pi}$. If an angle measure 120^0 then find the measure of the same angle in radians. Express the result in terms of π . Also, express the value as a decimal using the approximate value of $\pi = 3.14$.	

Summative assessment plan- only where relevant

16. A fraction becomes 1/4 when 2 is subtracted from the numerator and 3 is added to the denominator. Represent this situation as a linear equation in two variables. Also, find two solutions for this.
17. Write 3 solutions to the equation 2x-5y=10.
18. Draw the graph of the linear equation$y = \frac{2}{3}x + \frac{1}{3}$. Check from the graph that (7,5)is a solution of the linear equation.?

Teachers' reflections and experiences:

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

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Extended Learning:

http://ncert.nic.in/ncerts/l/ieep204.pdf

(for more practice)

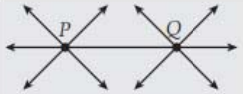
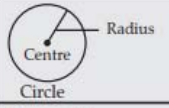
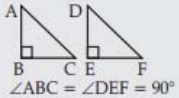
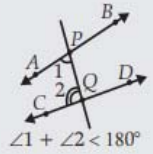
5. INTRODUCTION TO EUCLID'S GEOMETRY

https://epathshala.nic.in/topic-d.php?id=0962CH05

THE FOLLOWING CURRICULAR GOALS (CG) AND COMPETENCIES (C) WILL BE DEVELOPED THROUGH THIS CHAPTER

CURRICULAR GOALS(CG)	COMPETENCIES (C)
CG-4: Analysis characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships	C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triang to make and test conjectures and solve problems C-4.2: Proves theorems using Euclid's axioms and postulates t triangles and quadrilaterals, and applies them to solve geome problems
CG-7: Begins to perceive and appreciate the axiomatic and deductive structure of Mathematics	C-7.1: Proves mathematical statements and carries out geometric constructions using stated assumptions, axioms, postulates, definitions and mathematics vocabulary C-7.3: Proves theorems using Euclid's axioms and postulates · angles, triangle, quadrilaterals, circles, area-related theorems triangles and parallelograms
CG-10: Knows and appreciates important contributions of mathematicians from India and around the world	C-10.1: Recognises the important contributions made by mathematicians (Indian and others) in the field of Mathemati (such as evolution of members, geometry, algebra) C-10.2: Recognizes modern contributions to Mathematics ma in both India and abroad, and understands the next frontiers a the next major open questions in the field of Mathematics

MIND MAP

1	A straight line can be drawn from any one point to any other point.	
2	A terminated line can be produced infinitely.	
3	A cirde can be drawn with any centre and of any radius.	
4	All right angles are equal to one another.	
5	If a straight line falling on two straight lines makes the interior angles on the same side of it, taken together makes less than two right angles, then the two straight lines, if produced indefinitely, meet on that side on which the sum of the angles is less than two right angles.	

Introduction to Euclid's Geometry

Euclid's Geometry

Axiomatic system, in which all theorems are derived from a small number of axioms

Definitions

Point	Has no width, no length and no depth	Point
Line	Collection of points, can be extended in both directions.	Line
Surface	Two - dimensional collection of points (has length & breadth only)	Surface

Euclid's Postulates

Euclid's Axioms

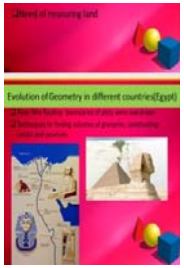
1	Things which are equal to the same thing are equal to one another.
2	If equals are added to equals, wholes are equal.
3	If equals are subtracted from equals,the remainders are equal.
4	Things which coincide with one another are equal to one another.
5	The whole is greater than the part.
6	Things which are double of the same things are equal to one another.
7	Things which are halves of the same things are equal to one another.

PERIOD WISE PLAN

Period No	Teaching Topic	Learning Outcomes
1	History	Understands Euclid's Contribution in Plane Geometry
2	Euclid's Definitions	Defines terms and knows undefined terms in Geometry
3	Axioms	Understands Euclid's Axioms
4	Postulates	Understands Euclid's Postulates
5	Theorems	Proves Theorems

Key concepts: 1. Introduction to Euclid geometry, Define and undefined terms, Euclid's definitions, Axioms and postulates

Chapter Plan(Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: INTRODUCTION TO EUCLIDS GEOMETRY** **Total no. of periods for this chapter: 5+1(WS)=6** **Period no :1**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
Students will be able to understand the term geometry and its origin. **Students should also know about the mathematician Euclid.** **Appreciate the contribution of great mathematician like Euclid, Thales in geometry.** **Knows and identifies the terms related to geometry given by Euclid by analyzing them critically.**	**Testing of Pre requisite knowledge 10 min** **Whole class discussion:** https://youtu.be/3LqFmr9jr-g **History of Ramappa temple** 1. **What shapes observed in the video?** 2. **Identify the geometrical shapes seen in the video and describe them?** 3. **To build such a monument what other geometrical concept used?** **History: 30 min**	**What is a closed figure formed by 3-line segments called?**	 https://www.youtu

	 **In groups, answer the following?** **See the above picture,** **Guess What is the picture about?** **Which shapes are in this figure?** **What geometrical shapes does it resemble?** **Can you guess shape of the base is?** **Teacher introduces the Egyptian Pyramids** **[Teacher Note: Focus on the use of geometry in building beautiful structures and monuments]** **Teacher further extends the discussion to the meaning of geometry, origin of geometry.** **Teacher shares famous people contribution towards geometry for the development of geometry.**	**Describe the word geometry in your own words?** **In how many chapters Euclid divided his famous book "THE ELEMENTS"?** **To which country Euclid belongs?** **Who is called father of geometry?**	om/watch?v=2 xfEl688u8 SOURCE:: **Euclids Definitio** https://www.youtu om/@Practically Introduction Euclidean geometry https://www.youtu om/watch?v=iNyFS 8 SOURCE:: https://www.youtu om/@LetstuteCBSE H History

Summative assessment plan- only where relevant

1. **Write the history of geometry in your own words.**

Teachers' reflections and experiences:

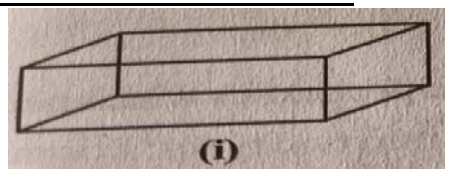
1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

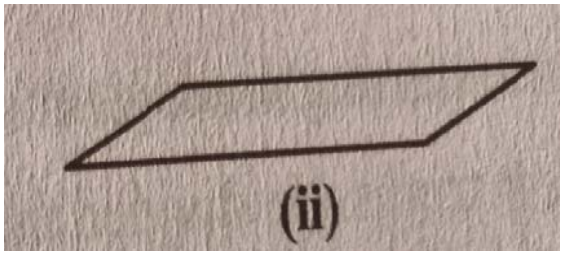
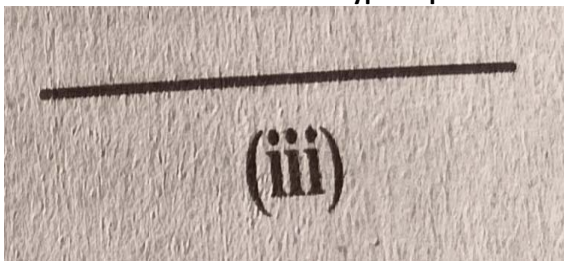
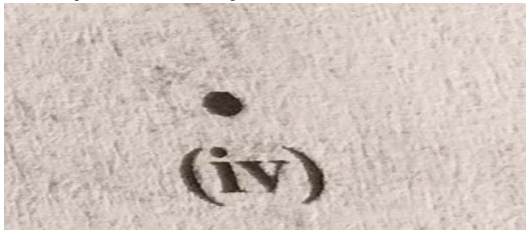
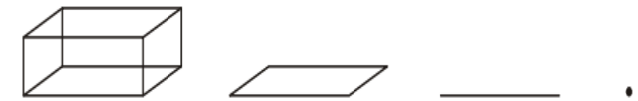
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

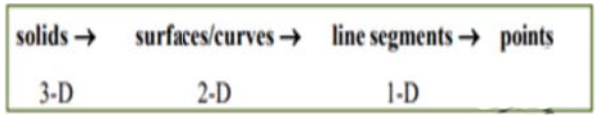
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: Introduction to Euclid's Geometry
Total no. of periods for this chapter: 6 Period no : 2
SUB TOPIC: Euclid's definitions

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.	Materi requir
KNOWLEDGE: Students will develop the ability to understand Euclid's defilations. **Skills and competences: Student would be able to reason effectively and critically, describe definitions.**	**Testing of Pre requisite knowledge 10 min** **Whole class discussion:** **Teacher draws on board or displays chart and asks questions:** **1.Draw a line segment.** **2.What is the start and ending of the line segment?** **3.Draw the line.** **4.How many points are there on a line?** **5.What is a plane?** **6.What is a solid?** **7.How many dimensions a solid has?** **Teacher Introduces the Euclid Definitions** **TOPIC: 20min**  **What is this picture?** **How many dimensions the above figure has?**	1. Give some examples to a solid figure. 2. In how many chapters Euclid divided his famous book 3. Define a solid in your own words? 4. What are the boundaries of a Surfaces?	**Euclid's Definitio** **https://www tube.com/w v=qLfScRAh** **SOURCE::htt www.youtul m/@TicTacL English**

	how many faces the cuboid has? **Suppose we remove height of the picture what type of picture formed?**  **How many dimensions this rectanglehas?** **If it loses one more dimension what type of picture formed?**  **If it has loss one more dimension what is the remaining part?** **Does point has any dimensions?**  	5. What are ends of a line?	

	 Teacher explains the following Euclid definitions by playing video.– **10 MINUTES** 1. A Point is that which has no part. 2. A line is breadthless length. 3. The ends of a line are points. 4. A straight line is a line which lies evenly with the points on itself. 5. A surface is that which has length and breadth only. 6. The edges of a surface are lines. 7. A plane surface is a surface which lies evenly with thestraight lines on itself.	6. How many definitions Euclid gave in hisfamous book THE ELEMENTS? 7. Write three steps from solids to points. 8. In Book 1, How many definitions were listed byEuclid? 9. Write defined and undefined terms according to Euclid?	**Euclid's Geometr** https://www ube.com/wa =CYQps3_1 SOURCE::htt www.youtut m/@Letstı

Summative assessment plan- only where relevant

1. **Write any five Euclid's definitions.**

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

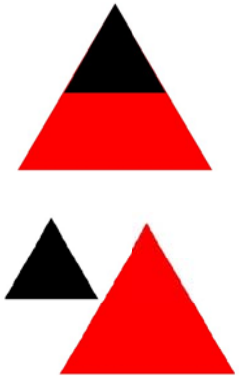
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

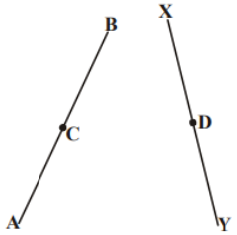
Class: 9th **Subject: Mathematics** **Chapter: INTRODUCTION TO EUCLIDS GEOMETRY** **Total no. of periods for this chapter: 6** **Period no: 3** **Topic: axioms**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
Know the undefined terms in geometry. **Differentiate and classify the point, line, plane related objects.**	**Testing Previous Knowledge: (10 min)** 1. Write some undefined terms? 2. Write some defined terms in geometry? 3.  Suppose 1st triangle is taken as whole then the black triangle is part. Write the relationship between the triangles in your own words.	What is an axiom?	**Euclid's Definitio** **https://y u.be/qLf AhZDw bmvc4w Okx2er** **SOURC ttps://wv youtube m/@Tic LearnEn h**

	Teacher introduces the Euclid axioms through playing video. (20 min) Dileep has as many biscuits as Rohit and Rohit has as many biscuits as Prabhu.  Can you tell any relationship between the number of biscuits Dileep and Prabhuhas? What is your observation? Teacher makes the students into groups, through playing the video explain all Euclid axioms? And also, teacher will explain remaining axioms as the above? Say some Euclid axioms? **Teacher asks the students to answer the following in groups: (10 min)**	Write Euclid Ist axiom? Write the Euclid axioms?	https://wv youtube.c watch?v=I AZRoDgI &t=300s Euclid axi

I. Match the following.

Numbers/letters	activity	Related axiom Number
1.A, B, C	A=B, B=C⇒ $A = C$	
2.A, B	$\frac{1}{2}A = \frac{1}{2}B$	
3. A	A=A	
4. X, Y	2X=2Y	
5. 6	6=6 $\Rightarrow 6 + 7 = 6 + 7$	
6.12	12=12 $\Rightarrow 12 - 5 = 12 - 5$	

II. In the adjacent figure, we have AC = XD, C and D are mid points of AB and XY respectively. Show that AB = XY.



What is given?

Is AB=2AC. Give reasons?

Is XY = 2 XD Give reasons?

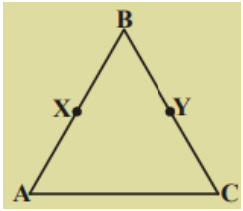
Which Euclid axiom applicable?

	What do you notice?		

Summative Assessment Plan- only where relevant

1.If a point Q lies between two points P and R such that PQ = QR, prove that PQ = $\frac{1}{2}$PR .

2. In the adjacent figure, we have $BX = \frac{1}{2}AB$, $BY = \frac{1}{2}BC$ and AB = BC. Show that BX = BY.



Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

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Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: INTRODUCTION TO EUCLIDS GEOMETRY**
Total no. of periods for this chapter:6 **Period no :4**
Key concepts: Introduction to Euclid's geometry, Euclid's definitions, undefined terms, Axioms, postulates
Topic: Postulates

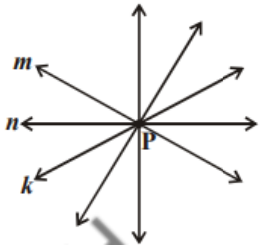
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
Know the undefined terms in geometry. **Differentiate and classify the point, line, plane related to objects.**	**Testing previous knowledge (10 min)** 1.Write any 2 Euclid's axioms? 2. Axioms are assumed (A) universal truths in all branches of mathematics (B) universal truths specific to geometry (C) theorems (D) definitions 3. John is of the same age as Mohan. Ram is also of the same age as Mohan. State the Euclid's axiom that illustrates the relative ages of John and Ram (A) First Axiom (B) Second Axiom (C) Third Axiom (D) Fourth Axiom 4. It is known that if x + y = 10 then x + y + z = 10 + z. The Euclid's axiom that illustrates this statement is :		**Euclid's Postulate** https://www tube.com/w v=BEheVM lc&t=178 **SOURCE** https://www tube.com/@ cLearnEngl

(A) First Axiom (B) Second Axiom
(C) Third Axiom (D) Fourth Axiom

Whole Class activity: (30 min)

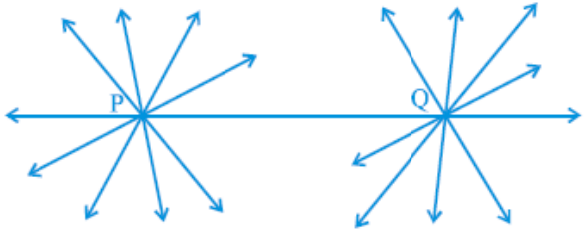
Click here

Using the above given video teacher has to explain the concept by drawing required diagrams.



Answer the following :

1. How many lines can we draw from a given point?



2. By observing the above figure write that how many lines can pass through given two points?

Describe about axioms and postulates in your own words?

Write Euclid's 1st postulate and also write related axiom?

Write Euclid's 2nd postulate ?

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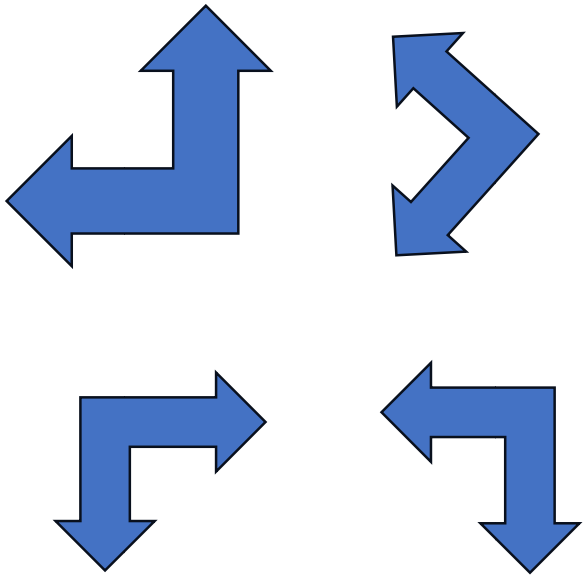
Euclid axio

How far we can extend AB?

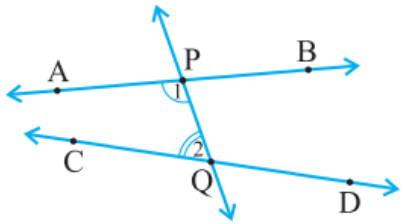
3. Radii of four circles are given as 3 cm, 4 cm, 4.5 cm and 5 cm. Using a compass, draw circles with these radii taking P, Q, R and S as their centres.
   If the Centre and radius of a circle are given, can you draw the circle?

Write Euclid's 3rd postulate

4. Take a grid paper. Draw different figures which represent a right angle. Cut them along their arms and place all angles one above other. What do you observe?



Write Euclid's 4nd postulate?

	5.  Measure the angles $\angle APQ, \angle CQP$. And add them? On which side of PQ, the lines AB and CD will intersect? By drawing some more similar figures write your observations?	Write Euclid's 5th postulate on your own words?	

Summative assessment plan- only where relevant

1. Why is Axiom 5, in the list of Euclid's axioms, considered a 'universal truth'? (Note that the question is not about the fifth postulate.)

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

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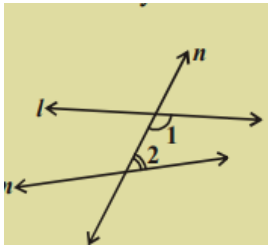
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: INTRODUCTION TO EUCLIDS GEOMETRY** **Total no. of periods for this chapter: 6** **Period no : 5** **Topic: Problems based on Euclid axioms and Postulates**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
Applies the concept of undefined terms, axioms and postulates of Euclid's Geometry. **Differentiate and classify the point, line, plane related objects etc**	**Teacher engages the students in applying the axioms and postulates proposed by Euclid: (25 min)** 1. Prove that an equilateral triangle can be constructed on any given line segment. 2. Daw a line segment of any length says PQ? 3. Draw a circle with Centre P and radius PQ. Draw another circle with Centre Q and radius QP. Mark the intersection point R where two circles meet. Join 'R' to P and Q to form Δ PQR. Is PQ = PR? Is PQ = QR? [Use Euclid's axiom, two things which are equal to same thing are equal to each another] So, can, we say ΔPQR is an equilateral triangle.	1.Write Euclid 3rd postulate? 2.Which Euclid postulate is used to prove the given triangle is equilateral? 3. Draw an equilateral triangle whose sides are 5.2 cm each.	https://yout K6R4MHB2w i=Or5sxaelm YUV SOURCE::htt www.youtut m/@Infinityl _NEET Problems Axiom

4. In the following figure, a line n falls on lines l and m such that the sum of the interior angles 1 and 2 is less than 180°, then what can you say about lines l and m.



[Teacher makes the students in pairs and ask them to solve Using Euclid's 5th Postulate.]

Work sheet: (15 min)

1. Write whether the following statements are True or False? Justify your answer.

(i) Pyramid is a solid figure, the base of which is a triangle or square or some other polygon and its side faces are equilateral triangles that converges to a point at the top.

(ii) In Vedic period, squares and circular shaped altars were used for household rituals, while altars whose shapes were combination of rectangles, triangles and trapeziums were used for public worship.

(iii) In geometry, we take a point, a line and a plane as undefined terms.

(iv) If the area of a triangle equals the area of a rectangle and the area of the rectangle equals that of a square, then the area of the triangle also equals the area of the square
.

(v) Euclid's fourth axiom says that everything equals

	itself. (vi) The Euclidean geometry is valid only for figures in the plane 2. Read the following statements which are taken as axioms: (i) If a transversal intersects two parallel lines, then (ii) corresponding angles are not necessarily equal. (iii) If a transversal intersects two parallel lines, then alternate interior angles are equal. Is this axioms consistent with other axioms we learnt ? Justify your answer. 3. Read the following two statements which are taken as axioms: (i) If two lines intersect each other, then the vertically opposite angles are not equal. (ii) If a ray stands on a line, then the sum of two adjacent angles so formed is equal to 180°. Is this a system of consistent axioms consistent? Justify your answer.		

Summative assessment plan- only where relevant

Q.1: What are the five postulates of Euclid's Geometry?
Q.2: If a point C lies between two points A and B such that AC = BC, then prove that AC =1/2 AB. Explain by drawing the figure.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

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Work Sheet: 1

Introduction to Euclid's Geometry (Class 9)

1) Axioms are assumed

(A) universal truths in all branches of mathematics

(B) universal truths specific to geometry (C) theorems (D) definitions

2) John is of the same age as Mohan. Ram is also of the same age as Mohan. State the Euclid's axiom that illustrates the relative ages of John and Ram

(A) First Axiom (B) Second Axiom (C) Third Axiom (D) Fourth Axiom

3) The number of dimensions, a solid has:

(A) 1 (B) 2 (C) 3 (D) 0

4) The total number of propositions in the Elements are:

(A) 465 (B) 460 (C) 13 (D) 55

5) A pyramid is a solid figure, the base of which is

(A) only a triangle (B) only a square (C) only a rectangle (D) any polygon

6) The side faces of a pyramid are:

(A) Triangles (B) Squares (C) Polygons (D) Trapeziums

7) In ancient India, the shapes of altars used for house hold rituals were

(A) Squares and circles (B) Triangles and rectangles

(C) Trapeziums and pyramids (D) Rectangles and squares

8) Which of the following needs a proof?

(A) Theorem (B) Axiom (C) Definition (D) Postulate

9) . Euclid stated that all right angles are equal to each other in the form of

(A) an axiom (B) a definition (C) a postulate (D) a proof

10) 'Lines are parallel if they do not intersect' is stated in the form of

(A) an axiom (B) a definition (C) a postulate (D) a proof

11) "A square is a polygon made up of four line segments, out of which, length of three line segments are equal to the length of fourth one and all its angles are right angles". Define the terms used in this definition which you feel necessary. Are there any undefined terms in this? Can you justify that all angles and sides of a square are equal?

12) Study the following statement: "Two intersecting lines cannot be perpendicular to the same line". Check whether it is an equivalent version to the Euclid's fifth postulate.

13) Read the following statements which are taken as axioms

(i) If a transversal intersects two parallel lines, then corresponding angles are not necessarily equal. (ii) If a transversal intersects two parallel lines, then alternate interior angles are equal. Is this system of axioms consistent? Justify your answer.

14) Read the following two statements which are taken as axioms

(i) If two lines intersect each other, then the vertically opposite angles are not equal. (ii) If a ray stands on a line, then the sum of two adjacent angles so formed is equal to 180°. Is this system of axioms consistent? Justify your answer.

Work Sheet: 2

Introduction to Euclid's Geometry (Class 9)

SUBTOPIC: EUCLID'S DEFINITIONS, AXIOMS AND POSTULATES

1. The three steps from solids to points are 1
(a) solids-surfaces-lines-points (b) solids-lines-surfaces-points
(c) lines-points-surfaces-solids (d) lines-surfaces-points-solids
2. The number of dimensions, a solid has 1
(a) 1 (b) 2 (c) 3 (d) 0
3. The number of dimensions, a surface has 1
(a) 1 (b) 2 (c) 3 (d) 0
4. Euclid divided his famous treatise 'The Elements' into 1
(a) 13 chapters (b) 12 chapters
(c) 11 chapters (d) 9 chapters
5. In Indus Valley Civilisation (about 3000 BC), the bricks used for construction 1
work was having dimensions in the ratio
(a) 1: 3: 4 (b) 4: 2 : 1 (c) 4 : 4 : 1 (d) 4 : 3 : 2

6. The number of interwoven isosceles triangles in Sriyantra (in the Atharvaveda) 1
is_____.

7. Greek's emphasised on 1
(a) inductive reasoning (b) deductive reasoning
(c) Both (a) and (b) (d) practical use of geometry
8. In ancient India, altars with combination of shapes like rectangles, triangles 1
and trapeziums were used for
(a) public worship (b) household rituals
(c) Both (a) and (b) (d) None of these

9. Thales belongs to the country 1
(a) Babylonia (b) Egypt (c) Greece (d) Rome

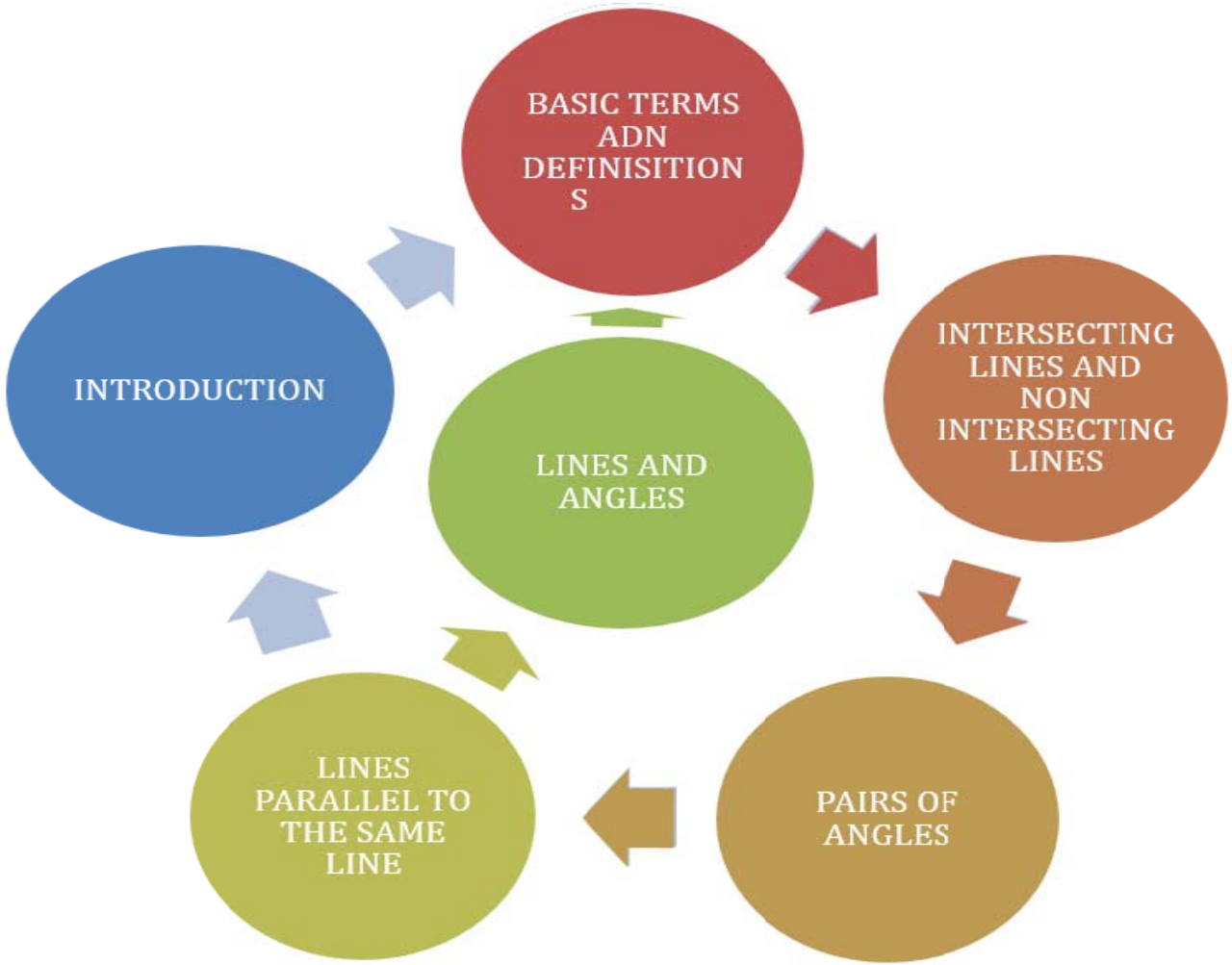
10. Which of the following needs a proof? 1

(a) Theorems (b) Axiom (c) Definition (d) Postulate

LINES AND ANGLES

CURRICULAR GOALS(CG)	COMPETENCIES (C)
CG-4: Analysis characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships	C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems

MIND MAP


BASIC TERMS ADN DEFINISITIONS
INTERSECTING LINES AND NON INTERSECTING LINES
PAIRS OF ANGLES
LINES PARALLEL TO THE SAME LINE
INTRODUCTION
LINES AND ANGLES

PERIOD WISE PLAN

Learning Outcome:

Applies axiomatic approach and derives proof of mathematical statements particularly relate to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles etc. in order to solve problems using them.

PERIOD NO.	TEACHING TOPIC	LEARNING OUTCOMES/Objectives
1	Basic terms and Definitions	Undrestanding basic terms and definition of lines and angles
2	Types of angles and pairs of angles	Undrestanding different kinds of angles and linear pair
3	Practice Period	Reinforcing the concepts
4	Vertex opposite angles and linear pair	Solving problems based on the properties of vertex opposite angles and linear pair angles
5	Vertically opposite angles and linear pair angles	Understaning relation of vertically oppsite angles and linear pair angles
6	Practice period	Reinforcing the learned concepts
7	Parallel lines and transversal	Relation between angles when transversal meet parallel lines

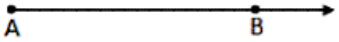
Key concepts: 1. Basic terms and Definitions 2. Pairs of angles 3. Parallel lines and Transversal 4. Lines parallel to the same line 5. Angle sum property of triangle

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles**

Total no. of periods for this chapter:7 **Period no :1**

Sub Topic: Basic terms and Definitions

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
LEARNING OUTCOMES Applies axiomatic approach and derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles etc. in order tosolve problems using them. Differentiates between lines, line segments and rays (C65). **Learning Objectives** Define segment, ray, collinear points, non-collinear points, acute angle, right angle, obtuse angle, straight angle, reflex angle, complementary angles, Supplementary angles and identifythem in a given figure. Pairs of angles Label angles created by two intersecting lines and identifyvertically opposite pairs, adjacent angles, linear pairs, complementary	**Teacher introduces the topic lines and angles through discussion mode and doing activities 30 min** **Activity** (i)  (ii)  (iii)  (iv)  Observe the figures and discuss the properties. 1) How many points are needed to draw a line? 2) Which of the above figures (i) to iv has measurement? 4) How many lines pass through a point?	1) Distinguish between Ray, line and line segment. 2) Number of lines passes through a point are _____ 3) Minimum number of points required to draw a line are _____	Geometry Box GeoGebra Application

/supplementary pairs of angles

Apply the concepts of linear pairs of angles and vertically opposite angles and establish relationships between the angles in a given figure and solve for missing values.

Parallel Lines and a Transversal

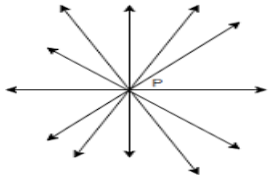
Label angles created by a transversal intersecting two parallel lines and identify corresponding angles,alternate angles, interior angles and define relationships between these angles.

Lines Parallel to the same Line

Find out the unknown angles created by a transversal in a given figure and infer if the lines are parallel or not.

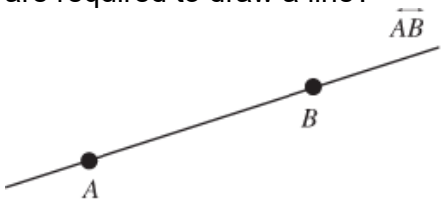
Angle Sum Property of a Triangle

Define the relationship between angles formed when a triangle is placed between two parallel lines and prove that the exterior angle of a triangle is the sum of the two opposite interior angles.



4) How many lines pass through the point P?

5) How many minimum points are required to draw a line?



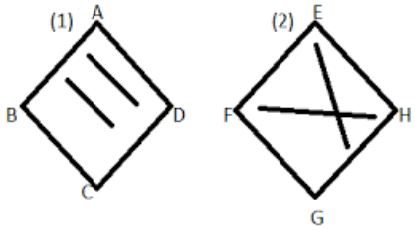
Term	Dimensions	Graphic	Symbol
Point	Zero	•	•A
Line Segment	One	A B	$\overline{AB}$
Ray	One	A B	$\overrightarrow{AB}$
Line	One		$\overleftrightarrow{AB}$
Point	A geometric element that has zero dimensions.	•P	P or Point P
Line	A line is a collection of points along a straight path with no end points.		$\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$
Line segment	A line segment is a part of a line that contains every point on the line between its end points.		$\overline{XY}$ or $\overline{YX}$
Ray	A ray is a line with a single end point that goes on and on in one direction.		PQ
Plane	A plane is a flat surface that extends to infinity.		Plane EFG or Plane T

Activity
Draw two different (distinct) lines on a plane? What is your observation?

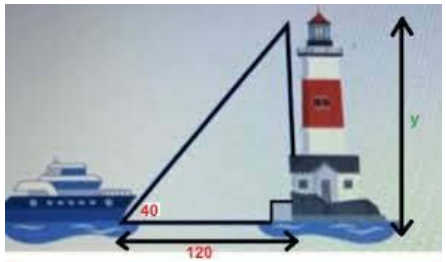
4) In how many ways can we draw two lines on a plane? Explain in detail.

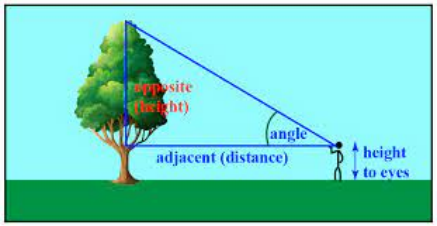
Basic Terms and Definitions c lines and angles

Introduction of lines and angles (video from tic Ta Learn English)

	 **Activity** Prepare a hut with sticks  What is your observation? Which types of lines you observed?  **Teacher explains lines and angles and related real-life fields10min**	What do you say about A,P, Q, and B? 5) If three or more points lie on the same line, they are called _____ points; otherwise, they are called _____ points.	Basic Terms and Definitions of lines and angles 2 Introduction of lines and angles

	lines and angles Architects use the concept of lines and angles in planning and construction. Everywhere in our classroom we find lines and angles. Ask students to discuss these questions: What is the angle between wall and floor, and wall and ceiling in the classroom? What is the angle between wall and the door when it is closed? How does the angle change when the door is open but not fully? Group activity: Measure the angle between a staircase and the floor. If the angles is increased i.e. if the staircase is made steeper, would it become more difficult to climb?	Draw a figure which represent non collinear points?	Match sticks





One can find the height of a building or a tree by calculating the angle to its top, and the horizontal distance to its base. This requires knowledge of trigonometry which students will learn in higher classes.

Geography: The location of a point on earth is described by two angles called latitude and longitude.

Summative assessment

1. Match each word with the correct statement. Write the correct letter on the line.

☐ (i) Point	a) Part of a line having one end point.
☐ (ii) Line Segment	b) An exact location in space.
☐ (iii) Angle	c) The shape formed when two rays meet at a vertex.
☐ (iv) Ray	d) A flat shape which extends endlessly in all directions.
☐ (v) Plane	e) Two or more lines that travel in the same direction and never meet.
☐ (vi) Perpendicular Lines	f) Part of a line having two endpoints.
☐ (vii) Parallel Lines	g) Two lines that cross to form a right angle.
	h) Two or more lines that cross or meet each other at a point.

Teacher Reflexions:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

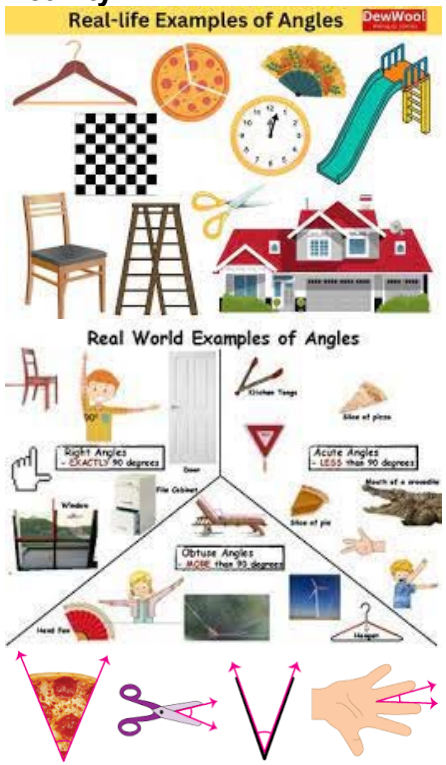
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

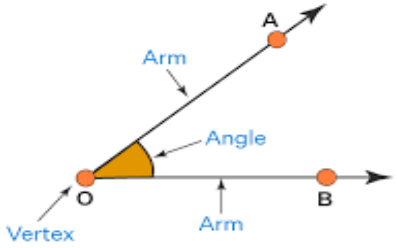
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles** **Sub Topic: Basic terms and Definitions**
Total no. of periods for this chapter:7 **Period no :2**

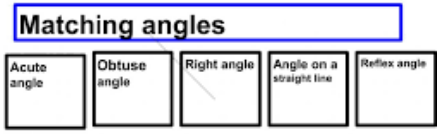
Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems Understanding different kinds of angles, adjacent angles, vertically opposite angles and linear pair	**Teacher testing prerequisite knowledge: (5 min)** **Activity**  **Examine your surroundings and identify the angles. (10 min)**	Identify the lines, angels and other geometrical shapes.	Geometry Box GeoGebra Application

Discuss and give some more examples.
How does an angle form?
Name the parts in the angle.



Ask the students to bring thin broomsticks and also bring cycle wall tubes and make different types of angles.

Activity (5 min)
Recall types of angles



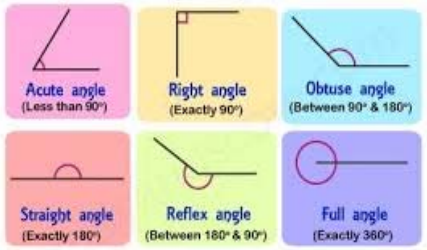
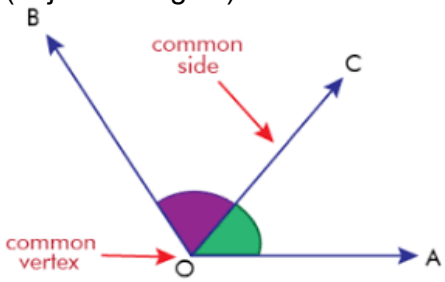
Let's recall the types of angles.

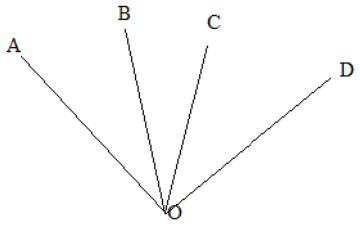
1)

Match each angle on the left side to the correct type on the right side.

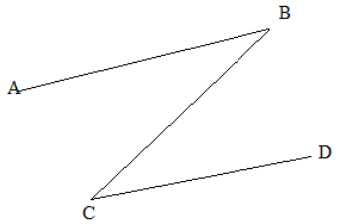
	Angle		Type
A		1	reflex angle
B		2	straight angle
C		3	obtuse angle

In which angle, the measure is more than 180° but less than 360°?

	 Types of angles **Teacher explains different types of pairs of angles through playing videos and showing models and illustrating real life examples** **<u>Pairs of Angles</u> (15 min)** **Activity** Observe the following figure. How do we say angle AOC, angle COB? (adjacent angles)  Give counter examples, and explain why they are not adjacent.	Describe adjacent angles in your own words.	Basic Terms and Definitions of lines and angles Video from Tic-Tac learnenglish adjacent angles

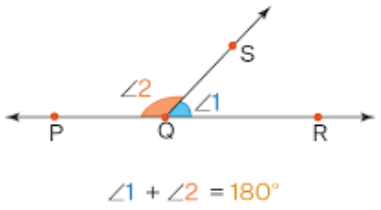


Why ∠AOB and ∠COD are not adjacent? Give reasons.

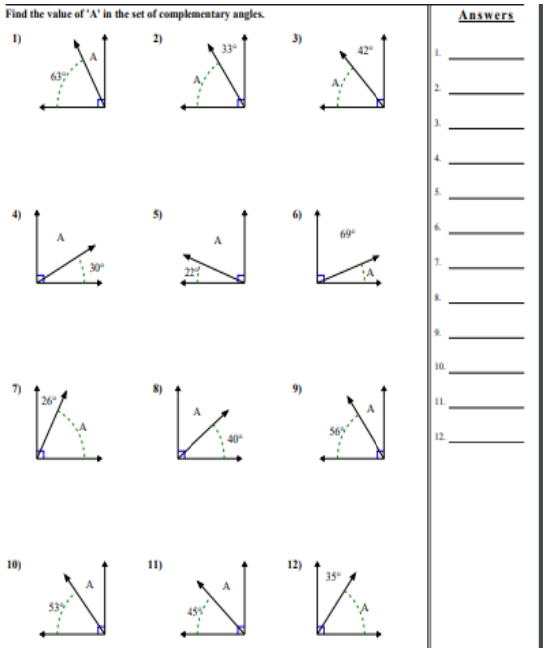


Why ∠ABC and ∠BCD are not adjacent? Give reasons.

What are linear pairs of angles?



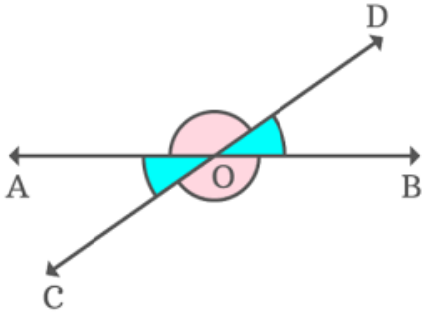
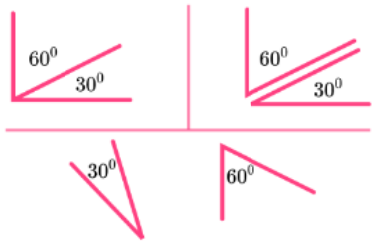
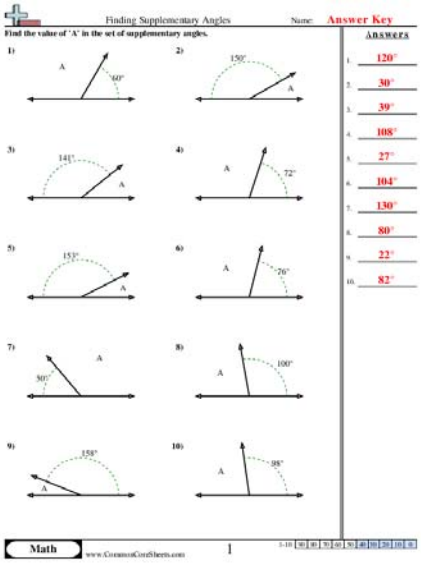
Activity **(10 min)**



Video from Tic-Tac learn English

Linear Pair of Angles - Complete Explanation

Vertically opposite angles.

	List out the vertically opposite angles in the following figure. What is your observation?  Teacher makes the students into pairs and introduces complementary and supplementary angles.  What is sum of two angles in each case? Are these adjacent angles?  	 Finding Supplementary Angles Name: Answer Key Find the value of 'A' in the set of supplementary angles. Answers 1. 120° 2. 30° 3. 39° 4. 108° 5. 27° 6. 104° 7. 130° 8. 80° 9. 22° 10. 82° Math www.CommonCoreSheets.com 1 Describe vertically opposite angles in your own words. Draw different intersecting lines and measure vertically opposite angles so formed. Write your observation. What is your conclusion?	 Complementary and Supplementary Angles

	In the above figures if $\boldsymbol{a + b = 180°}$ $\boldsymbol{p + q = 180°}$ What do you call a and b? What do you call p and q? Teacher focus on Discuss the similarities between linear pair and supplementary angles.		

Summative assessment (wherever relevant)

Teacher Reflexions:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

PERIOD PLAN

Class: 9th Subject: Mathematics Chapter: Lines and Angles Sub Topic: Basic terms and Definitions
Total no. of periods for this chapter:7Period no :3
Sub Topic: work sheet 1(Practice of questions/Remedial Class)

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems **LEARNING OUTCOMES** Applies relationship between two angles (vertically opposite angles, linear-pair angles, adjacent angles,	Teacher focuses on explaining the axioms related to pair of angles. (40 min) Teacher makes the students into groups ask them to solve and present Infront of the class. 1) If two angles are complements of each other, then what is the type of each angle? 2) If two complementary angles are in the ratio 7:3, then find their angles. (Hint: 7x+3x=90) 3) If two supplementary angles are in the ratio 4:5, then find their angles. (Hint: 4x+5x=180) 4) Find the supplement of ⅗ of right angle. (Hint: 180-⅗ of 90) 5) Find the measure of an angle, if six times its complement is 12° less than twice its supplement. {Hint: 6(90-x)=2(180-x)-12} 6) If angles with measures x and y form a complementary pair, then which of the following	1) If two supplementary angles are in the ratio 11:7, then find their angles. 2) Find the measure of an angle which is 36° more than its complementary. Angle.	Geometry Box GeoGebra Application

supplementary angles and complementary angles) to find unknown values – Learning Indicator C70	measures of angles will form a supplementary pair? A) (x+47°), (y+43°) B) (x-23°), (y+23°) C) (x-43°), (y-47°) D) No such pair is possible		

Summative assessment plan- only where relevant

Teacher Reflexions:

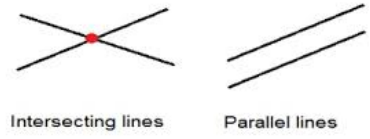
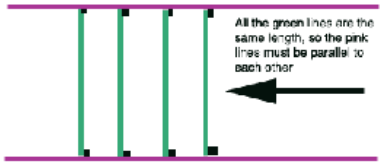
1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

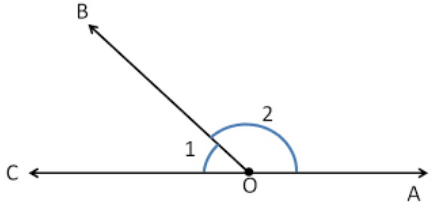
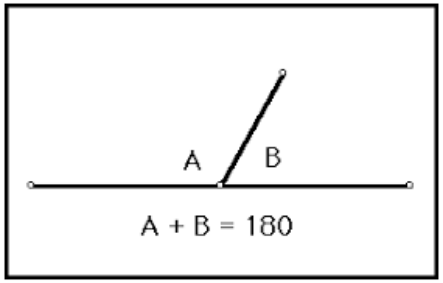
PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles**

Total no. of periods for this chapter:7 **Period no :4**

Sub Topic: Theorem 1

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems	**Activity (5 Min.)** Draw two different lines PQ and RS on a paper. In how many ways can we draw them?   Observe the lengths of common perpendiculars at different points on the parallel lines. **Are they equal?**	What do you notice?	Geometry Box GeoGebra Application

LEARNING OUTCOMES - Proves vertically opposite angles are equal. Learning Indicator C69 Pairs of angles Label angles created by two intersecting lines and identify vertically opposite pairs, adjacent angles, linear pairs, complementary /supplementary pairs of angles Apply the concepts of linear pairs of angles and vertically opposite angles and establish relationships between the angles in a given figure and solve for missing values.	**Recall Axiom** **Fill in the blank** **Activity** **(5 min)**  Observe the figure and discuss angles 1 and 2. **Linear pair Axiom** **Axiom1** **(5 min.)**  **Theorem1** **(10 min)** **If two lines intersect each other, then the vertically opposite angles are equal.**	Measure the angles 1 & 2 and find their sum? Write your observation? Discusses linear pair axioms. Write the converse of the above axiom?	

Measure the four angles 1, 2, 3, 4 in each of the above figure and complete the table:

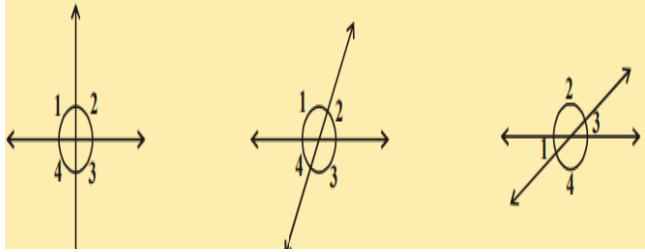


Figure	∠1	∠2	∠3	∠4
(i)				
(ii)				
(iii)				

Measure each pair of vertically opposite angles in each figure.
Write your observations?

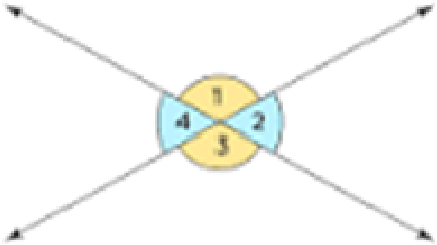
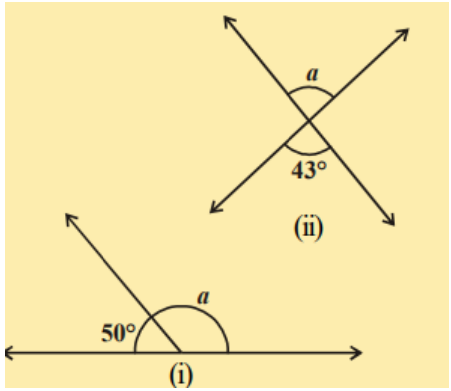
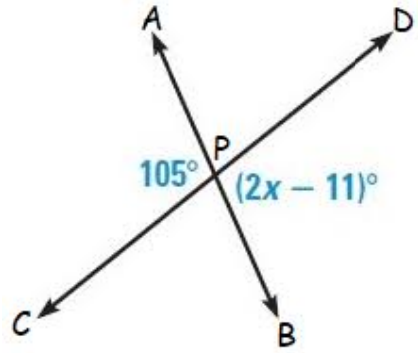
[Teacher will prove this result in a logical way.]

What is given statement?

Draw the relevant figure for given statement?

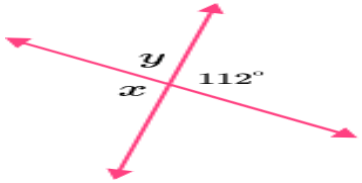
What do you observe about the pairs of vertically opposite angles?
Are they equal?

Working model for VERTICALLY OPPOSITE ANGLE -ideal maths lab with models and projects

	 What is the sum of angle 1 and 2. (10 min) What is the sum of angle 2 and 3 By euclid axiom $\angle 1 + \angle 2 = \angle 2 + \angle 3 = 180°$ What do you say about angle 1 and angle 3? Write your conclusion? Teacher makes the stiudent into groups and ask them to solve the following problem and present infront of the class?  	 Find x?	proof of vertically opposite theorem

	Draw several pairs of intersecting lines such that each pair intersects at a different angle. (5 min.) 1. How many angles are formed when two lines intersect? 2. Measure all the angles in all the intersecting lines and write the angle measurements in a table 3. What do you observe? 4. What is the largest angle? Is this same for all pairs of lines? 5. What is the sum of largest and smallest angles? Is this the same for all pairs of lines?		

Summative assessment plan- only where relevant



2) Find x and y in the given figure.

Teachers' reflections and experiences:

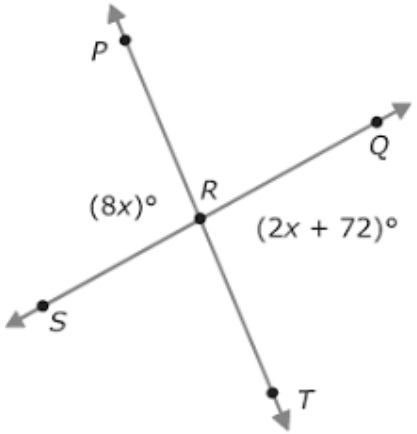
1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

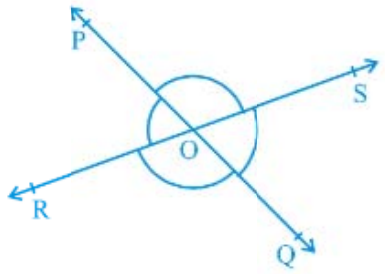
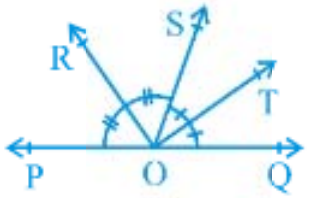
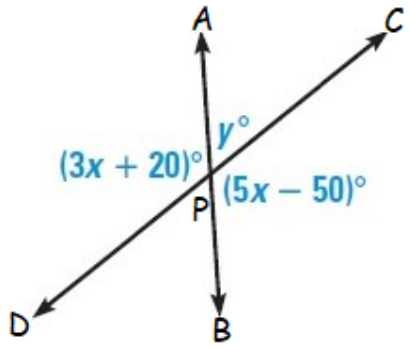
PERIOD PLAN

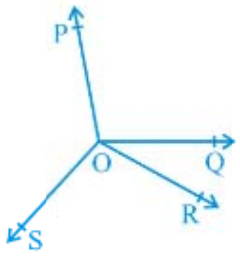
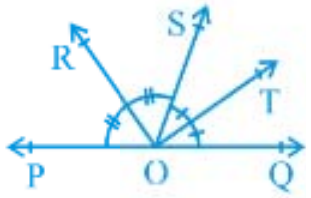
Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles**

Total no. of periods for this chapter:7 **Period no :5**

Subtopic: Problems related to vertically opposite theorem (work sheet 2)

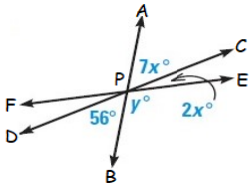
Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
LEARNING OUTCOMES Applies axiomatic approach and derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles etc. in order to solve problems using them. Applies relationship between two angles (vertically opposite angles, linear-pair angles, adjacent angles, supplementary angles and complementary angles) to find unknown values – Learning Indicator C70 **Learning Objectives** Define segment, ray, collinear points, non-collinear points, acute angle, right angle, obtuse angle, straight angle, reflex angle, complementary angles, Supplementary angles and identify them in a given figure.	**1Teacher makes the students into groups and ask them to solve the given questions and present Infront of the class** 1.Find ∠SRT in the following figure.  2.In Fig. lines PQ and Rs intersect each other at point O. If ∠POR:∠ROQ=5:7, find all the angles.	1.Find x and y in the following figure	Geometry Box GeoGebra Application

Pairs of angles Label angles created by two intersecting lines and identify vertically opposite pairs, adjacent angles, linear pairs, complementary /supplementary pairs of angles Apply the concepts of linear pairs of angles and vertically opposite angles and establish relationships between the angles in a given figure and solve for missing values. Parallel Lines and a Transversal Label angles created by a transversal intersecting two parallel lines and identify corresponding angles, alternate angles, interior angles and define relationships between these angles. Lines Parallel to the same Line Find out the unknown angles created by a transversal in a given figure and infer if the lines are parallel or not. Angle Sum Property of a Triangle Define the relationship between angles formed when a triangle is placed between two parallel lines and prove that the exterior angle of a triangle is the sum of the two	 3.In Fig. ray OS stands on a line POQ. Ray OR and ray OT are angle bisectors of ∠POS and ∠SOQ, respectively. If ∠POS=x, find ∠ROT.  4.In Fig. OP, OQ, OR and OS are four rays. Prove that ∠POQ+∠QOR+∠SOR+∠POS =360°	 2.In Fig. ray OS stands on a line POQ. Ray OR and ray

opposite interior angles.		OT are angle bisectors of ∠POS and ∠SOQ, respectively. If ∠POS=x, find ∠ROT. 	

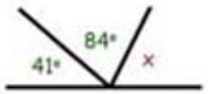
Summative assessment plan- only where relevant

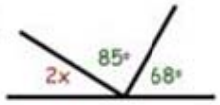
1) Find x and y in the following Fig.

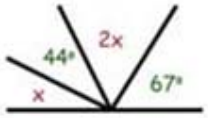


2) Find x in the following figures.

1. 

2. 

3. 

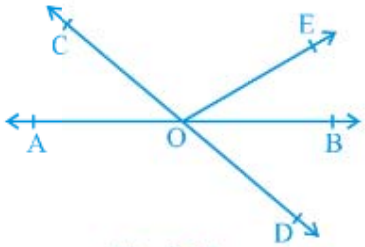
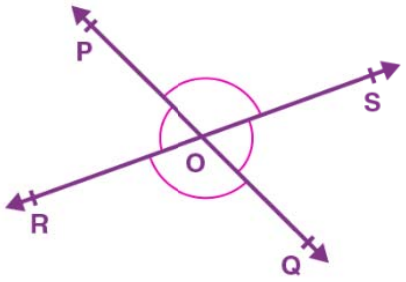
4. 

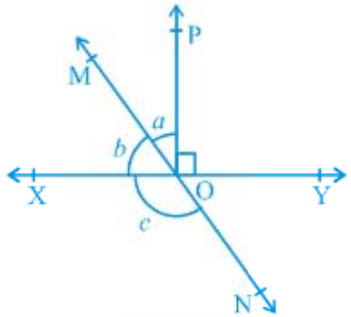
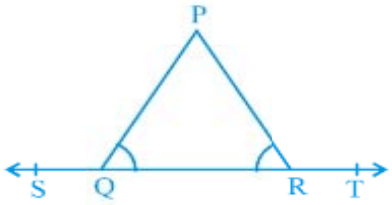
Teacher Reflexions:

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles**

Total no. of periods for this chapter:7 **Period no: 6 (work sheet 3)**

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
LEARNING OUTCOMES Applies axiomatic approach and derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles etc. in order to solve problems using them. **Learning Objectives** Define segment, ray, collinear points, non-collinear points, acute angle, right angle, obtuse angle, straight angle, reflex angle, complementary angles, Supplementary angles and identify them in a given figure. Pairs of angles Label angles created by two intersecting lines and identify vertically opposite pairs, adjacent angles, linear pairs, complementary /supplementary pairs of angles	Teacher makes the students into groups and ask them to solve the given problems. **Exercise 6.1** 1. In Fig.6.13, lines AB and CD intersects at O. If ∠AOC+∠BOE=70° and ∠BOD=40°, find ∠BOE and reflex ∠COE.  Fig. 6.13 2. In Fig.6.14 lines XY and MN intersect at O. If ∠POY=90° and	**In the figure, lines PQ and RS intersect at point O.** **If ∠POR :∠ROQ = 5 : 7, find all the angles.**  	Geometry Box GeoGebra Application The tic taclearn English video deals with basic terms and definition of lines and angles. Teacher can use the

Apply the concepts of linear pairs of angles and vertically opposite angles and establish relationships between the angles in a given figure and solve for missing values. Parallel Lines and a Transversal Label angles created by a transversal intersecting two parallel lines and identify corresponding angles,alternate angles, interior angles and define relationships between these angles. Lines Parallel to the same Line Find out the unknown angles created by a transversal in a given figure and infer if the lines are parallel or not. Angle Sum Property of a Triangle Define the relationship between angles formed when a triangle is placed between two parallel lines and prove that the exterior angle of a triangle is the sum of the two opposite interior angles.	a:b=2:3, find c.  Fig. 6.14 3. In Fig.6.15, ∠PQR=∠PRQ, then prove that ∠PQS=∠PRT.  Fig. 6.15 . 4. In Fig. 6.16, if x+y=w+z, then prove that AOB is a line.	**In the below figure, AB, CD and EF are three concurrent lines intersecting at O. Find the value of y.**	video to reinforce the concept.

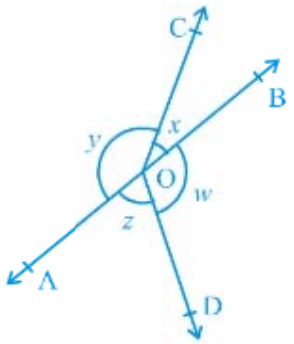
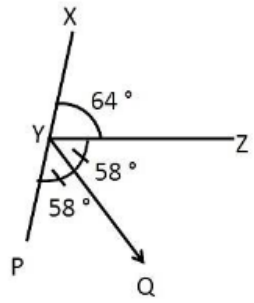
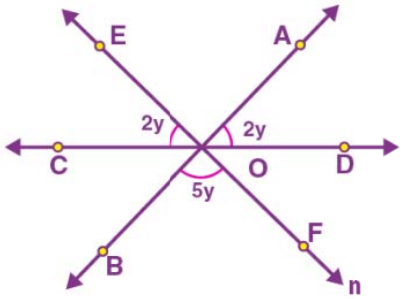


Fig. 6.16

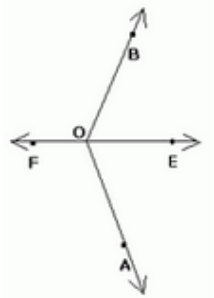
6. It is given that ∠XYZ=64° and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects ∠ZYP, find ∠XYQ and reflex ∠QYP





Summative assessment plan- only where relevant

Ray OE bisects ∠AOB and OF is the ray opposite OE. Show that ∠FOB = ∠FOA.



Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

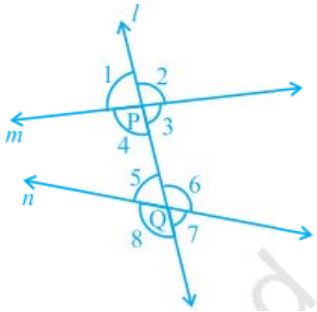
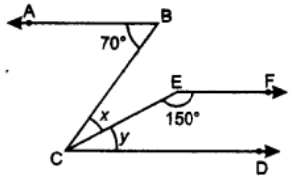
4.How effective were the Materials and resources used in the lesson?

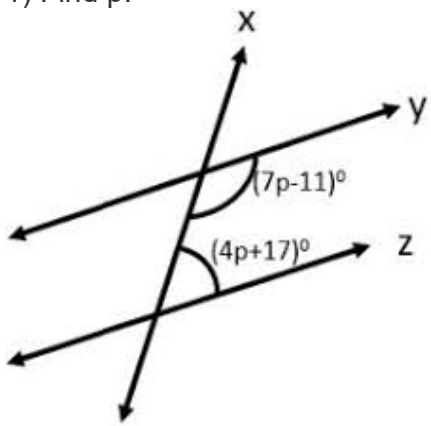
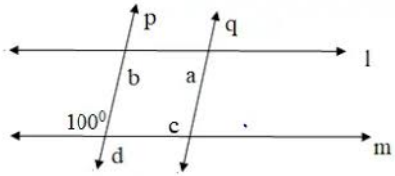
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

PERIOD PLAN

Class: 9th **Subject: Mathematics** **Chapter: Lines and Angles** **Sub Topic: Parallel lines and Transversal**

Total no. of periods for this chapter:7 **Period no :7 (Example questions)**

Learning Outcomes & Indicators/Micro Components	Teaching Learning Process	Assessment	TLM
LEARNING OUTCOMES Applies axiomatic approach and derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles etc. in order to solve problems using them. **Learning Objectives** Define segment, ray, collinear points, non-collinear points, acute angle, right angle, obtuse angle, straight angle, reflex angle, complementary angles, Supplementary angles and identify them in a given figure. Pairs of angles Label angles created by two intersecting lines and identify vertically opposite pairs, adjacent angles, linear pairs, complementary /supplementary pairs of angles	**Prerequisite knowledge: (10 min)** **Teacher should recap the following concepts.** **Parallel lines** **Transversal** **Relation between angles when transversal intersects parallel lines.**  **1.indetify the following pair of angles.** **1. corresponding angles** **2.alternate interior angles** **3.alternate exterior angles** **4.co interior angles.** **Activity: (30 min.)**	If AB || EF and EF || CD, then find the value of x.  	Geometry Box GeoGebra Application Parallel lines and a transversal

Apply the concepts of linear pairs of angles and vertically opposite angles and establish relationships between the angles in a given figure and solve for missing values. Parallel Lines and a Transversal Label angles created by a transversal intersecting two parallel lines and identify corresponding angles,alternate angles, interior angles and define relationships between these angles. Lines Parallel to the same Line Find out the unknown angles created by a transversal in a given figure and infer if the lines are parallel or not. Angle Sum Property of a Triangle Define the relationship between angles formed when a triangle is placed between two parallel lines and prove that the exterior angle of a triangle is the sum of the two opposite interior angles.	**Teacher makes the students into groups and ask them to solve and present Infront of the class.** 1) Find p.  2) Find a,b,c and d  3.In Fig. 6.19, if PQ‖RS, ∠MXQ=135° and ∠MYR=40°, find ∠XMY.	In the given figure AB‖CD, A is right angle then find angle ECD.	The above Tic tac learn English videos regarding parallel lines, transversal and relation betwee angles. Teacher can use th video to reinforce th concept visually

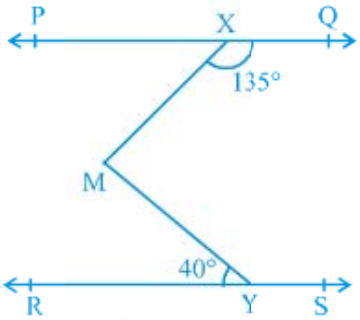
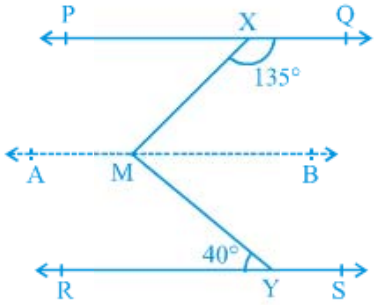


Fig. 6.19

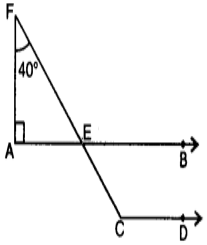


Draw a line AB parallel to line PQ, through point M

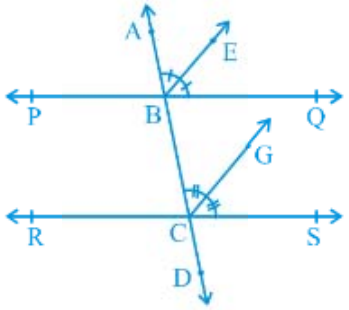
AB parallel to PQ and MX is transversal then find angle XMB.

How do you find angle YMB.

Add $\angle XMB, \angle YMB$.



Write ∠XMY?

	2.If a transversal intersects two lines such that the bisectors of a pair of corresponding angles are parallel, then prove that the two lines are parallel.  Teacher makes the student into pairs and ask them to solve the problem using the properties of parallel lines and its transversal and present Infront the class.		

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

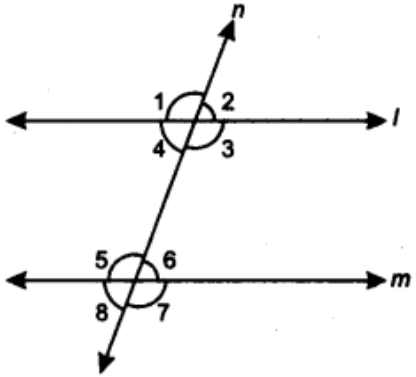
Remaining Periods for Activities, Remedial Teaching, work sheets and Practice

Activity period

Exemplary Learning

Work Sheet-1
Lines and Angles (Class-9)

1) In the figure l‖m and ∠1=(2x+y)°, ∠4+(x+2y)°. Find ∠7 and ∠8.



2) In Fig. 6.22, AB‖CD and CD‖EF. Also EA⊥AB. If ∠BEF=55°, find the values of x,y and z.

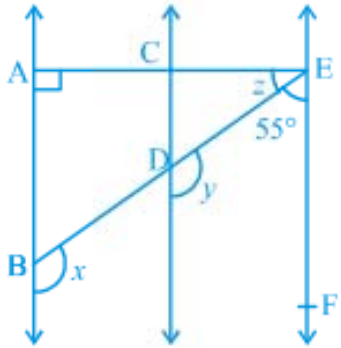


Fig. 6.22

3) In Fig. 6.23, if AB‖CD, CD‖EF and y:z=3:7, find x.

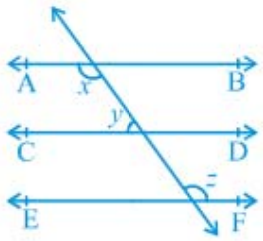
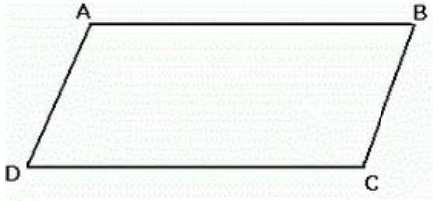


Fig. 6.23

4)



5) In a quadrilateral ABCD, AB‖CD and AD‖BC, Prove that ∠ABC=∠ADC

In Fig. 6.24, if AB‖CD, EF⊥CD and ∠GED=126°, Find ∠AGE, ∠GEF and ∠RGE.

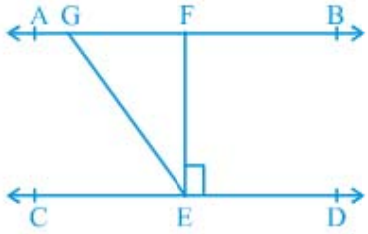


Fig. 6.24

6) In Fig. 6.25, if PQ‖ST, ∠PQR=110° and ∠RST=130°, find ∠QRS.

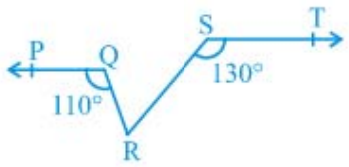
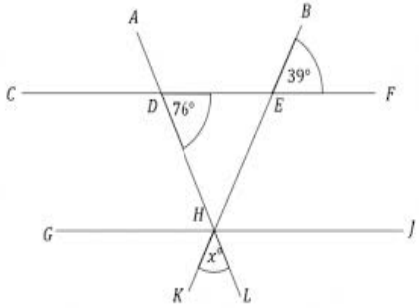
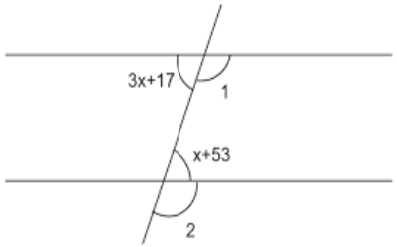


Fig. 6.25

7) Find x



8) Find angle 2 in the following figure.



Work Sheet-2
Lines and Angles (Class-9)

1) In Fig. 6.27, PQ and RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B, the reflected ray moves along the path BC and strikes the mirror RS at C and again reflects back along CD. Prove that AB‖CD.

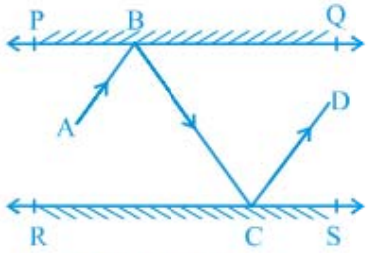
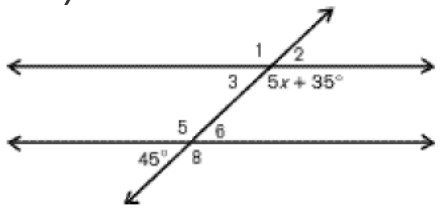
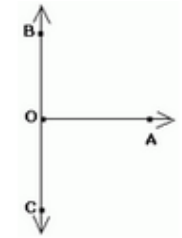


Fig. 6.27

2) **Find x**



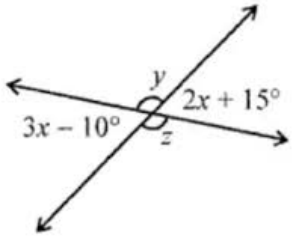
3.

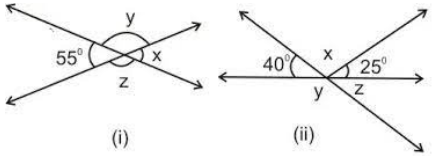


Given that each of the angles AOC and AOB is a right angle. Show that BOC is a line.

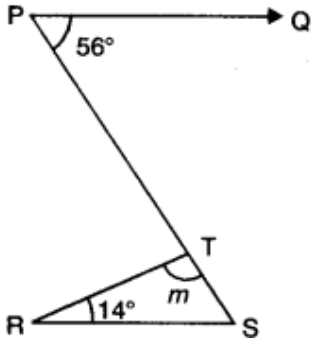
4. The difference of two complementary angles 40°. Find the angles.

5. Find x, y and z.

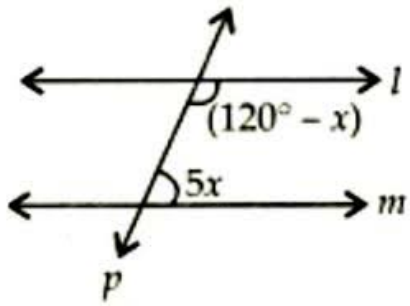




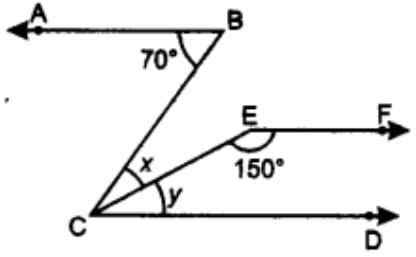
6. Find m



7. Find x in the following figure.

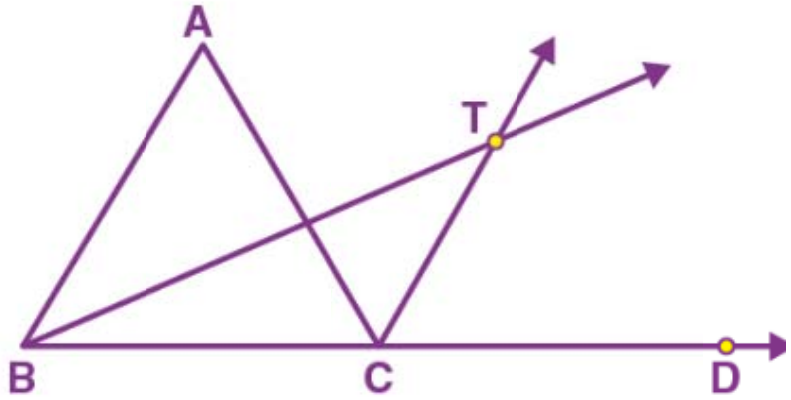


8. Find x and y in the following figure.

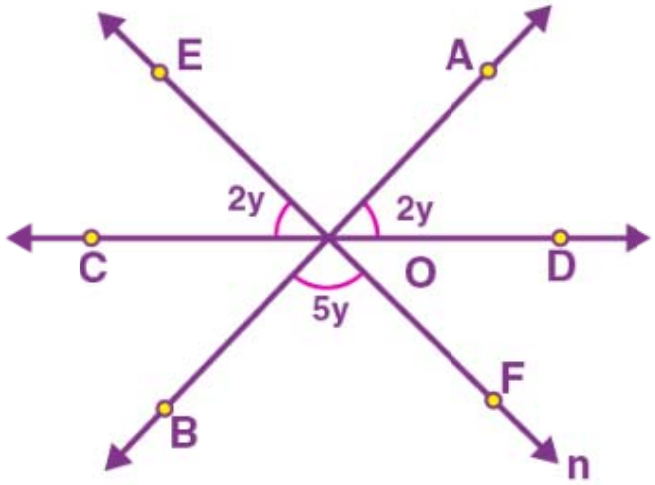


Work Sheet-3
Lines and Angles (Class 9)

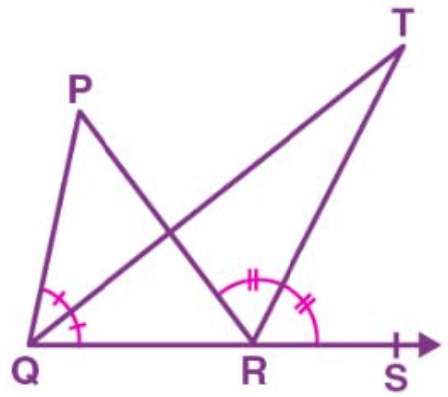
1) Bisectors of interior ∠B and exterior ∠ACD of a Δ ABC intersect at point T. Prove that ∠ BTC = ½ ∠ BAC.



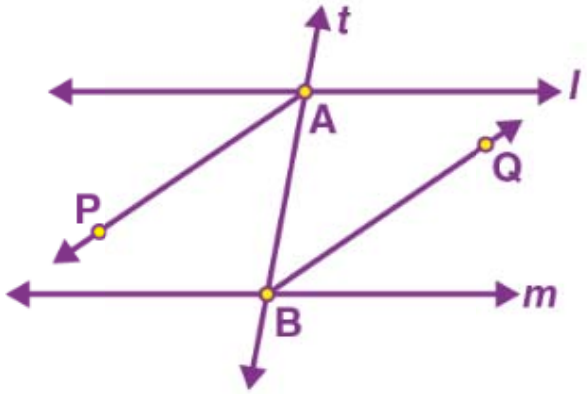
2) In the below figure, AB, CD and EF are three concurrent lines intersecting at O. Find the value of y.



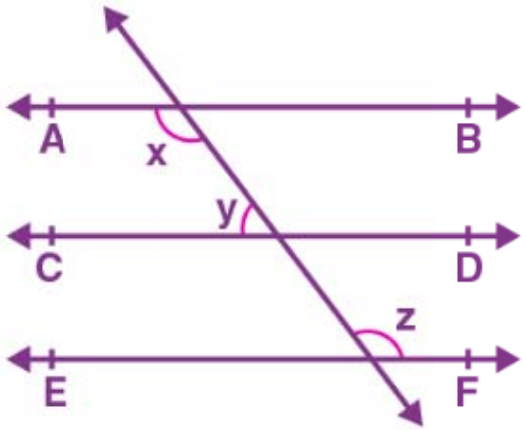
3) **In the figure, the side QR of ΔPQR is produced to a point S. If the bisectors of ∠PQR and ∠PRS meet at point T, then prove that ∠QTR = ½ ∠QPR.**



4) AP and BQ are the bisectors of the two alternate interior angles formed by the intersection of a transversal t with parallel lines l and m (below figure). Show that AP || BQ.



5) If AB || CD, CD || EF and y : z = 3 : 7, find x from the below figure.


A
B
x
y
C
D
z
E
F

INTRODUCTION

[Go to http://epathshala.nic.in/QR/?id=0962CH07**]**

[Type or Scan QR Code]

7.TRIANGLES

Chapter Plan (Unit plan/ lesson plan)

The following curricular goals (CG) and competencies (c) will be developed through this chapter

CG-4: Analyses characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships.

C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems.

C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems.

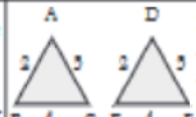
CG-7 Begins to perceive and appreciate mathematics axiomatic and deductive structures.

C-7.3: Proves theorems using Euclid's axioms and postulates forangles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram.

C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints.

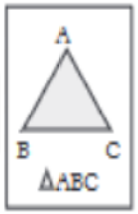
Triangles

Congruence rule

Rule	Statement	Figure
1. SAS	Two triangles are congruent if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle.	 In $\triangle AOD$ and $\triangle COB$ $CO = OD$ $\angle COB = \angle AOD$ $OB = OA$ $\therefore \triangle AOD \cong \triangle COB$
2. ASA	Two triangles are congruent if two angles and the included side of one triangle are equal to two angles and the included side of other triangle.	 In $\triangle ABC$ and $\triangle DEF$ $\angle B = \angle E$ $BC = EF$ $\angle C = \angle F$ $\therefore \triangle ABC \cong \triangle DEF$
3. AAS	Two triangles are congruent if any two pairs of angles and one pair of corresponding sides are equal.	 Given $AB \parallel CD$ In $\triangle AOB$ and $\triangle COD$ $\angle ABO = \angle DCO$ $\angle AOB = \angle DOC$ $OA = OD$ $\therefore \triangle AOB \cong \triangle COD$
4. SSS	If three sides of one triangle are equal to the three sides of another triangle, then two triangles are congruent.	 In $\triangle ABC$ and $\triangle DEF$ $AC = DF$ $AB = DE$ $BC = FE$ $\therefore \triangle ABC \cong \triangle DEF$
5. RHS	If in two right triangles the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of the other triangle, then the two triangles are congruent.	 In $\triangle ABC$ and $\triangle DEF$ $AC = DF = 5cm$ $BC = FE = 4cm$ $AB = \sqrt{AC^2 - BC^2} = \sqrt{5^2 - 4^2} = 3$ $DE = \sqrt{DF^2 - EF^2} = \sqrt{5^2 - 4^2} = 3$ $\therefore AB = DE$ Hence $\triangle ABC \cong \triangle DEF$

Triangle

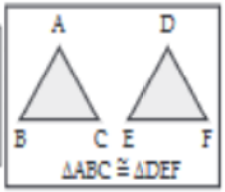
closed figure formed by three straight lines — It has three - sides, angles and vertices each



$\triangle ABC$

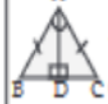
Congruent

If any three parameters of given triangles are same, the triangles will be congruent.



$\triangle ABC \cong \triangle DEF$

Properties

Statement	Figure
Angles opposite to equal side of an isosceles triangle are equal	 $AB = AD$ $\angle B = \angle C$
The sides opposite to equal angles of a triangle are equal	 $\angle BAC = \angle CAD$ $\angle ADB = \angle ADC$ $\triangle ABD \cong \triangle ACD$ (ASA rule) Hence, $AB = AC$

Inequalities

Statement	Figure
In any triangle, the angle opposite to the longer side is larger.	 AC is the longest side $\therefore \angle B$ is largest
In any triangle, the side opposite to the larger (greater) angle is longer.	 If $\angle B$ is the largest $\therefore$ AC is longest
The sum of any two sides of a triangle is greater than the third side.	 In $\triangle ABC$ $AB + AC > BC$ $AB + BC > AC$ $AB + BC > AB$
Difference of any two sides of a triangle is less than the third side.	 In $\triangle ABC$ $AB - BC < CA$ $AB - AC < BC$ $AC - BC < AB$

PERIOD WISE PLAN

Period No	Teaching Topic	Learning Outcomes
1	Introduction of the chapter	Works out ways to differentiate between congruent and similar figures
2	SAS congruency rule	Establishes property for congruency of two triangles logically using SAS rule
3	ASA congruency rule	Establishes property for congruency of two triangles logically using ASA rule
4	AAS congruency rule	Establishes property for congruency of two triangles logically using AAS rule
5	Theorem 7.2	Proves theorem related to congruency of triangles
6	Problem solving on in Ex:7.2	Solves problems related to congruencyof triangles
7	SSS congruency	Establishes property for congruency of two triangles logically using SSS rule
8	RHS Congruency	Establishes property for congruency of two triangles logically using RHS rule
9	Worksheet 1	Solves problems based on congruency criteria
10	Worksheet 11	Solves problems based on congruency criteria

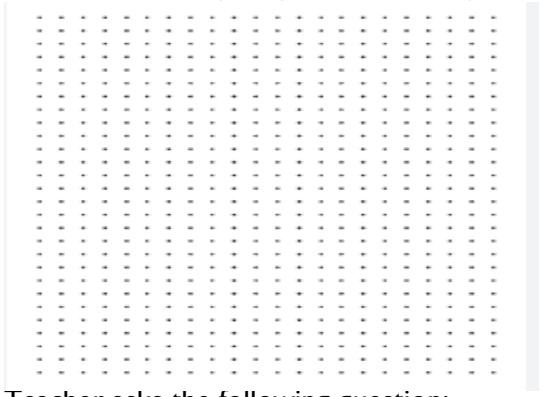
1. **Key concepts:**Introduction to triangles
    a. Congruence of triangles
    b. Criteria for congruence of triangles (CPCT, SAS, ASA)
    c. Some properties of triangles
    d. Criteria for congruence of triangles (SSS, RHS)

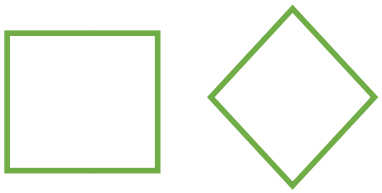
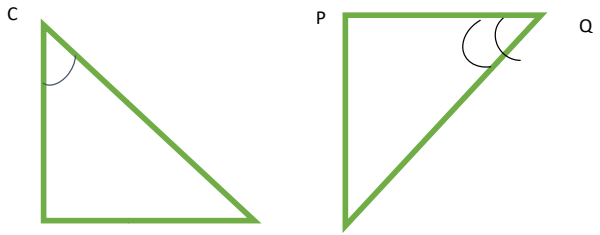
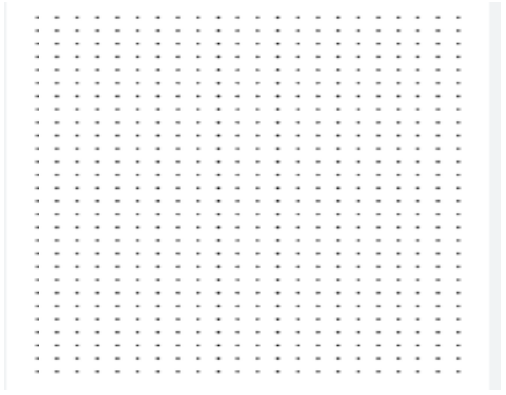
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles**

Total no. of periods for this chapter: 10 **Period no: 1/10**

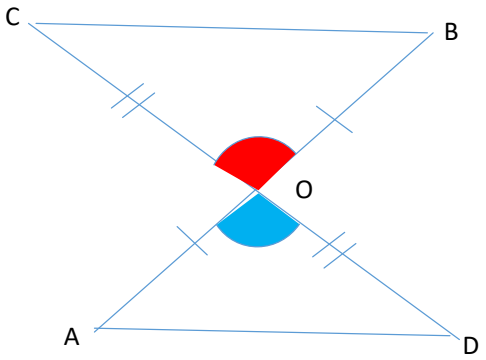
Sub Topic: Congruency of Triangles-Introduction

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi require**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram.	**Activity 1 (10 min)** • The teacher distributes dot sheets to the children and ask them to quickly draw 2-D shapes  • Teacher asks the following question: - How many 2 d shapes you have drawn? - Have you drawn triangles? - Can you now draw different kinds of triangles based on their sides and angles?		https://yo be/g9GxZ T4NY?si= UpS6xlH Uf77 5 min. T TacLear video o Congrue of Triang

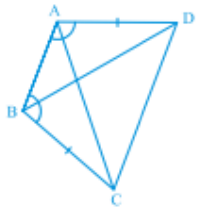
C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints. **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves	Activity 2 (5 min) • Teacher draws figures of two non-congruent shapes.  -Are these figures same? - Ask reason for their answers from the students - Ask students to give some more examples **Activity 3(25 min)** • The teacher introduces the concept of congruency • Shows students bangles of different sizes • Teacher asks the following question: - Pick out the identical bangles - What is the difference between the identical and the non-identical bangles? - How can you conclude that some of the bangles are identical? • Teacher gives the definition of congruency. • Figures with same size and shapes are called congruent figures • List down some congruent body parts. • List down some congruent objects in your classroom • Are these figures congruent? • Which of the sides are same?  	Draw two congruent triangles on dot sheets.  Construct congruent triangles to the given measurements: AB= 3 cm	

Summative assessment plan- only where relevant
Teachers' reflections and experiences: 1. How can I better manage the time allocated for each activity? **2.** Did the students actively participate and show interest in the class?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter:10** **Period no :2/10** **Sub Topic: SAS Congruency**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
Learning outcome: **Identifies/ classifies polynomials among algebraic expressions and factories them by applying appropriate algebraic identities.** **SWBAT** **Recognize whether two given triangles are congruent** **Recognize that ASA and AAS are conditions of congruency** **Solve a word problem or a more complex geometric problem using SAS congruence criteria** C-4.1: Describes relationships including congruence of two-dimensional geometric shapes	Testing previous knowledge: (5minits) The teacher recalls the previous period by showing a picture  Teacher promotes discussion among peers on the following questions: • If two friends have two triangular plots one tip of the both plots coincide (as shown in figure). first friend plot is ΔCBO and second friend plot is		

(lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram. C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints. **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given	ΔDAO. Teacher inquires the students to answer the following: • Is AD parallel to BC? • Identify the sides which are equal? • Are both plots congruent to each other? • Can you say $\angle COB = \angle DOA$? Justify? • Can you say the angles are included in between the corresponding side? Teacher gives the explanation with the definition: (5 min) **(SAS Congruence Rule)** Two triangles are congruent if two sides and the included angle of the one triangle are equal to two sides and the included angle of another triangle. Teacher explains a problem for the clear understanding of congruence rule: ABCD is a quadrilateral in which AD=BC and ∠DAB=$\angle CBA$ prove that (i)ΔABD≅ ΔBAC (ii)BD=AC (iii)∠ABD=∠BAC (20 Min)	Ask them to draw both triangles separately What are the corresponding parts of the triangles of ΔABD and ΔBAC	https://youtu.be/7ZvnaNFEs?ture=shad **Explanat of SA Congru y criteri from T Taclea Englis**

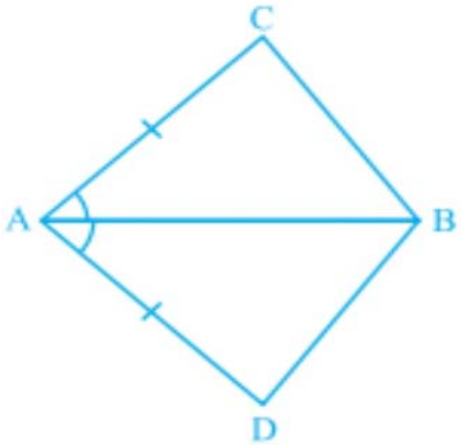
triangle as per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	 Teacher generalizes the student what data is given in the problem (i) • Ask them which sides and angles are equal • What is the common arm of ΔABD and ΔBAC • Can we say ΔABD and ΔBAC are similar by SAS congruency (ii)& (iii) • Can you define CPCT rule? • Is CPCT applicable for ΔABD and ΔBAC		

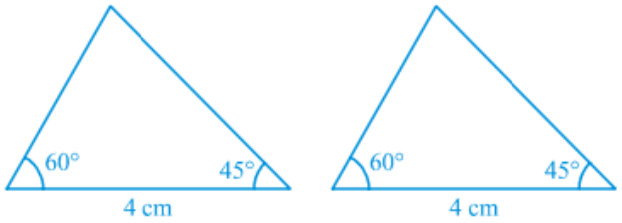
Summative assessment plan- only where relevant

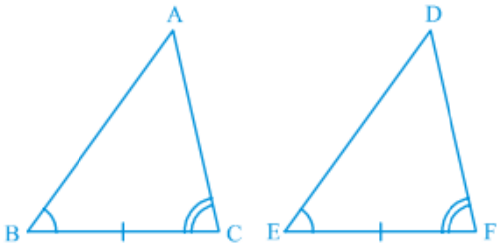
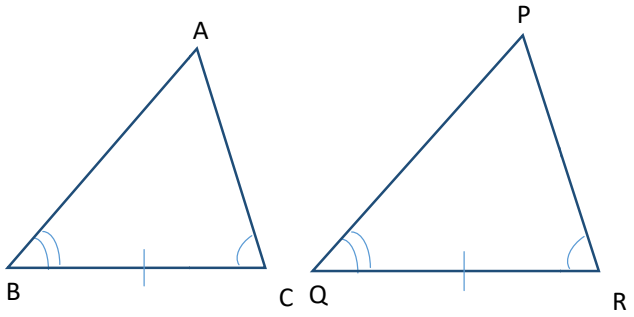
Teachers' reflections and experiences:

1. Did I encourage self-reflection and meta cognition among the students?
2. How well did I manage the class room during the period?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter:10** **Period no :3/10** **Sub Topic: ASA Congruency Rule**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles **Learning outcome: Identifies** similarities and differences	Teacher promotes discussion among peers on the following questions (15 min) Two friends bought a plot and thinking to divide into half. They buy a plot in shape of quadrilateral as shown image:  	Write congruency criterions for triangles.	

among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	• Seeing Image, can you say how they divided the plot? • Is BC =BD? Justify • State both plots have equal areas? • What about the perimeters of the plots?(equal or not) • Is ΔABC is congruent to ΔABD Teacher gives some more examples as an activity as a Recall. Teacher will conduct the following activity.  If we place one triangle on the other triangle, do they cover one another completely? What do you call those triangles? The teacher introduces the topic showing the above activity the equality of two angles and included sides. **<u>Theorem (ASA Congruence Rule)(25 min)</u>** Two triangles are congruent if two angles and the included side of the triangle are equal to two angles and the included size of another triangle.		https://y u.be/bFU U0LP I?si=uVV LkWgee wdrm **5 min. T** **TacLea** **video c** **ASA** **criteri**

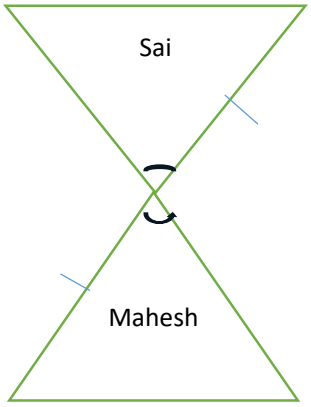
	 Teacher asks the question 1. Are the above triangles congruent? 2. What is the corresponding side and the corresponding angle?		
Student gain the knowledge that the equal angles are included between pairs of equal sides Student identifies and classifies (if any two pairs of angles and one pair of corresponding sides are equal. We call it as AAS congruence.)	Teacher draws the figure and asks the question.  1. Is the above triangle congruent? 2. Is it necessary that the corresponding side must be in between the included corresponding angles? 3. Teacher explains the side is not included between the corresponding equal pairs of angles. Then also the sum of the three angles of a triangle is 180 degrees. So if two pairs of angles are equal 3rd pair= 180-Sum of equal angles	**Formative Assessment** Line segment AB is parallel to another line Segment CD. O is the midpoint of AD. Show that 1. triangle AOB is congruent to triangle DOC. 2. O IS ALSO THE MID POINT OF bc.	
Summative assessment plan- only where relevant			
Teachers' reflections and experiences:			

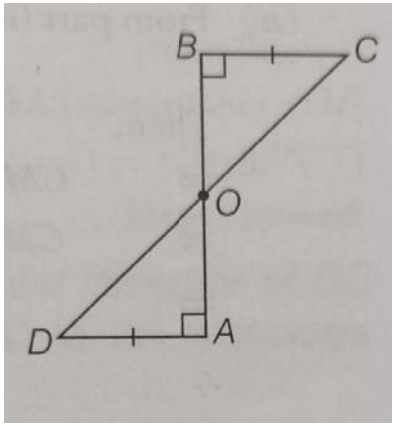
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles**

Total no. of periods for this chapter:10 **Period no :4/10**

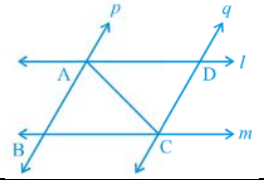
2. **Sub Topic:** AAS congruency rule

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles **Learning outcome: Identifies**	Teacher gives a situation as an activity and promotes discussion by dividing the whole class in to 4 peer groups Activity: (10 min) Sai and Mahesh bought two plots of Triangular Shape such that, one edge of both coincides with each other as shown in figure  Based on the information teacher asked the following questions: 1. Is both Triangular Plots are congruent or not? State (T/F) 'O' is midpoint of AD? 2. AB ≠CD is T/F?		https://y u.be/A5 14Ghr4I fUnxyZ ZZUsuI **3 Min. T TacLea Englis video c AAS criteri**

similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	3. OC=OD is T/F? 4. If both plots are congruent then by which criteria, they are congruent? Proof (20 min) Teacher explains clearly by above situation as follows: Since AB‖CD, BC is transversal line so $\angle OBA = \angle OCD$ (alternate interior angles) --------(1) Given OA=OD----------(2) $\angle AOB = \angle COD$----------(3) From 1, 2, 3 the above triangles are congruent by AAS Congruency. Teacher gives the statement of AAS Congruency If two triangles have two equal angles and a side adjacent to only one of the angles that are equal, then the two triangles are congruent. Teachers note: Teacher should ensure that students understand that, if the equal side is not included in between equal angles then also the given triangles are congruent by AAS Congruency rule. Activity: (10mins) Teacher gives an activity to the whole class: Teacher gives instruction to take them a sheet of paper and draw two triangles with given measurements $\angle B = \angle Q = 65°$ $\angle C = \angle R = 50°$ AC=PR=7 cm Ask them to cut the two triangles with the above measurements and place on one another. What do you observe?	1. AD and BC are equal perpendiculars to a line segment AB show that CD bisects AB.  	https://youtu.be/fgylKmKY8K4BYExTQiTI7 **3 Min. T** **TacLea** **Englis** **video c** **AAS** **criteri**

Summative assessment plan- only where relevant

3. l and m are two parallel lines intersected by another pair of parallel lines p and q (see Fig. 7.19). Show that Δ ABC$\cong\Delta$CDA.



Teachers' reflections and experience:

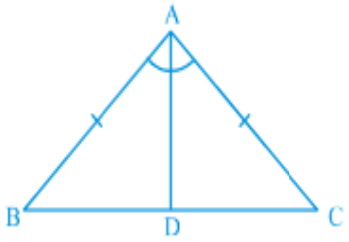
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles**

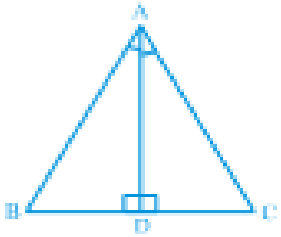
Total no. of periods for this chapter: 10 **Period no: 5/10**

Sub Topic:

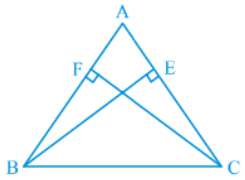
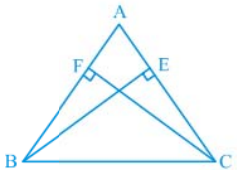
- **Angles opposite to equal sides of an isosceles triangle are equal**
- **The sides opposite to equal angles of a triangle are equal**

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/ assignments/self-assessment checklists/etc.**	**Material required**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles and quadrilateral, circles area related theorem	Teacher recalls the previous class and begins with a theorem and asks some questions before Explanation (5 min) THEOREM: (15 min) Angles opposite to equal sides of an isosceles triangle are equal.  • In the given figure what sides are equal?	Define SAS congruency rule?	https://youtu.be/V2iK77V-Q_g?si=_a7-X0PMOiZcoO **4 min. Infinity Learn video on the proof of this Theorem.**

for triangles and parallelogram. C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints. **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor**.** **derives** proofs of mathematical statements particularly	• What is the ⊥lar bisector of BC? • Is=∠CAD? why? • What is the common side of$\Delta BAD, \Delta$CAD? • Which type of congruence it satisfies? Teacher concludes that ∠BAD=∠CAD (By CPCT) ∴ ∠B=∠C **Activity:2 (10 min)** Teacher makes the class into 4 groups and ask the student of each group • Construct a ΔABC With BC of any length and ∠B=∠C =50^0 • Draw a bisector of ∠A and intersect BC at D Teacher guides the children to cut out the triangle from the sheet and fold it along AD to coincide B with C • Does ΔADB covers completely ΔADC • Does it same for all the 4 groups • What about the lengths of AB and AC • Are they equal or not • If you open the folded part, what are the opposite angles of AB and AC Teacher draws a conclusion with the student answers that sides opposite to equal angles are equal (10 min) Based on this activity observation let us derive the following theorem with the use of congruence of triangles: **In ΔABC, the bisector AD of ∠A is perpendicular to side BC. Show that AB=AC**	Given an ΔABC whose perimeter is 13cm ∠ABC =∠ACB and length of side BC=3CM find the length of the side AB and AC. S Before and after folding, Is the triangles similar	

related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	**and ΔABC is Isosceles**  Fig. 7.27 • Teacher ensures the student to draw figure using the statement • Teacher guides the students if they are unable to do • Teacher notifies that this result can be proved in many ways. One of the proofs is given as an activity • Teacher concludes that angles opposites to equal sides of an isosceles triangle are equal		
Summative assessment plan- only where relevant			
Teachers' reflections and experiences: • **Were there any disruptions or behavioural issues that I need to address?** • **What strategies can I implement to improve classroom management?**			

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

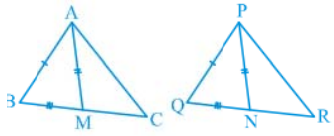
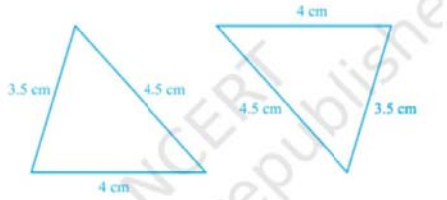
Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter: 10** **Period no: 6/10** **Sub Topic: Problems on Congruency criteria.**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and	Teacher gives a question to the class and explain as follows (25 Minutes): 1. ABC is a triangle in which altitudes BE and CF to sides AC and AB are equal (see Fig. 7.32). Show that (i) Δ ABE$\cong\Delta$ACF (ii)AB =AC, i.e., ABC is an isosceles triangle. ΔAOB$\cong$  Teacher explains the problem by asking following questions:	(15 Minutes) 1. ABC is an isosceles triangle in which altitudes BE and CF are drawn to equal sides AC and AB respectively (see Fig. 7.31). Show that these altitudes are equal.  	https://yu.be/4w!yl8lZ4?sLuCUBCd2AskU **5 min video fr Focus C on solvir proble relating it.**

postulates forangles, triangles **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangleas per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems	1. Can you say altitudes drawn to the sides AB and AC? 2. Mention the angle made by the altitudes, With the sides at point of contact? 3. Let us consider ΔABE, ΔACF. 4. What is the common angle for both Triangles? 5. Is the two Triangles congruent? 6. Then by which criteria? Teacher gives conclusion that, the two angles, one side of ΔABE and two angles, one side of ΔACF are equal. Δ ABE≅ΔACF (By AAS congruency) 7. What are corresponding sides of ΔABE, ΔACF 8. If AB=AC thenΔ ABC which type of Triangle (Teacher guides the students if necessary)		 https://youtu.be/x6zoclR3DJk?si=2tmwOsXvPNNq4deV **51 min BIJU'S video on total Exercise**

using them.			
Summative assessment plan- only where relevant			
Teachers' reflections and experiences: 1. How can I increase student engagement and create a more interactive learning environment? **2.** How can I improve my assessment and feedback practices?			

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

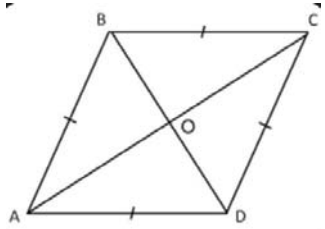
Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter: 10** **Period no: 7/10** **Sub Topic: SAS Congruency**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles **Learning outcome: Identifies**	Teacher promotes a discussion among students by showing a kite and asks the following (15 Minutes)  Name the 2D shapes you are observing from the kite? Teacher calls a student and gives some instructions - asks him to measure all the sides, and name the type of the quadrilateral. -cut the kite along one diagonal.		https://y u.be/Hu wSeAyC =7sHHw S83 -a5 **5 min. T TacLea Englis video c SSS crit**

similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor. **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	-what are the shapes you observed after cutting? -place the triangles on one another, does it overlap with each other? Teachers note (5 Mints): Teacher should ensure that, the students should come to know, the two triangles are overlapping with each other i.e., those are congruent. (SSS congruence rule) : If three sides of one triangle are equal to the three sides of another triangle, then the two triangles are congruent. Teacher gives a question related to topic(20 MINTS): Two sides AB and BC and median AM of one triangle ABC are respectively equal to sides PQ and QR and median PN of D PQR . Show that: (i) Δ ABM ≅Δ PQN  Teacher ask the students to read the problem and list out the given values	 Are the two triangles shown in the above fig congruent?	

	1. Consider the Δ ABM Δ QPN 2. Since AM is the median drawn to the side BC then express the length of BM in terms of BC(BM=BC/2) 3. PN is the median drawn to the side QR so express QN in terms of QR (QN=QR/2) 4. Now In Δ ABM and ΔPQN, AB=PQ, AM=PN, BM=QN Now can you say that these two triangles are congruent by which criteria		

Summative assessment plan- only where relevant

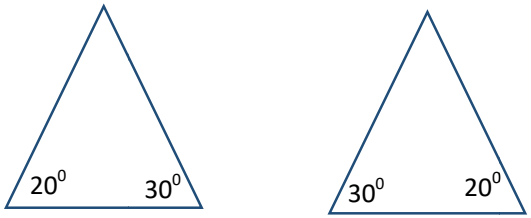
- In the given figure apply SSS Congruence prove that diagonal of the Rhombus bisects each other at Right angles

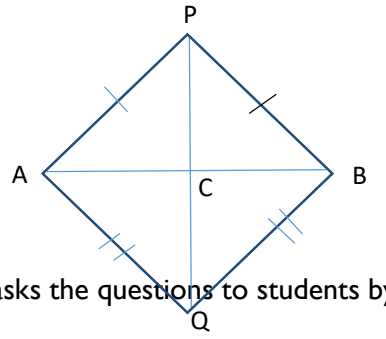
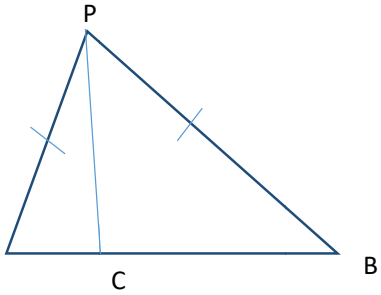


Teachers' reflections and experiences:

3. How can I increase student engagement and create a more interactive learning environment?
4. How can I improve my assessment and feedback practices?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter: 10** **Period no: 8/10** **Sub topic: RHS congruence rule**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and	Teacher will recollect the previous knowledge from students: 1. If 2 sides and included angle of one triangle are equal to 2 sides and included angle of the other triangle then which type of congruence is it? 2.  Above triangles follows which congruency?		https://y u.be/V2i 7V- Q_g?si= NwQitE UOGv

postulates for angles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram. C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor. **derives** proofs of mathematical	**Theorem:** In two right angled triangles, if the length of the hypotenuse and one side of the one triangle is equal to the length of the hypotenuse and corresponding side of the other triangles are congruent. Teacher asks the following questions: 1. What does RHS stands for? 2. Can you draw 2 triangles of one equal side and equal hypotenuse? Teacher explains CPCT rule according o this topic and asks them to take only ΔPAC and ΔPBC. Tacher asks the questions: 1. Which side is the common for both triangles? 2. Is ∠APC = ∠BPC true or not? 3. What do you observe. Are any congruency criteria coming? Teacher explains the concept by the drawing a figure and pointed vertices, sides.  Teacher asks the questions to students by showing a figure.	 1. Which sides are correspondent and is any corresponding there? 2. Can you give symbolically congruency of ΔPAC and ΔPBC.	 **https://youtu.be/F2nhizQc?sib9_4Brd2M8p** **explanats congrue rules Video from digguru**

statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	1. Which sides are equal? 2. What is the horizontal line of AB? 3. Which 2 triangles are congruent? Teacher gives an explanation by SAS rule $\Delta PAC \cong \Delta PBC$ Thus, AC = BC and $\angle ACP = \angle BCP$ 1. What is the sum of $\angle ACP$ and $\angle BCP$? 2. Can we show / prove without showing congruence of Δ PAQ and = PBQ?	Is the angle included between the equal pairs of sides?	

Summative assessment plan- only where relevant

- P is a point equidistant from two lines l and m intersecting at point A. Show that the line AP bisects the angle between them.

Teachers' reflections and experiences:

1. Was the pacing of the lesson appropriate?
2. Did I cover all the planned content without rushing or leaving gaps?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter: 10** **Period no: 9/10** **Sub Topic: Case Study Questions**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram. C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors,	1. "If three sides of one triangle are equal to three sides of the other triangle, then the two triangles are congruent" is a _____. (a) SSS congruence rule (b) ASA congruence rule (c) RHS congruence rule (d) AAS congruence rule 2. The sum of any two sides of a triangle is _____ than the third side. (a) Lesser (b) Greater (c) Equal (d) None of the above 3. Two squares of the same sides are _____. (a) Not congruent (b) Congruent (c) Both (a) and (b) (d) None of the above 4. Sides opposite to equal angles of a triangle are _____. (a) Smaller (b) Greater (c) Equal (d) None of the above 5. "If in two right triangles, hypotenuse and one side of a triangle are equal to the		

triangles and other polygons satisfying given constraints. **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor**.** **derives** proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	hypotenuse and one side of other triangle, then the two triangles are congruent" is a _____. (a) SSS congruence rule (b) ASA congruence rule (c) RHS congruence rule (d) AAS congruence rule 6. In a triangle, angle opposite to the longer side is _____. (a) Equal (b) Smaller (c) Larger (d) None of the above 7. Two figures are congruent, if they are of the _____ shape and of the _____ size. (a) Same, Different (b) Same, Same (c) Different, Same (d) Different, Different 8. Two circles of the _____ radii are congruent. (a) Same (b) Different (c) Unequal (d) None of the above 9. If two triangles ABC and PQR are congruent under the correspondence A ↔ P, B ↔ Q and C ↔ R, then symbolically, it is expressed as _____. (a) Δ ACB ≅Δ PQR (b) Δ ABC ≅Δ PQR (c) Δ ABC ≅Δ PRQ (d) None of the above 10. "If two sides and the included angle of one triangle are equal to two sides and the included angle of the other triangle, then the two triangles are congruent" is a _____. (a) SSS congruence rule (b) SAS congruence rule (c) RHS congruence rule (d) None of the above		

Summative assessment plan- only where relevant
Teachers' reflections and experiences: 1. Did the students actively participate and show interest in the lesson? 2. How can I increase student engagement and create a more interactive learning 3. environment?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Triangles** **Total no. of periods for this chapter: 10** **Period no: 10/10** **Sub Topic: Case Study Questions**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (lines, angles, triangles) to make and test conjectures and solve problems. C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems. C-7.3: Proves theorems using Euclid's axioms and postulates for angles, triangles and quadrilateral, circles area related theorem for triangles and parallelogram.	1. In a park, there are two triangular flower beds. Flower bed ABC has sides AB= 8cm, BC= 6 cm, and CA= 10 cm. Flower bed PQR has sides PQ= 8cm, QR=10cm, and RP=6cm. Justify you answer that the flower bed ABC is congruent to flower be PQR? a) If angle A =40^0 and angle B= 60^0 in flower bed ABC, what is the measure of angle C? b) If angle P=50^0 and angle Q=70^0 in flower be PQR, what is the measure of angle R? c) Suppose flower ABC is shifted to a new location within the park without changing its shape or size. In this new location, is flower bed ABC congruent its original position? Why or why not? d) If angle P = 500 and angle Q=700 in flower bed PQR, what is the measure of angle R? 2. In the two triangles ABC and DEF, AB = DE and AC = EF. Name two angles from the two triangles that must be equal so that the two triangles are congruent. Give reason for your answer		

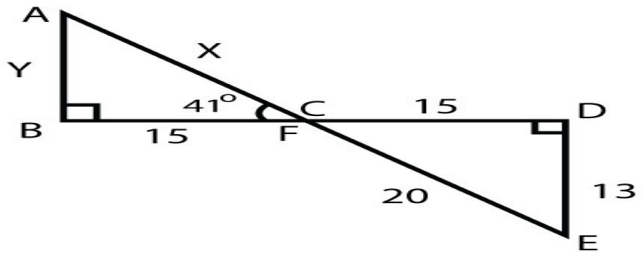
C-7.4: Constructs different geometrical shapes like bisectors of line segment, angles and their bisectors, triangles and other polygons satisfying given constraints. **Learning outcome:** **Identifies** similarities and differences among different geometrical shapes **Analyses** similarities and differences between parts of shapes (lines, angles, triangles) **constructs** a triangle similar to a given triangle as per a given scale factor**.**	3. In triangles ABC and DEF, $\angle A = \angle D$, $\angle B = \angle E$ and AB = EF. Will the two triangles be congruent? Give reasons for your answer. 4. M is a point on side BC of a triangle ABC such that AM is the bisector of $\angle BAC$. Is it true to say that perimeter of the triangle is greater than 2 AM? Give reason for your answer. 5. In triangles ABC and PQR, $\angle A = \angle Q$ and $\angle B = \angle R$. Which side of Δ PQR should be equal to side BC of Δ ABC so that the two triangles are congruent? Give reason for your answer.		
Summative assessment plan- only where relevant			
Teachers' reflections and experiences: 1. How can I use student work as a valuable source of information for my teaching? **2.** Did I effectively utilize formative assessments to monitor student progress and adjust instruction accordingly?			

WORK SHEET 1

Word Problems on Congruent Triangles Worksheet

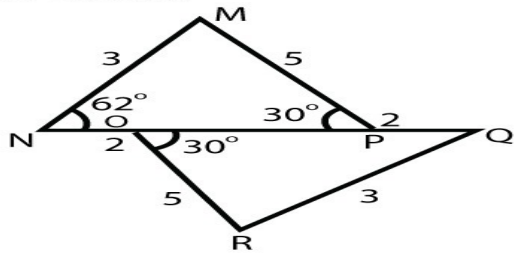
1 For each of these given sets of triangles, state the rule that tells you that they are congruent. Find the unknown values.

a)



X = _____ , Y = _____

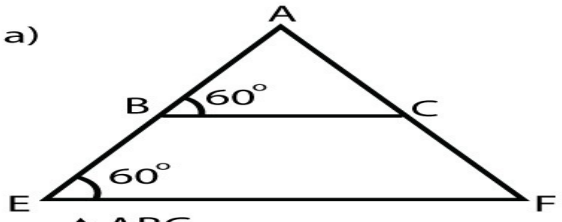
b)



∠OQR = _____ , ∠QRO = _____

2 Which of these pairs of triangles are similar ? For the pairs that are similar, give the rule used to prove them similar.

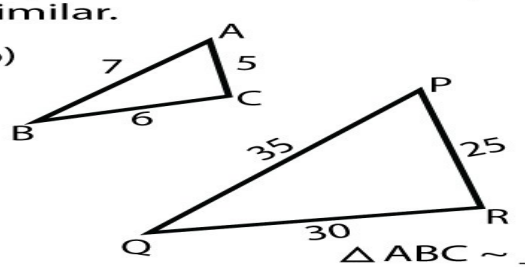
a)



△ ABC ~ _____

_____

b)

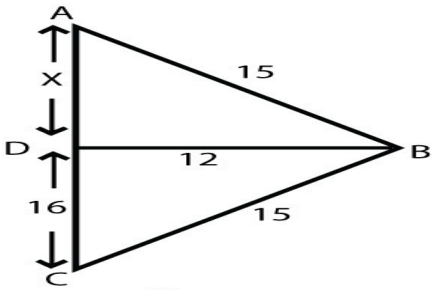


△ ABC ~ _____

_____

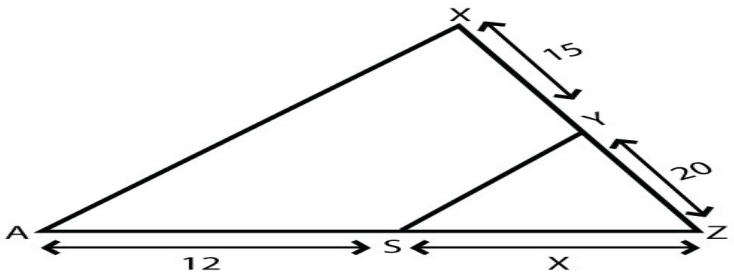
3 Solve for x in the given figures

a) Given △ABD ~ △CBD



X = _____

b) Given △ AXZ ~ △SYZ



X = _____

WORK SHEET 2

Congruence Statements

A) **Complete each congruence statement.**

1) $\Delta DEF \cong \Delta YXZ$

$\overline{EF} \cong$ _____

2) $\Delta LMN \cong \Delta PQR$

$\angle M \cong$

3) $\Delta ABC \cong \Delta FGH$

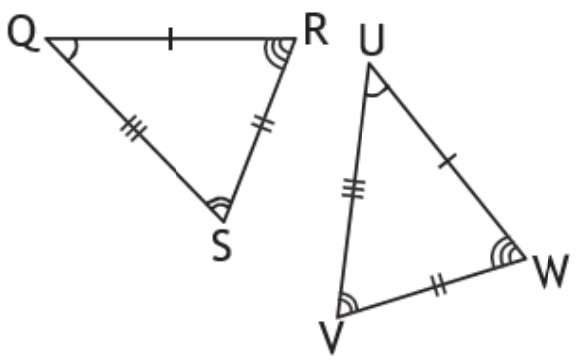
$\angle F \cong$ _____

4) $\Delta STU \cong \Delta XYZ$

$\overline{ST} \cong$

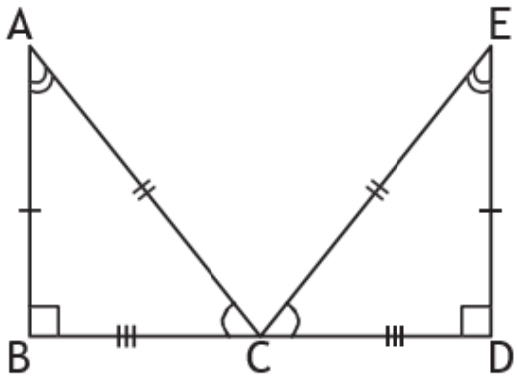
B) Complete each congruence statement.

5)



$\angle Q \cong$ _____

6)



$\overline{AB} \cong$

WORK SHEET 3

1. Which of the following is not a criterion for congruence of triangles?

(A) SAS (B) ASA (C) SSA (D) SSS

2. If AB = QR, BC = PR and CA = PQ, then

(A) Δ ABC $\cong\Delta$ PQR (B) Δ CBA $\cong\Delta$ PRQ (C) Δ BAC $\cong\Delta$ RPQ (D) Δ PQR $\cong\Delta$ BCA

3. In Δ ABC, AB = AC and $\angle B = 50°$. Then $\angle C$ is equal to

(A) 40° (B) 50° (C) 80° (D) 130°

4. In Δ ABC, BC = AB and $\angle B = 80°$. Then $\angle A$ is equal to

(A) 80° (B) 40° (C) 50° (D) 100°

5. In Δ PQR, $\angle R = \angle P$ and QR = 4 cm and PR = 5 cm. Then the length of PQ is

(A) 4 cm (B) 5 cm (C) 2 cm (D) 2.5 cm

QUADRILATERALS

Chapter 8

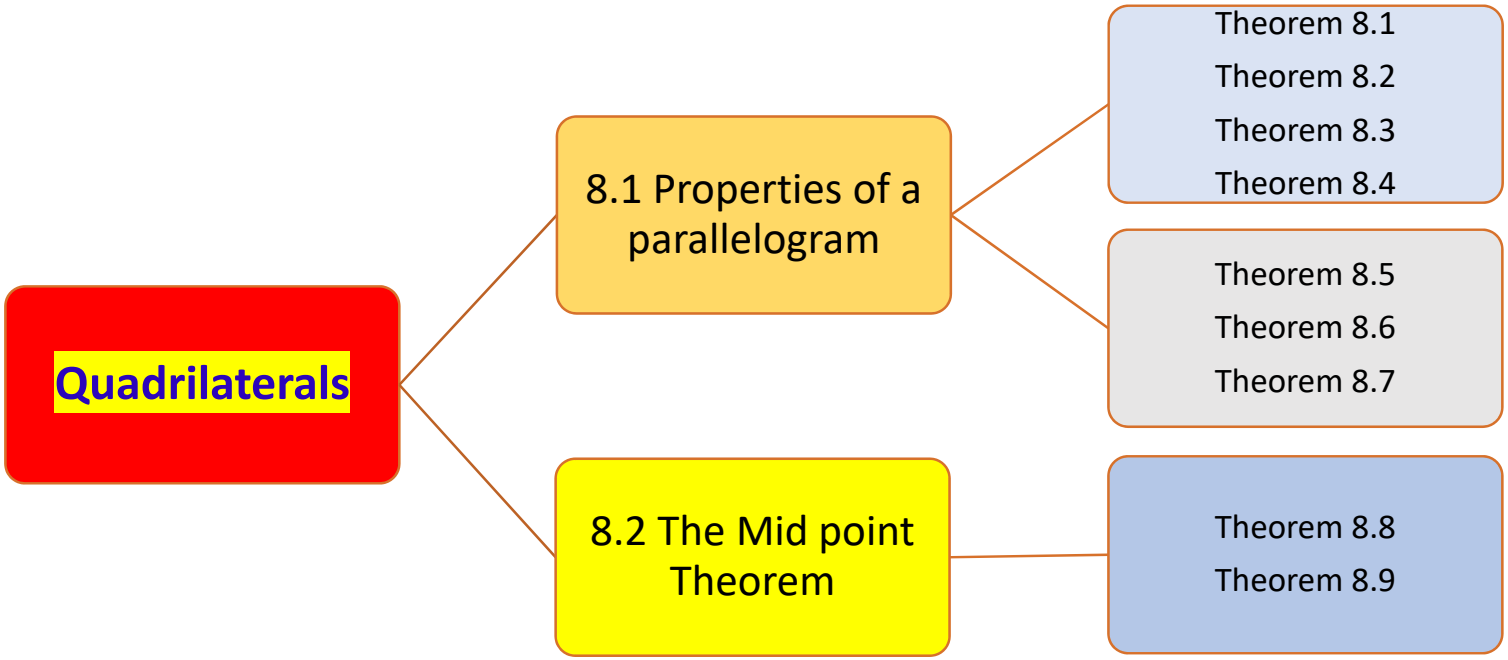
Period plan (40 mins class)

http://epathshala.nic.in/QR/?id=0962CH08

Chapter Plan / Unit Plan / Lesson Plan
Introduction: The following curricular goals and competencies will be developed through this chapter.

CURRICULAR GOALS	COMPETENCIES
CG-4: Analysis characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships CG-7: Begins to perceive and appreciate the axiomatic and deductive structure of Mathematics.	C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles to make and test conjectures and solve problems C-7.3: Proves theorems using Euclid's axioms and postulates - for angles, triangle, quadrilaterals, circles, area-related theorem for triangles and parallelograms.

MIND MAP


Quadrilaterals
8.1 Properties of a parallelogram
8.2 The Mid point Theorem
Theorem 8.1
Theorem 8.2
Theorem 8.3
Theorem 8.4
Theorem 8.5
Theorem 8.6
Theorem 8.7
Theorem 8.8
Theorem 8.9

PERIOD WISE PLAN

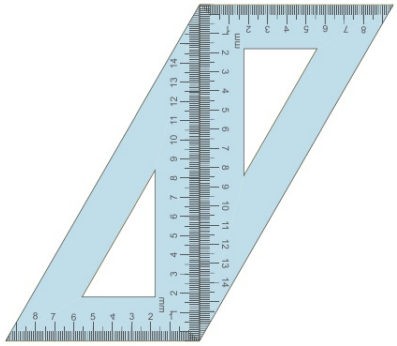
PERIOD	TEACHING TOPICS	LEARNING OUTCOMES
LP 1Introduction Theorem 8.1	A diagonal of parallelogram divides it in to two Congruent Triangles	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 2 Theorem 8.2 Theorem 8.3	➢ In a Parallelogram opposite sides are equal. ➢ Converse of the above Theorem.	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 3 Theorem 8.4 Theorem 8.5	➢ In a parallelogram opposite angles are equal ➢ Converse of the above Theorem.	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 4 Theorem 8.6 Theorem 8.7	➢ The diagonals of a parallelogram bisect each other ➢ Converse of the above Theorem.	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 5 Example Problems	➢ Example 2	Identifies similarities and differences among different geometrical shapes
LP 6 Example Problems	➢ Example 3	Identifies similarities and differences

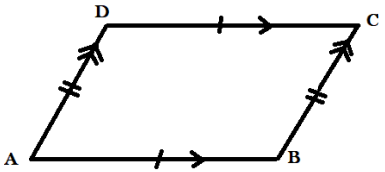
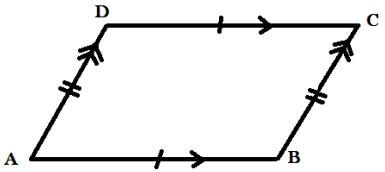
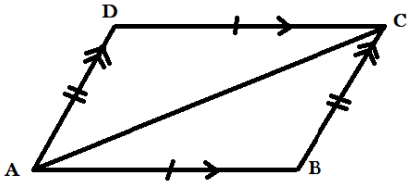
		among different geometrical shapes
LP 7 Example Problems	➢ Example 4	Identifies similarities and differences among different geometrical shapes
LP 8 Practice Period	➢ Problems from exercise 8.1	Enable learners to learn to think critically and solve problems, and use a multidisciplinary perspective
LP 9 Theorem 8.8	➢ Mid-point Theorem	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 10 Theorem 8.9	➢ Converse of Mid-point Theorem	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 11 Practice Period	➢ Problems from exercise 8.2	Enable learners to learn to think critically and solve problems, and use a multidisciplinary perspective

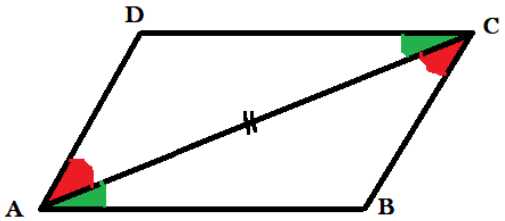
Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals**

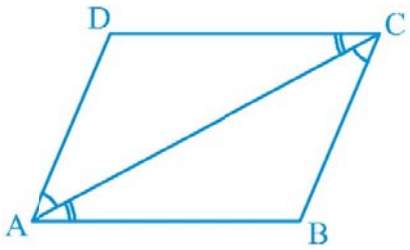
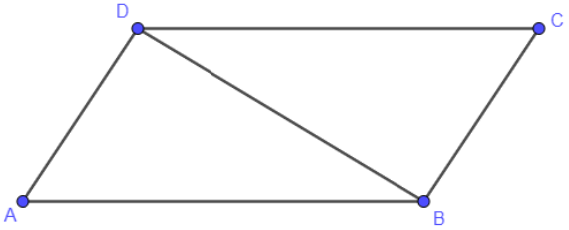
Total no. of periods for this chapter:11 **Period no :1 / 11**

Key concepts: Properties of parallelogram.

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
The student will be able to learn that the diagonal of a parallelogram divides it into two congruent triangles Learning outcome: Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	Teacher asks the following question and recaps the previous knowledge:**10 MINUTES** 1. Observe the window in your class room and describe its shape. 2. Take two identical set squares from your geometry boxes and arrange them as shown here.  Identify the parallel sides in it. This also has opposite sides parallel and equal. Is it a rectangle? No, It's a		Properties Parallelog https://yout /Gso-pSljQ4g?si=x DYt_Paz0j SOURCE::htt www.youtul m/@byjuscl

	parallelogram. 3. Teacher asks the students to draw a rough sketch of a parallelogram and makelist of all the properties of parallelogram by observation.  Teacher initiates discussion: 1. In the figure below  AB // CD, and AD intersects AB and CD. then what is AD called? Identify other possible transversals in the figure. 2. In the figure given below  ABCD is a parallelogram then, ACis _____ and _____. [Teacher Note: It is important to get students to see how AC can be seen both as		**Live obje present the cla room** **Paper a other stationa**

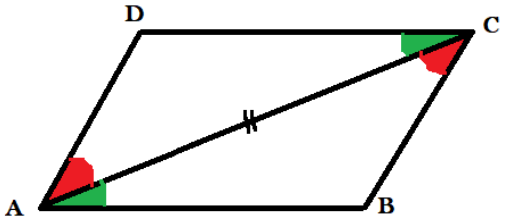
	diagonal and also a transversal.] **ACTIVITY:10 MINUTES**  Teacher asks the students (in groups) 1. to cut out a parallelogram (Say ABCD) from a sheet of paper and cut it along the diagonal (AC). Teacher displays related figure to ease the student's activity. 2. (Note: Take two congruent triangles) Place one triangleover the other and turn around such that they overlap with each other.[Teacher to ask questions: What do they understand when we say 2 figures are congruent, symbol used to represent congruence] The teacher concludes that the diagonal of a parallelogram divides it into two congruent triangles. Teacher uses mathematical terminology to give the proof of the theorem 8.1 **Theorem 8.1 A diagonal of a parallelogram divides it into two congruent triangles.**		

	20 MINUTES  In the above figure, it is given that ABCD is a parallelogram and AC is a diagonal dividing the parallelogram into two triangles, $\triangle ABC$ and $\triangle ADC$. We need to prove that the two triangles are congruent. Teacher asks students, how can we prove two triangles congruent?[Teacher Note: It is important for teacher to see that student remembers the congruency criterion and diagonals role as a transversal] Teacher asks whether any congruency criteria is helpful in this case. (TeacherNote: it is important for teacher to see that the student remembers the equality of the alternate interior angles. ACacts as common side and ASA congruency criteria is applicable.) Student will come to know that $\angle CAB = \angle DCA$, $\angle BCA = \angle CAD$ and $AC = AC$. Teacher concludes that by ASA congruency,	In the given parallelogram ABCD, if BD is the diagonal, then show that ΔABD congruent to ΔCDB.  	

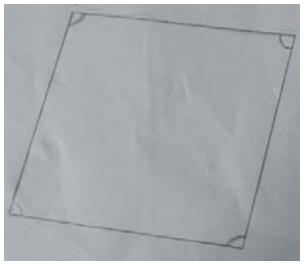
	$\triangle ABC \cong \triangle CDA$.		
Summative assessment plan- only where relevant			
Teachers' reflections and experiences: ➢ **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?** ➢ **How well did the pedagogical strategies engage students and promote active participation in the learning process?** ➢ **How effective were the materials and resources used in this lesson?** ➢ **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**			

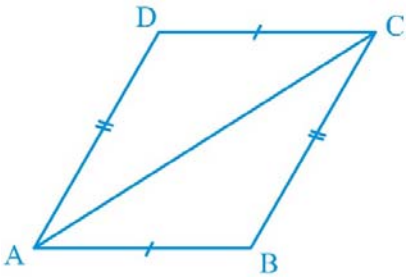
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Quadrilaterals**
Total no. of periods for this chapter:11	**Period no :2**	
Sub Topic:	**Theorem 8.2 – In a parallelogram, opposite sides are equal.** **Theorem 8.3 – If each pair of opposite sides of a quadrilateral is equal then it is a parallelogram.**	

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
The student will be able to learn that in a parallelogram, opposite sides are equal and converse. **Learning outcome:** Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using	**Theorem 8.2 In a parallelogram, opposite sides are equal 20 MINUTES** Teacher asks the following question and recaps the previous knowledge: 1. The diagonal divides the parallelogram into two congruent triangles. ACTIVITY 1:  Teacher asks the students (in groups) 3. to cut out a parallelogram from a sheet of paper and cut it along the diagonal. Teacher displays related figure to ease the student's activity.		https://yout /ncQm3OI _o?si=_oOD bb2ZcFII SOURCE::htt www.youtut m/@Tutorial t_ https://yout

them.	4. to place one triangle over the other and turn around, if needed, and say whether they overlap in any case!Children recap that $\Delta ABC \cong \Delta CDA$. Let us identify the sides of the two triangles which overlap with each other. Teacher gets the response from the students about different pairs of sides, if not, teacher guides them to get it. And teacher conveys that such sides are called corresponding sides and are equal as they coincide. In this case the teacher gives emphasis on AB=CD and BC=AD. The teacher concludes that the opposite sides of a parallelogram are equal. triangles. ACTIVITY 2: 5 MINUTES Teacher asks the students (in groups): 1. to take two identical pens and two identical pencils and arrange them to form a quadrilateral with equal opposite sides.  2. to identify the shape of the quadrilateral	1. In parallelogram ABCD, AB = 6cm and BC = 4cm. Find its perimeter. 2. In parallelogram ABCD, AB = (x+4) cm and CD = (2x-2) cm, then find x.	/5fuSjobEwCI?si=r0vwCPUEB5o93ebY SOURCE::https://www.youtube.com/@DeltaStep **Live objects present in the class room.** **Paper and other stationary.** **Pens and Pencils etc.**

	formed. Children may give multiple types of quadrilateral names. 3. to place this quadrilateral on a paper and draw its boundaries on paper and label it as ABCD.  4. to measure all the four angles and check the sum of adjacent angles at B and C. Children would get the sum as 180 degrees. Teacher conveys that these adjacent angles are the co-interior angles for the lines AB and CD with transversal as BC and are supplementary, hence AB//CD. 5. to check the same property with angles at A and B, and conclude that BC//AD. With this activity teacher hints that the quadrilateral with opposite sides equal may be parallelogram and proceeds for its geometric proof. **Theorem 8.3 15 MINUTES** **If each pair of opposite sides of a quadrilateral is equal then it is a parallelogram.** Teacher will explain the proof of this theorem by	3. In quadrilateral ABCD, AB = 6cm, BC = 4cm, CD = 6cm and DA = 4cm. Is ABCD a parallelogram. Give reasons in support of your	

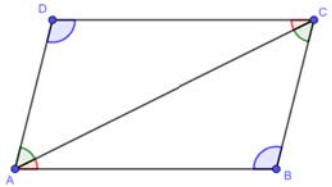
	asking questions and supplying necessary inputs.  1. In the given quadrilateral ABCD, AB=CD and AD=BC and we want to show that ABCD is parallelogram. For it, we shall show that AB//CD and BC//AD. 2. Teacher asks the question to the children, how to prove that AB//CD with the given information. Children may find it difficult to respond. Then teacher would say that there is need of diagonal which acts as a transversal. 3. Teacher asks to join AC which divides the given quadrilateral into two triangles. 4. Teacher asks children to observe the two triangles for the equal sides. Children respond that the AB=CD, BC=AD and AC=AC. So, SSS congruency is applicable and the triangles are congruent. 5. Teacher asks children whether this information is anyway helpful for AB//CD and BC//AD? Children may be puzzled. Teacher conveys that the corresponding	answer.	

	angles of the two congruent triangles may be helpful here. 6. Teacher asks children to identify the pairs of corresponding angles in the two triangles. Children respond $\angle BAC = \angle DCA$ and $\angle DAC = \angle BCA$ and $\angle D = \angle B$. Teacher may guide the students to arrive at these results. 7. Teacher asks the children to identify the pairs of equal angles obtained that may be helpful in proving AB//CD and BC//AD. Student responds that $\angle BAC = \angle DCA$ implies AB//CD and $\angle DAC = \angle BCA$ implies BC//AD , due to equality of alternate interior angles. Teacher helps students getting these results if needed. 8. Teacher asks the children whether the goal is reached! Children responds that, yes, the quadrilateral is parallelogram now, as the opposite sides are proven to be parallel lines. The teacher concludes that a quadrilateral with opposite sides equal is a parallelogram.		
Summative assessment plan- only where relevant			

Teachers' reflections and experiences:

- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals** **Total no. of periods for this chapter:11** **Period no :3** **Sub Topic: Theorem 8.4 – In a parallelogram, opposite angles are equal.** **Theorem 8.5 – If each pair of opposite angles of a quadrilateral is equal then it is a parallelogram**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
The student will be able to learn that in a parallelogram, opposite angles are equal and converse. **Learning outcome:** Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	**Theorem 8.4 In a parallelogram, opposite angles are equal** Teacher explains the theorem and analyses it by conducting the following activity. ACTIVITY 1:  Teacher asks the students (in groups) 5. to cut out a parallelogram from a sheet of paper and cut it along the diagonal. Teacher displays related figure to ease the student's		https://yout /48FD1J0DH =irGrQjns2M K1 SOURCE::htt www.youtul m/@Pocket oom video regarding Angles a equal

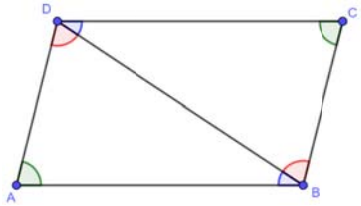
activity.

6. to place one triangle over the other and turn around, if needed, and say whether they overlap in any case!Children recap that $\Delta ABC \cong \Delta CDA$.

   Let us identify the angles of the two triangles which overlap with each other. Teacher gets the response from the students about different pairs of angles, if not, teacher guides them to get it. And teacher conveys that such angles are called corresponding angles and are equal as they coincide.

   In this case the teacher gives emphasis on $\angle BAC=\angle DCA$, $\angle BCA=\angle DAC$ and $\angle B=\angle D$, and concludes that $\angle B=\angle D$ forms the opposite angles of the parallelogram ABCD.

   Similarly, the teacher conducts the same activity with diagonal BD and helps the students prove that $\angle A=\angle C$.



   The teacher concludes that the opposite

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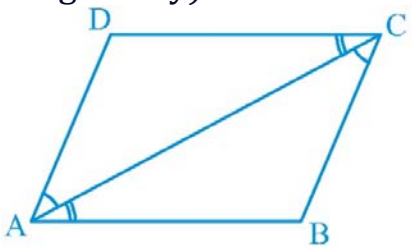
	angles of a parallelogram are equal. Teacher Note: Teacher is advised to use the GeoGebra tool on IFP's to demonstrate this property to all the students. **Proof of Theorem – 8.4** Teacher asks children to draw a parallelogram and label it as ABCD.  Teacher asks the students to identify thatwe have to prove$\angle A=\angle C$ and $\angle B=\angle D$. Teacher asks the students to find the connection between given information (parallelism of opposite sides) and what to be proved (opposite angles are equal). Students recollects the process involved in proving Theorem – 8.1 and responds that diagonals AC and BD might help. Teacher asks the children to join the diagonal AC and makes sure that the	1. In a parallelogram ABCD if $\angle A=70^0$ then find the remain three angles.	

	students prove △ABC≅ △CDA (ASA congruency).  Teacher asks students, how this congruence relation helps in proving the required? Children respond that the corresponding angles in these triangles are equal. Teacher concludes that with the use of diagonal AC, ∠B= ∠D. In similar way, teacher asks children to join diagonal BD and repeats the same steps so that student could reach at the conclusion that ∠A=∠C. So, teacher finally concludes that each pair of opposite angles in a parallelogram are equal. **Theorem:8.5**In **a quadrilateral, if each pair of opposite angles is equal then it is a parallelogram.** Teacher asks the students to state the converse of		

	the theorem 8.4. (Teacher Note: Teacher should ensure that student is able to state the converse statement). Now, Teacher explains the given theorem, by asking some questions through the following activity. **ACTIVITY 2** 1. Teacher asks the students to form a quadrilateral with 4 pens or pencils such that both pairs of opposite angles are equal (students may seek the help of protractor to measure the angles).  2. Teacher asks to identify the type of quadrilateral formed? (Teacher Note: Teacher should ensure that the children arrive at the conclusion of parallelogram by adding up the adjacent angle measures and seeing it as 180^0). Children identify it as a parallelogram. **Proof of Theorem – 8.5** Teacher asks the students to draw a quadrilateral and label it as ABCD and consider that its opposite angles are known to be equal.		

So, Teacher ensures that students identify, it is given that $\angle A = \angle C$ and $\angle B = \angle D$.

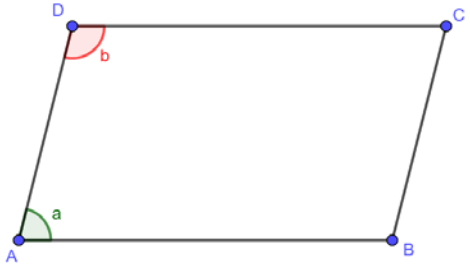
Now, teacher ask the student to recollect what we have to prove? Students responds parallel property of opposite sides, i.e., AB//CD and BC//AD .

Teacher asks the students to utilize the given information and use the suitable property to do the proof.

After several trials students realise (if not teacher hints) that we could use the angle sum property of quadrilateral,
i.e., $\angle A + \angle B + \angle C + \angle D = 360^0$.

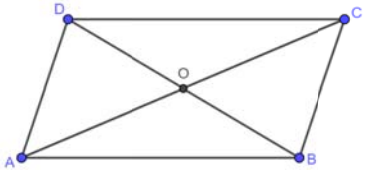
So, using $\angle A = \angle C$ and $\angle B = \angle D$, teacher asks students to simplify $\angle A + \angle B + \angle C + \angle D = 360^0$. (Teacher Note : Teacher should make sure that the students reach at sum of two adjacent angles is 180^0.)

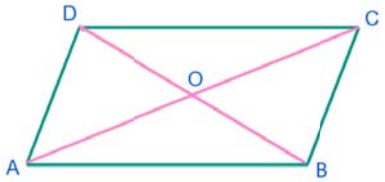
2. In the given figure, ABCD is a parallelogram and a:b = 2:3 . Then find the measures of all the angles of the parallelogram.

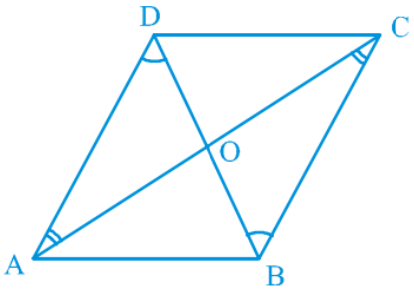


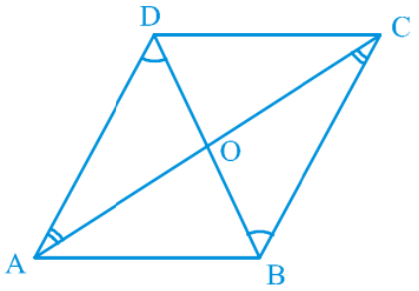
	Teacher should ask students to identify if this helps to prove opposite sides parallel to each other. (Teacher Note: Teacher should ensure that students arrive at the conclusion of AB//CD and BC//AD using angle properties by transversals). Teacher concludes that the quadrilateral with both pairs of opposite angles equal is a parallelogram.		
Summative assessment plan- only where relevant 1. Show that each angle of a rectangle is a right angle.			
Teachers' reflections and experiences:			

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals** **Total no. of periods for this chapter:11** **Period no: 4** **Sub Topic: Theorem 8.6 – Diagonals of a parallelogram bisect each other.** **Theorem 8.7 – If the diagonals of a quadrilateral bisect each other then it is a parallelogram**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
The student will be able to learn that diagonals of a parallelogram bisect each other and converse. **Learning outcome:** Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	Teacher asks the following questions to recall the previous knowledge of students relevant to the topic: 10 MINUTES 1. Teacher draws a parallelogram with diagonals on IFP / Green Board and says that it is a parallelogram with two diagonals. Do they have any common point? (Teacher Note: Teacher should ensure that students recall that there is one common point called Intersecting Point.)  2. Teacher asks the children to observe the figure shown and asks what are the	1. How many points of intersection do the diagonals of a parallelogram have? 2. What are the different congruence criterion for testing	https://y u.be/TE Yr67BI?s KtHZUI uI6PUF 9 min. Kh Academ video regardir Diagonals parallelog bisects ea other

	triangles visible? Are they congruent? If yes, why? (Teacher Note: Teacher should ensure that students recap the congruence criterion viz., SSS, SAS, ASA and RHS) **Theorem 8.6 The diagonals of a parallelogram bisect each other. 15 MINUTES** Teacher explains the theorem and analyses it by conducting the following activity. ACTIVITY 1: Teacher asks the students (in groups) 7. to cut out a parallelogram from a sheet of paper with diagonals drawn and cut it along both the diagonals. Teacher displays related figure to ease the student's activity.  8. to place one triangle over the other and turn around, if needed, and say whether they overlap in any case!Children identify that $\Delta AOB \cong \Delta COD$ and $\Delta BOC \cong \Delta DOA$ Let us identify the sides of the two triangles which overlap with each other. Teacher gets the response from the students about	the congruency of triangles?	https://yu.be/TEYr67BI?sFWgtDXpqqHw 9 min. KhAcademvideoregardirDiagonalsparallelogbisects eaother **Paper aotherstationa** **GeoGebClassisuiteinstalledIFP's.**

	different pairs of sides, if not, teacher guides them to get it. And teacher conveys that such sides are called corresponding angles and are equal as they coincide. In this case the teacher gives emphasis on OA=OC and OB=OD which hints that the diagonals AC and BD bisect each other. The teacher concludes that the opposite angles of a parallelogram are equal. Teacher Note: Teacher may use the GeoGebra tool on IFP's to demonstrate this property to all the students. **Proof of Theorem – 8.6**  Teacher asks the students to consider the parallelogram ABCD with diagonals AC and BD intersecting at the point O. Teacher restates that we need to prove here that diagonals bisect each other, i.e., OA=OC and OB=OD.	3. In parallelogram ABCD, diagonals are bisecting at the point O. Prove that $\triangle AOD \cong \triangle COB$.	

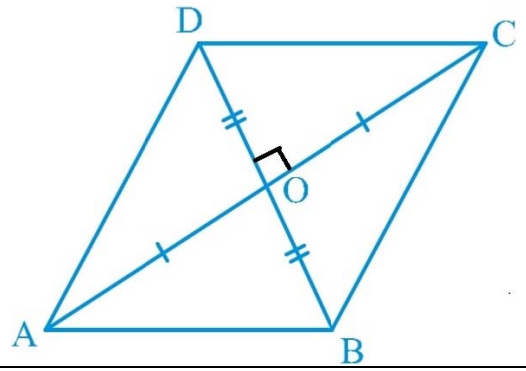
	Teacher asks the students to find what may help in proving it. (Teacher Notes: Teacher has to ensure that student identifies opposite triangles are congruent as this would only help them in proving the result.) Teacher asks the students about the known relations between the opposite triangles which may help them prove congruent, say, in $\triangle AOB$ and $\triangle COD$, what sides or angles are equal? Student should identify that $AB=CD$ (Opposite sides of a parallelogram are equal), $\angle OAB=\angle OCD$ and $\angle OBA=\angle ODC$ (alternate interior angles are equal) (teacher may guide if needed) and applies ASA congruency to establish that $\triangle AOB\cong\triangle COD$. Teacher asks, how this helps in getting the result. Students respond that the corresponding sides in these triangles are equal and that is our result (with teacher's assistance, if needed). Teacher concludes that, yes, $OA=OC$ and $OB=OD$. So, the diagonals of a parallelogram bisect each other.		
Summative assessment plan- only where relevant 2. Show that each angle of a rectangle is a right angle.			
Teachers' reflections and experiences:			

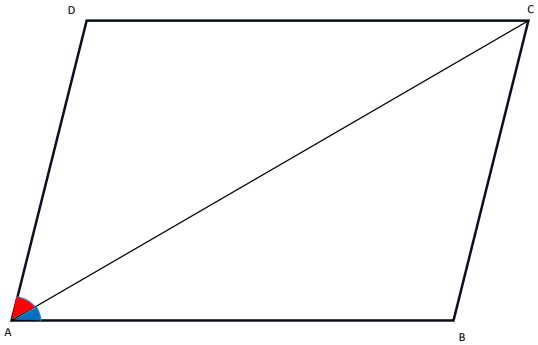
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

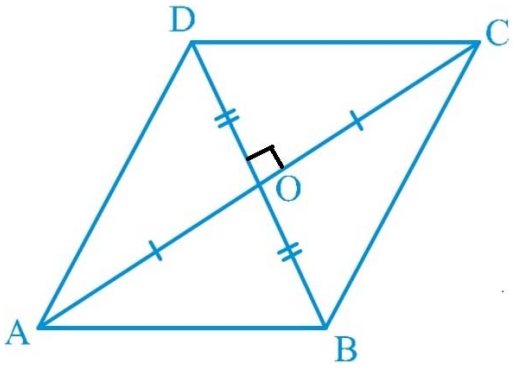
Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals**

Total no. of periods for this chapter:11 **Period no :5/11**

Sub Topic: Example 2

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration** **20 MINUTES**		**Materi required**
The students will be able to learn. The diagonals of Rhombus are perpendicular to each other. C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems Learning outcome: Identifies similarities and differences among different geometrical shapes	Teacher asks the following questions and testing the previous knowledge 1. If a parallelogram had two pairs of adjacent side are qual? Then which type of Quadrilateral it is? 2. How are the angles in a Rhombus? 3. Can you say that a Rhombus is a parallelogram? 4. How are the diagonals in a parallelogram? Teacher will explain Example 2 in the text book and analyze it:  		**https://utu.be/q6x8Sz8?si=0ShzNs0bcDX8W** **7 min Delta Step video regardi Diagon of a Rhomb are perpen ular t each**

	Example 2:**20 MINUTES** Show that the diagonals of a Rhombus are perpendicular to each other. • If ABCD is a Rhombus. • Can you say relation between the sides in a Rhombus? Teacher asks the following questions and testing the previous knowledge 5. If a parallelogram had two pairs of adjacent side are qual? Then which type of Quadrilateral it is? 6. How are the angles in a Rhombus? 7. Can you say that a Rhombus is a parallelogram? 8. How are the diagonals in a parallelogram? Teacher will explain Example 2 in the text book and analyze it:	 The diagonal AC of a parallelogram ABCD bisects ∠A So that 1. It bisects C also **2.** ABCD is a Rhombus.	**other** **History of Rededicates** **IFP** **GeoGebra graph**



Example 2:

Show that the diagonals of a Rhombus are perpendicular to each other.

- If ABCD is a Rhombus.
- Can you say relation between the sides in a Rhombus?
- In △AOD and △ DOC, Which sides are equal?
- If AD = CE, AO = OC, OD=OD,what can you say about △AOD and △DOC are they congruent?
- Then how is the measure of ∠DOA and ∠DOC?
- Are they equal?
- From figure what is the measure of ∠DOA +∠ DOC?
- What is the condition involved in it?
- If the sum of two angles

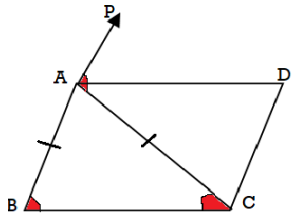
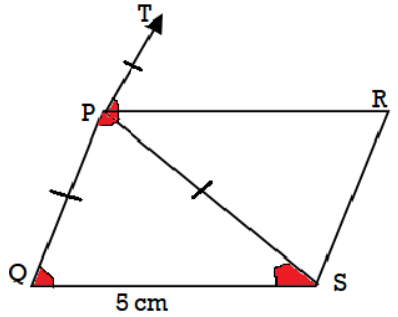
	$\angle AOD + \angle DOC = 180^0$ then • What is the measure of each angle? • The students will give the answer the measure of each angle is 90^0 • The teacher will give the conclusion, the diagonals of a Rhombus perpendicular to each other.		
Summative assessment plan- only where relevant			
'eachers' reflections and experiences:			

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals**

Total no. of periods for this chapter:11 Period no:6

Sub Topic:Example 3: ABC is an Isosceles triangle, in which AB=AC, bisects exterior angle PAC and CD//AB. S.T 1)$\angle DAC = \angle E$ 2) ABCD is a parallelogram.

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems Learning outcome: Identifies similarities and differences among different geometrical shapes	Teacher elicits the previous knowledge of the students by asking. 10 MINUTES 1. In $\triangle PQR$ if $\angle Q = \angle R$ then give the relation of PQ and QR. Example 3:30 MINUTES ABC is an Isosceles triangle in which AB = AC. AD bisects exterior angle PAC and CD//AB. Show that $(i)\ \angle DAC = \angle BCA$ and (ii) ABCD is a parallelogram. Teacher will explain the following example by asking some questions. 1. Given $\triangle ABC$ is an Isosceles triangle where AB=AC then how can you prove that $\angle DAC = \angle ACB$  	 In the above figure if PQ = PR and the measure of QR = 5cm and PS bisect $\angle TPR$ then find the measure of PS and $\angle S$.	https://yout /L09FIr0iG9 VaR9gualts_ 9 min. 'Mathema class IX' rega the solutio the proble

	2. From fig. how can you express $\angle PAC$. (Teachers note: Teachers should ensure that the students recall that one of the exterior angles of the triangle is equal to sum of its opposite interior angles. i.e. $\angle PAC = \angle ABC + \angle ACB$. In isosceles triangle ABC the base angles are equal. So $\angle ABC = \angle ACB$). Teacher asks the students how can you express $\angle PAC$ in terms of $\angle ACB$($\angle PAC = 2\ \angle ACB$ 1)⟶ 3. From figure if AD bisects $\angle PAC$ how can you express $\angle \boldsymbol{PAC}$in another way? Can I express $\angle PAD = 2\angle DAC$2⟶ By compare eq 1 and 2 and give the conclusion. ($\angle DAC = \angle ACB$) (Teachers note: Teachers has to ensure that the student identifies that these equal angles form a pair of alternate angles when line segments BC and AD are intersected by a transversal AC) So now compare BC, AD and BA, CD (BC‖ $AD, BA \parallel CD$) Now teacher concludes that both pairs of opposite sides of a quadrilateral ABCD are parallel so ABCD is a parallelogram.		
Summative assessment plan- only where relevant			

Teachers' reflections and experiences:

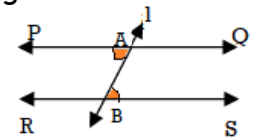
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

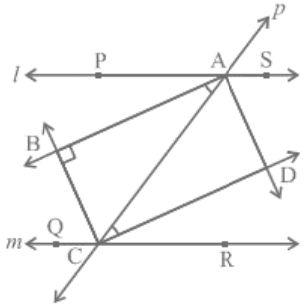
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals**

Total no. of periods for this chapter:11 Period no: 7

Sub Topic: Example 4: ABC is an Isosceles triangle, in which AB=AD, bisects exterior angle ∠PAC and CD//AB. Show that 1)$\angle DAC = \angle BCA$ 2) ABCD is a parallelogram.

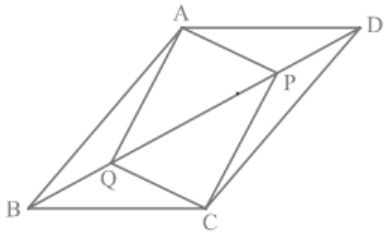
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi requir**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems Learning outcome: Identifies similarities and differences among different geometrical shapes	Teacher asks the following questions and testing the previous knowledge of the students.**5 MINUTES** 1. In the given figure  If PQ‖ RS and 'l' is a transversal then identify the relationship between $\angle PAB$ and $\angle ABS$? 2. In a parallelogram if one angle is 90° then which type of quadrilateral is it? Example 3:**35 MINUTES** Two parallel lines 'l' and 'm' are intersected by a transversal 'p'. Show that the quadrilateral formed by the bisectors of interior angles is a rectangle.		**https:// utu.be/ WzNR4(8?si=i2- QAQq8 8Dv 3 min Doubtn videc regardi problen isoscel triang Propert of**

	 Teacher will explain the above example by asking the following questions: Given PS‖ QR and 'p' is a transversal. AB, CD are the angular bisectors of $\angle PAQ$ & $\angle ACR$ and AD, CB are the angular bisectors of $\angle SAC$ & $\angle ACQ$. 1. Which type of angles are $\angle PAC$&$\angle ACR$? 2. If $\angle PAC$=60° then what is the measure of $\angle ACR$? 3. What is the role of bisector? (Teachers note: Teachers should ensure that the students recollect the bisector divides the angle into two congruent angles. i.e. $\angle PAB = \angle BAC = \frac{1}{2}\angle PAC$ and $\angle ACD = \angle DCR = \frac{1}{2}\angle ACR$) 4. So, can I conclude that $\angle BAC = \angle ACD$? Now once again observe the fig. (Teacher note: Teacher should explain that AC is transversal for the lines AB and CD and so AB‖CD. In the same manner by considering the angles$\angle ACB$&$\angle CAD$. We can say that AD‖ BC.) Teacher concludes that since both pair of opposite sides are parallel ABCD is a parallelogram. 5. Teacher asks students from fig. what is the	(i) ABCD is a rectangle I which diagonal AC bisects $\angle A$ as well as $\angle C$. Show that (i) ABCD is a square. (ii) Diagonal BD bisects $\angle B$ as well as $\angle D$	**quadrila als cha** **Models quadrila als.**

	measure of $\angle PAC + \angle CAS$. (180° a linear pair) 6. Then what is the measure of ½ $\angle PAC$+ ½ $\angle CAS$ (90° - Right angle). (Teachers note: Teachers should ensure that the students should understand ½ $\angle PAC$+ ½ $\angle CAS$ =$\angle BAC$+$\angle CAD$= 90° and from fig. $\angle BAD$=90°) Teacher can conclude that ABCD is a parallelogram in which one angle is 90°. There for ABCD is a rectangle.		

Summative assessment plan- only where relevant

1. In Parallelogram ABCD two points P and Q are taken on diagonal BD such that DP=BQ. Show that

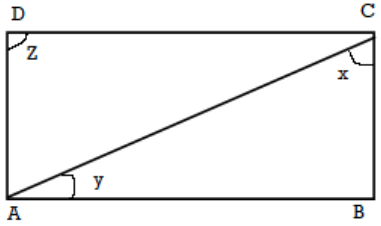


(i) $\triangle APD \cong \triangle CQB$
(ii) AP = CQ
(iii) $\triangle AQB = \triangle CAB$
(iv) AQ=CP
(v) APCQ is a Parallelogram

Teachers' reflections and experiences:

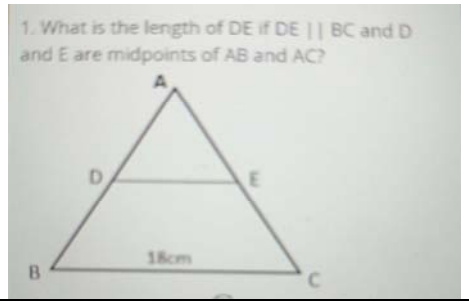
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Quadrilaterals** **Total no. of periods for this chapter:11** **Period no: 8** **Sub Topic: Practice period based on the all the properties of parallelogram.**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems C-7.3: Proves theorems using Euclid's axioms and postulates - for angles, triangle, quadrilaterals, circles, area-related theorems for triangles and parallelograms Learning outcomes: Enable learners to learn to think critically and solve problems, and use	Teacher asks the students in groups to practice the following questions 5 MINUTES 1. Problem no. 6, 7 from exercise-8.1 from chapter-8, Quadrilaterals. 10 MINUTES 2. ABCD is a parallelogram. AM and BN are respectively the perpendiculars from A and B to SC and CD produced. Prove that AM = BN. 10 MINUTES 3. In the given fig. ABCD is a parallelogram, what is the sum of the angles x, y and z? 5 MINUTES 		

a multidisciplinary perspective			

Summative assessment plan- only where relevant

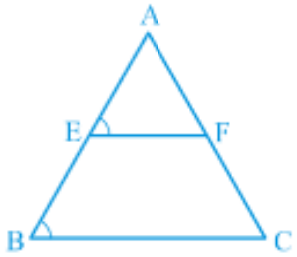


Teachers' reflections and experiences:

- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

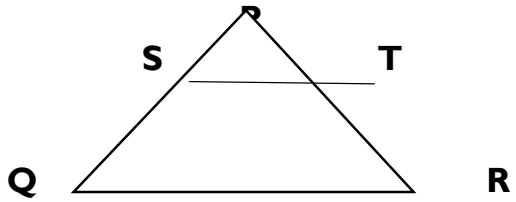
Class: 9th **Subject: Mathematics** **Chapter: 8 quadrilaterals** **Total no. of periods for this chapter: 11** **Period no: 9/11** **Sub Topic: Theorem: 8.8: The line segment joining the mid-points of two sides of a triangle is parallel to the third side**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**

C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems C-7.3: Proves theorems using Euclid's axioms and postulates - for angles, triangle, quadrilaterals, circles, area-related theorems for triangles and parallelograms Learning outcomes: Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	Teacher recollects the previous knowledge about the properties of triangles. Quadrilaterals and transversal. **Activity: 10 MINUTES** Teacher asks the students to take a sheet of paper and draw a triangle. Now make the mid points of the triangle and join them ➡ Students measure the length of the EF and BC with the help of the scale ➡  Teacher asks students to measure the angle, ∠E and ∠B with help of the protractor after completion of measurement of sides EF and BC and angle ∠E, ∠B	(iii) ABCD is a rectangle in which diagonal AC bisects $\angle A$ as well as $\angle C$. Show that (i) ABCD is a square. (iv) Diagonal BD bisects $\angle B$ as well as $\angle D$	https://yo be/0a8ccJ R0?si=4xe 27A2XII 4 min. vide CREAT CLASSE regarding line segm joining t midpoints two sides Triangle parallel to third sid GeoGebr Byju's A

	Students observe that EF= 1\2 BC and ang$\angle AEF = \angle ABC$ (Teacher's note: Teacher has to ensure that student identifies that ∠E and∠B are on the same side of the line AB and the measure is equal so such type of angles is called corresponding angles and the lines are parallel) Teacher concludes that EF//BC Teacher asks the student repeat the same activity with some more triangles ad give the answer weather it is applicable for all the triangles THEOREM 8.8 30 MINUTES The line segment joining the mid points of two sides of a triangle is parallel to the third side **A** **E** **F** **D**		

	B **C** theorem by giving the following clues and asking questions. Teacher will explain the students in the given figure, here E,F are the mid points of the sides of the triangle AB & AC we want to show that EF//BC. How to prove EF//BC with the given information children may find it difficult to respond. (**Teacher's note: Teacher** has to ensure that there is a need of another line CD where CD//BE and one more line FD where FD//BC) Now consider the two triangles Δ AEF &Δ CDF Which criteria is applicable to prove the two triangles are congruent Proof: Teacher will explain the proof Teacher asks the students since CD//BA then what is the role of AC? **Teacher's Note:** Teacher has to ensure that student		

	identifies all the appropriate rules to prove the congruency of Δ AEF &Δ CDF $\angle AFE = \angle ACD$. (Alternate inter angle) $\angle AFE = \angle DFC$ (Vertically opp. Angle) AF=FC (F is the mid -point) This proves that $\Delta AEF \cong \Delta CDF$ • Teacher asks students what are the corresponding sides of the two triangles • Students will give response CD=AE=BE • EF=DF From figure identify the quadrilateral BCDE can you name which type a quadrilateral it is BCDE Students conclude that BCDE is a parallel ogram **(Teacher's note:**Teacher need to conclude that EF//BC EF= 1\2 ED = 1\2 BC So, the line segment joining the mid-point of two sides of a triangle is parallel to the third side)		
Summative assessment (plan-only where relevant) **In Δ PQR ST//QR then S. T are mid-points PQ, PS respectively. If the length of ST=5cm Then find the length QR**			



Teachers' reflections and experiences:

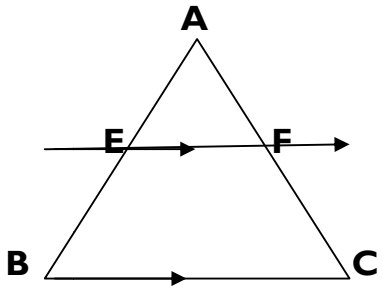
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

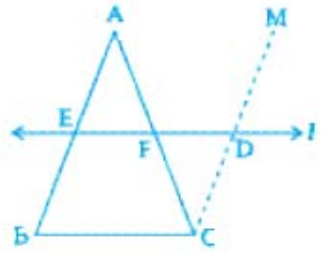
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: 8 quadrilaterals**

Total no. of periods for this chapter: 11 **Period no: 10/11**

Sub Topic: Theorem: 8.9: The line drawn through the mid-point of one side of a triangle parallel to another side, bisects the th side

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi require**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems C-7.3: Proves theorems using Euclid's axioms and postulates - for angles, triangle, quadrilaterals, circles, area-related theorems for triangles and parallelograms Learning outcomes: Derives proofs of mathematical statements	**Activity:**  Teacher conducts the following activity by giving instructions to the students to take a sheet of paper and draw a triangle ABC Take point E which mid-point of AB and name it as E Now draw a parallel line for BC through the point E now this parallel line intersects Ac at F with the help of the scale measure the length of AF and FC Teacher gets the response from the students that		https://y u.be/2cN N7iDAE ePZdnU jMYrhC 2 min video fr R & H acaden regardi the pro

particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.	AF = FC Teacher concludes that the line EF bisects AC **THEOREM 8.9 :** The line drawn through the mid-point of one side of a triangle Parallel to another side bisects the third side 1.Teacher will explain the proof of this theorem by asking questions and supplying necessary inputs  1. In the given ∆ABC, E is the midpoint of the side AB if a line l is passing through the point E and parallel to BC the line l intersects AC at the point F now produce EF up to the point D 2. Teacher asks the question to the children how to prove that AF=FC (Teacher's Note: Teacher need to give clarity that the given information is not sufficient to prove the theorem, so there is a need to draw another line m//AB and intersecting l at the point D). so, l // BC and m is // to AB	P and Q are the mid-points of the opposite sides AB and CD of a parallelogram ABCD. AQ intersects DP at Sand BQ intersects CP at R. Show that PQRS is a parallelogram. ABCD is a square. E, F, G and H are points on AB, BC, CD and DA respectively, such that AE= BF =CG=DH. Prove that EFGH is a square.	

	For this we should that the line l bisects AC i.e AF=FC Teacher asks the students how to prove that AF = FC Student may feel difficult to give the answers so teacher explains by asking the following questions Observe the opp. Sides of the Quadrilateral BCDE and give the relations 3. Which type of a quadrilateral it is? 4. Teacher concludes that from the figure CD = BE and BC = ED so BCDE is a parallelogram 5. Now teacher asks consider ΔCFD and ΔEFA to prove that AF=FC we need to prove that ΔCFD≅ΔEFA? Teacher's Note: Teacher has to ensure that student identifies all the appropriate rules to prove the congruency of triangle ΔCFD &ΔEFA ∠AFE=∠ACD. (Alternate inter angle) ∠AFE=∠DFC (Vertically opp. Angle) and CD = AE=BE (AAS) criteria triangle CFD ≅ AFE 6. Teacher concludes that since ΔCFD ≅ ΔAFE and so AF = FC (CPCT) 7. So, the line drawn through the mid-point of one side of a triangle parallel to another side bisects the third side.		

Summative assessment plan-only where relevant

In a parallelogram ABCD, E and F are the mid-points of sides AB and CD respectively (see Fig. 8.22). Show that the line segments AF and EC trisect the diagonal BD.
AI
Fig. 8.22

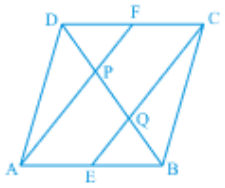


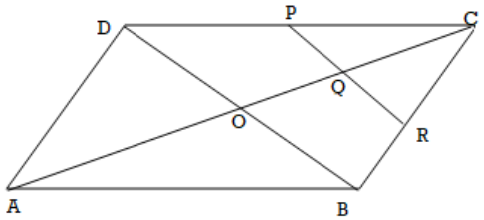
Fig. 8.22

6. ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC intersects AC at D. Show that
(i) Dis the mid-point of AC
(ii) MD⊥AC

Teachers' reflections and experiences:

- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**
- **How well did the assessment strategies measure student understanding and achievement of the learning outcomes?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Quadrilaterals**	
Total no. of periods for this chapter:11	**Period no: 11**		
Sub Topic: Practice period based on the Mid – point Theorem and Converse of mid-point.			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Materi require**
C-4.1: Describes relationships including congruence of two-dimensional geometric shapes (such as the lines angles triangles) to make and test conjectures and solve problems C-4.2: Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems C-7.3: Proves theorems using Euclid's axioms and postulates - for angles, triangle, quadrilaterals, circles, area-related theorems for triangles and parallelograms Learning outcome:Enable learners to learn to think critically and solve problems, and use a multidisciplinary perspective	Teacher asks the students in groups to practice the following questions 1. Problem no. 1,2 and 3 from exercise-8.2 from chapter-8, Quadrilaterals. 2. In the given fig. ABCD is a parallelogram I which P is the mid-point on AC, such that CQ = ¼ AC. Also, PQ when produced meets BC at R. Prove that R is the mid-point of BC.  		SCAN MI https://youtu M7L6VAwZn =YScdhvtZ2E 2 SOURCE https://www ube.com/@r withmadhuri

Summative assessment plan- only where relevant
Teachers' reflections and experiences:

WORK SHEET

Chapter:8

Multiple choice questions

1. What is the sum of angles of quadrilaterals?

I. 90
II. 180
III. 360
IV. 270

2. A quadrilateral with only one pair of opposite sides parallel is called:

I. Trapezium
II. Square
III. Rectangle
IV. Rhombus

3. The consecutive angles of a parallelogram are

I. Complementary
II. Supplementary
III. Equal
IV. None of these

4. If in a parallelogram its diagonals bisect each other and are equal then it is a,

I. Square
II. Rectangle
III. Rhombus
IV. Parallelogram

Solve the following problems

5. In a parallelogram ABCD if $\angle B = 135^0$ determine the measures of its other angles?

6. ABCD is a rhombus such that $\angle ABD$=50^0,then what is the measure of $\angle ACB$?

7. A diagonal of a parallelogram divides its into how many congruent triangles?

8. If the angle of a parallelogram is two-third of its adjacent angle, find the angles of the parallelogram?

9. In a quadrilateral ABCD, the angles A,B,C,and D are in the ratio of 1:2:4:5.Find the measure of each angles of the quadrilateral?

10. In a parallelogram ABCD determine the sum of angles $\angle C \; and \; \angle D$

WORK SHEET-2

Multiple Choice Questions.

1. If in a parallelogram its diagonals bisect each other at right angles and are equal, then it is a

I. Square
II. Rectangle
III. Rhombus
IV. Parallelogram

2. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral ABCD taken in order is a square only if.

I. ABCD is a rhombus
II. Diagonals of ABCD are equal
III. Diagonals of ABCD are equal and perpendicular
IV. Diagonals of ABCD are perpendicular

3. Which of the following is not true?

I. Every square is a rectangle
II. Every rectangle is a quadrilateral
III. Every parallelogram is a trapezium
IV. None of these

4. Which of the following is not true for a parallelogram?

I. Diagonals bisect each other
II. Opposite sides are equal
III. Opposite angles are equal
IV. Opposite angles are bisected by the diagonals

WORK SHEET-3
Multiple Choice Questions

Solve the following problems

1.ABCD is a parallelogram such that its diagonals are equal. What is the measure of $\angle ABC$?

2.In a parallelogram ABCD IF $\angle C$=80^0,then what is the measure of $\angle A$?

3.Diagonals of a parallelogram ABCD intersects at o . If $\angle BOC$=$90^0$and $\angle BDC$=40^0then whatis the measure of $\angle OAB$?

4.Name the various kinds of Parallelograms?

5.In a quadrilateral ABCD, CO and DO are the bisectors of $\angle C\ and\ \angle D$ respectively. Prove that $\angle COD = 1/3(\angle A + \angle B)$.

6. In a triangle P, Q and R are the mid points of the sides BC, CA and AB respectively. If AC=21cm, BC=29cm andAB=30cm, find the perimeter of the quadrilateral ARPQ.

CIRCLES

Chapter 9

https://epathshala.nic.in/topic-d.php?id=0962ch10

Introduction: The following curricular goals and competencies will be developed through this chapter.

Curricular Goals:

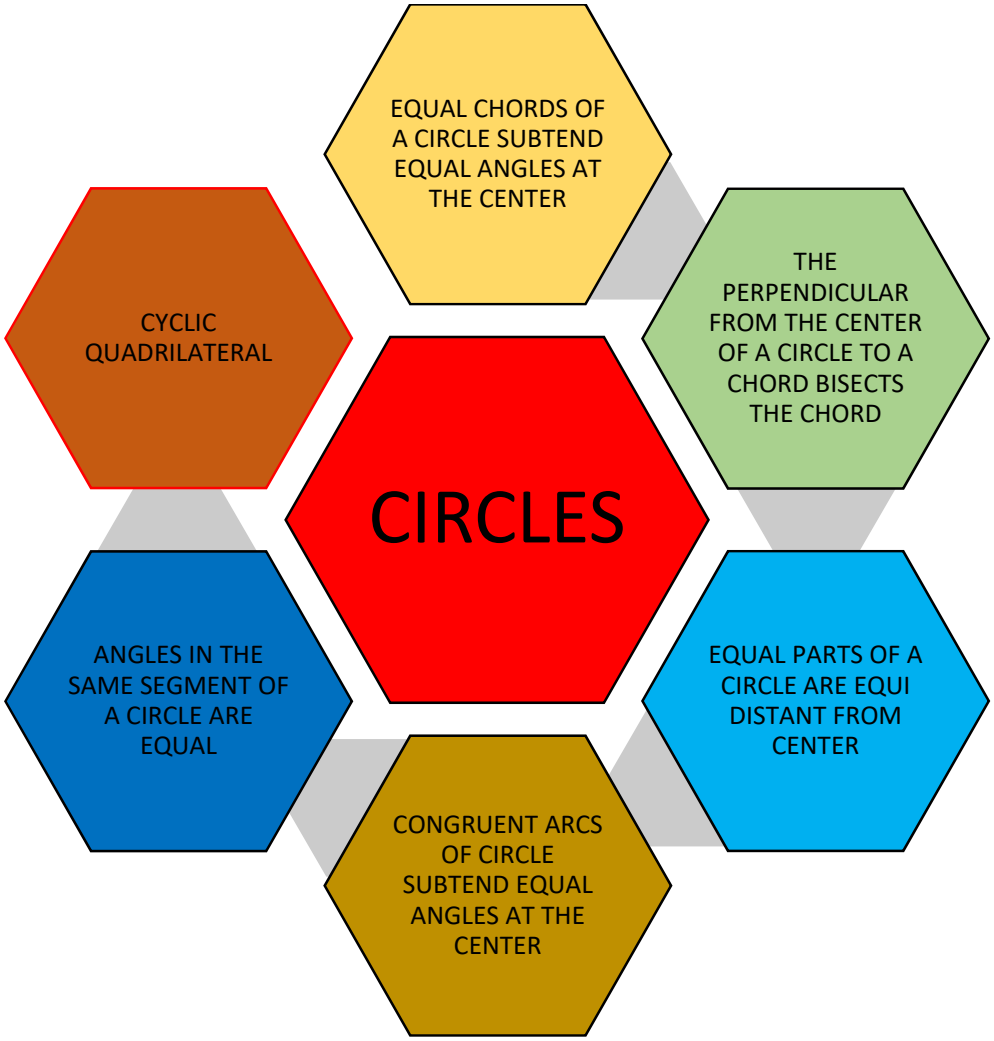
C.G. - 4 *Analyses characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships*

Curricular Competencies:

C-4.1 *Describes relationships including congruence of two-dimensional geometric shapes (such as lines, angles, triangles) to make and test conjectures and solve problems*

C-4.3 *Proves theorems about the geometry of a circle, including its chords, subtended angles, inscribed polygons, and area in terms of π*

MIND MAP


EQUAL CHORDS OF A CIRCLE SUBTEND EQUAL ANGLES AT THE CENTER
THE PERPENDICULAR FROM THE CENTER OF A CIRCLE TO A CHORD BISECTS THE CHORD
CYCLIC QUADRILATERAL
CIRCLES
ANGLES IN THE SAME SEGMENT OF A CIRCLE ARE EQUAL
EQUAL PARTS OF A CIRCLE ARE EQUI DISTANT FROM CENTER
CONGRUENT ARCS OF CIRCLE SUBTEND EQUAL ANGLES AT THE CENTER

PERIOD WISE LESSON PLAN

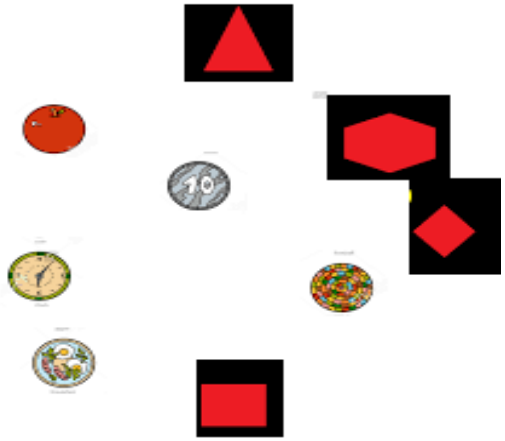
PERIOD (TEACHING CONCEPT)	LEARNING OUTCOMES
LP 1 **Recollecting the definitions of Circle, chord, diameter, radius and properties of chords and Theorem.1**	Defines circle, radius, diameter, arc (minor arc and major arc), chord, segment (minor segment and major segment), central angle and subtended angles. C120. Identifies interior, boundary and exterior of a circle. C121. Proves equal chords subtend equal angles at the Centre (and the converse).
LP 2 **1) The perpendicular from the Centre of a circle to a chord bisects the chord** **2) The line drawn from the Centre of a circle to bisect the chord is Perpendicular to the chord**	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 3 **Equal chords and their distances from the Centre**	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 4 **If two intersecting chords of a circle make equal angles with the diameters passing through their point of intersection then that the chords are equal**	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 5 **1. Angle subtending by an arc of a circle** **2. Angle subtended by an arc at the Centre is double the angle subtended by if at any point on the remaining part** **3. Angles in the same segment are equal**	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.
LP 6 **Cyclic Quadrilateral**	Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines, triangles, quadrilaterals, circles, etc., by applying axiomatic approach and solves problems using them.

Chapter Plan (Unit plan/ lesson plan)

Period plan (40 Minutes)

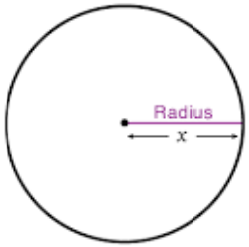
Class: **9**Chapter: **9. Circles** Total no. of periods for this chapter:**6**Period No:**1 / 6**

Subtopic:Recollecting the definitions of Circle, chord, diameter, radius and properties of chords and Theorem.1

Learning Outcomes & Indicators/ Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
Learning outcome: Students will demonstrate their knowledge of parts of circles and their relationships. Students will use appropriate tools to construct circles of given dimension. Students will find the circumference and area of the circles they construct. Students will analyze a work of art. Identifies and express the real-life situations into circles. Apply the concept of circles in daily life situations. Derive proofs of theorems in circles.	**Testing prerequisite knowledge 15min** **Identify the circular and non-circular objects in the following?**  **Define a circle?** Identify the circular shapes in our class room? What is the name of the figure?	Is circle 2D figure or 3D figure? Identify each part and name it	**Circular objects** GeoGebra graph circle shapes. Ex: bangles, tennikoit ring

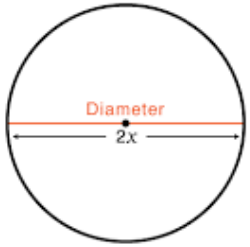
Describe about circle in your own words.

Radius



What is radius of circle?

Diameter



What is dimeter of the circle?

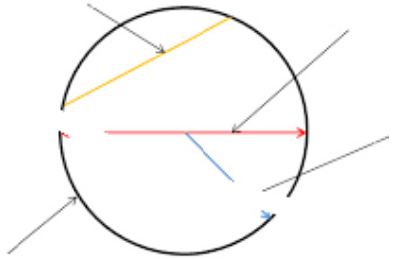
Is every chord being a diameter?

What is the largest chord in the circle?

What do you call the chord passes through center of the circle?

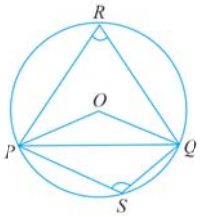
If radius of the circle is 5cm then what is its diameter?

In the following figure name the part which are representedby arrow marks?

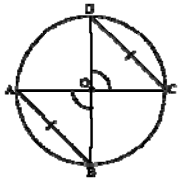


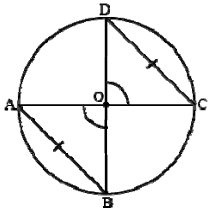
[All about Circles: Ch Diameter, a RadiusByju

In the figure what do you call the shaded region?



In the adjacent figure writhe names of angles subtended by an arc and also subtended by a chord.





Measure the lengths of chords AB and CD.

Name the angle the chord AB subtend angle at the Centre.

Name the angle the chord CD subtend angle at the Centre.

Are the lengths of chords equal?
Are the angles subtended by AB and CD at the Centre are equal?

Teacher Note: 15min

Theorem.1: **Equal chords of congruent circles subtend equal angles at their Centre.**

What is given in the theorem?

The length of chords is equal.

What are the angles subtended by the chords $\overline{AB}$, $\overline{CD}$?

What we have to prove?

How to prove the angles $\angle AOB = \angle COD$?

Are $\Delta AOB \cong \Delta COD$

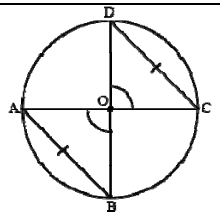
Prove that equal chords of congruent circles subtend equal angles at their Centre.

Formative Assessment:

1.Write 5 circular objects identified in your house?

Angle Subtend by an Arc of a Circle From t Tac learn engl

Maths - Equ chords subte equal angle a centre
Video from BODHA GU

	Why which congruency rule applied here? Then what do you say about $\angle AOB \text{ and } \angle COD$? What is your conclusion? What is the converse of the above theorem? **Theorem.9.2: If two chords are subtended equal angles at the Centre then they are equal** **10min** Proof left to the students. **(By playing videos Teacher will explain the above two theorems)**	 2.In the adjacent figure $\angle AOB = \angle COD = 60°$ And AB=5cm CD=? 3.Prove that "if the angles subtended by two chords of congruent circles at the corresponding Centers are equal, then the chords are equal". 4. AB is a chord of a circle having center O. if $\angle AOB = 60°$,then prove that the chord AB is of radius length. **Activity:** Take thick card board sheet and draw a circle of any radius and cut it. And identify different parts by marking thick lines.	33 Circles and t Chords | Lea with BYJU'S BYJU'S

Summative Assessment Plan

(Only… where relevant)

1.If A,B and C are three points on a circle such that AB=BC=CA and O is the Centre of the circle, then find the angle subtended by the chord AB,BC and CA at the Centre O.

Teachers' Reflections and Experiences:

(Teacher has to identify write down by own)

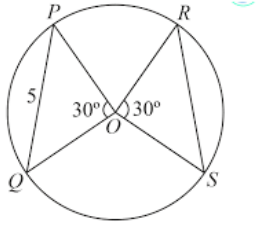
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for bet alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**

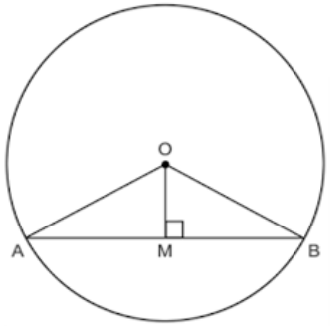
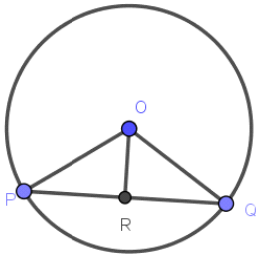
Chapter Plan (Unit plan/ lesson plan) *Period plan (40 Minutes)*

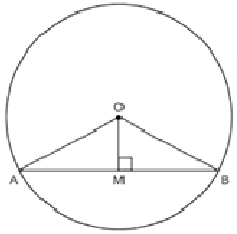
Class: 9 **Subject: Mathematics** **Chapter: 9. Circles**

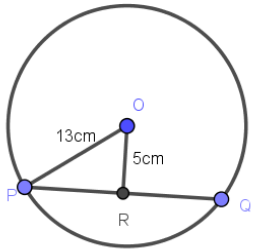
Total no. of periods for this chapter:6 **Period No:2/6**

Sub Topics: **1) The perpendicular from the Centre of a circle to a chord bisects the chord**
2) The line drawn from the Centre of a circle to bisect the chord is Perpendicular to the chord

Learning Outcomes & Indicators/ Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Material required**
Learning outcome: Students has …. to define and explain the concept of a circle; to identify the different parts of a circle; to explain the relation between the radius and diameter of a circle; to teach students how to solve simple problems involving radius and diameter. Students will demonstrate their knowledge of parts of circles and their relationships. Identifies/ classifies Identify and express the 1) real-life students in to circles 2) apply the concept of circles in daily life situations 3) Derive proofs of theorems in circles	**Testing of Prerequisite Knowledge: 10min** 1) Draw an angle PRQ subtended by chord PQ at a point R. 2) Can equal chords of a circle have subtended equal angles at the Centre? 3) Explain congruency of triangles in your own words? 4) say some congruent rules? 5) If the angles subtended by the chords of a circle at the Centre equal then what do you say about chords? 6) Draw a circle of any radius? 7) Draw a Chord? 8) Draw a perpendicular from Centre to chord?	 Find RS.	**Circle modles**

4) understand the relation between chord and Perpendicular from the Centre.	Measure length of AM and MB? What do you notice? Is AM=MB? Express the relation between and AB in your own words? OM  **<u>Teacher explains the theorems by making groups:</u>** **15min** **<u>Theorem 9.3</u>: The perpendicular drawn from the Centre of a circle to a chord bisects the chord.** What is given? What is to be prove? For proving the above theorem first, you have to draw	**Formative Assessment** 1.In the adjacent figure Find the length of OB, MB and AB  	 **<u>The perpendicula from the cen of a circle to chord bisects</u>** **<u>chord●</u>**  **<u>the line draw through cent of a circle to bisect a chor perpendicula</u>** **Visual aid** **Chalk and Blackboa**

	circle with any radius? Draw a chord for that circle? Draw a perpendicular from Centre to the chord. Now in triangles OAM and OMB Identify the equal corresponding parts? Which congruent rule is related to prove the above two triangles ΔOAM and ΔOBM are congruent? Compare the corresponding parts of congruent triangles? Can we say OM is perpendicular bisector of AB? Express the above the statement in your own words. Write the converse of the above theorem? (Proof left to the students) **Teacher explains model problems related to the above theorems 15min**		2. In the given figure $OR \perp PQ$, $\angle OPQ = 60°, then\ find\ \angle OQP, \angle OPR$ $\angle QOR$ 3. Write converse of the theorem? 4.Prove the converse of the theorem?	**GeoGebra**

	APPLICATION: Find the length of a chord which is at a distance of 5cm from the Centre of a circle of radius 13cm  What is the angle ORP? Is triangle ORP is right triangle? Use Pythagoras theorem and find PR and also find PQ.		

Summative Assessment Plan (Only… where relevant)

1.Two circles of radius 5 cm and 3cm intersect at two pints and the distance between these centers is by a fixed the length of the common chord.

2.Prove that the line joining the mid-points of two parallel chords of a circle passes through the center.

Teachers' Reflections and Experiences:

(Teacher has to identify write down by own)

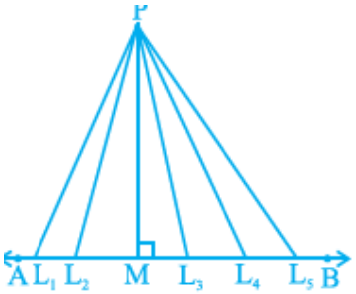
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**

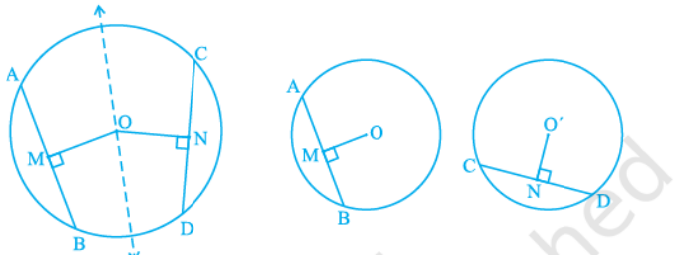
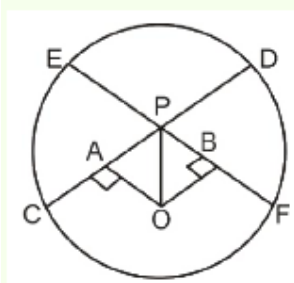
Chapter Plan (Unit plan/ lesson plan)*Period plan (40 Minutes)*

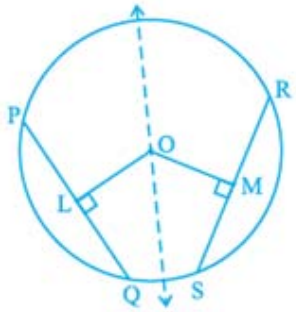
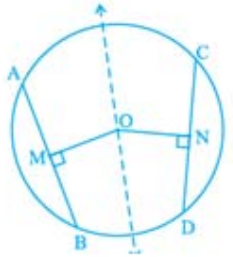
Class: **9** **Subject: Mathematics** Chapter: **9. Circles**

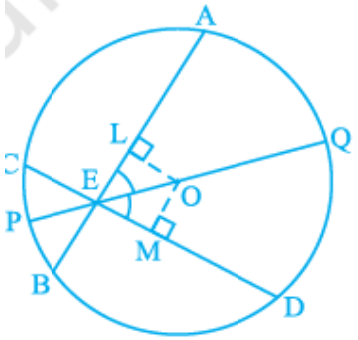
Total no. of periods for this chapter: **6**Period No:**3 / 6**

Sub Topic: Equal chords and their distances from the Centre

Learning Outcomes & Indicators/ Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Materi require**
Learning outcome: Students will demonstrate their knowledge of parts of circles and their relationships. Students will use appropriate tools to construct circles of given dimension. Students will find the circumference and area of the circles they construct. Students will analyze a work of art. Identifies and express the real-life situations into circles. Apply the concept of circles in daily life situations. Derive proofs of theorems in circles. Understand the relation between chords and its distance from the Centre	**Testing of Prerequisite knowledge: 10min** 1. Express in your own words the relationship between chord and Perpendicular line from the Centre. 2. If a line drawn through the Centre of a circle to bisect chord, then what is the angle between line and chord. 3.What is the smallest distance from a point to a line among all distances? 4.Draw some line segments from given point to line and measure all the lengths of line segments. what is the least measure. 5. How many chords can we draw in a circle? 6. What do you call the longest chord in the circle? **Teacher makes the students into groups and ask them to follow the step-by-step instructions 10min** **Activity:**	 Among all distance form P to line AB which is the shortest one. What is the distance between Centre to Diameter? In the given figure IF OA=OB then what do you say about Chords CD and EF.	**GeoGeb** For drawin figures and measuring lengths an angles

	Draw a circle of any radius on a tracing paper. Draw two equal chords AB and CD of it and also the perpendiculars OM and ON on them from the Centre O. Fold the figure so that D falls on B and C falls on A You may observe that O lies on the crease and N falls on M. Therefore, OM = ON. Repeat the activity by drawing congruent circles with centers O and O^1 and taking equal chords AB and CD one on each. Draw perpendiculars OM and O'N on them Cut one circular disc and put it on the other so that AB coincides with CD. Then you will find that O coincides with O^1 and M coincides with N. In this way you verified the following:  Do you think that there is some relationship between the length of chords and their distances from the Centre? **Teacher Explains the theorem related the above activity** **Whole class activity** **10 min** **Theorem.9.5: Equal chords of a circle (or of congruent circles) are equidistant from the Centre (or centers).**	 	https://youtu.be/76iIWSx9ys=vzucn449a36r9I

	 Draw relevant figure by using and read the above statement. 1. Draw a circle with Centre “O” 2. From the Centre “O” draw two-line segments OL and OM of equal length. 3. Draw chords PQ and RS of the circle perpendicular to OL and ON respectively 4.Measure the length of the PQ and RS 5.what do you notice? 6.wrte your conclusion? **Example (model problem)** If two intersecting chords of a circle make equal angles with the diameter passing through their point of intersection, prove that the chords are equal.	**Formative Assessment** 1. In the adjacent Figure OM = ON. If AB=5cm then find the length of CD  2.Two circles of radii 5 cm and 3 cm intersect at two points and the distance between their centers is 4 cm. Find the length of the common chord. 3.Prove that Chords equidistant from the Centre of a circle are equal in length.	



What is given in the problem?

Draw the relevant figure?

What is to be proved?

Draw perpendiculars OL and OM on chords AB and CD, respectively.

Is $\angle LOE = \angle MOE$? (give reasons)

In triangles OLE and OME,

∠LEO = ∠MEO (Why ?)

∠LOE = ∠MOE (Why?)

EO = EO (Why ?)

ΔOLE ≅ ΔOME (Why ?)

This gives OL = OM (How?)

Is AB = CD (Why ?)

Write your conclusion?

Summative Assessment Plan

(Only… where relevant)

I. A circular park of radius 20m is situated in a colony. Three boys Ankur, Syed and David are sitting at equal distance on its boundary each having a toy telephone in his hands to talk each other. Find the length of the string of each phone.

Teachers' Reflections and Experiences:

(Teacher has to identify write down by own)

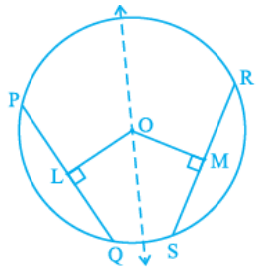
- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**

Chapter Plan (Unit plan/ lesson plan)*Period plan (40 Minutes)*

Class: **9** **Subject: Mathematics** Chapter: **9. Circles**

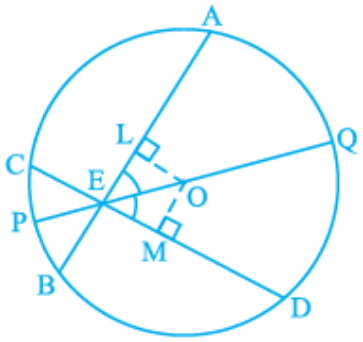
Total no. of periods for this chapter: **6**Period No:**4 / 6**

Sub Topic: If two intersecting chords of a circle make equal angles with the diameters passing through their point of intersection then that the chords are equal

Learning Outcomes & Indicators/ Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.	**Materi Requir**
Learning outcome: Students will demonstrate their knowledge of parts of circles and their relationships. Students will use appropriate tools to construct circles of given dimension. Students will find the circumference and area of the circles they construct. Students will analyze a work of art. Identifies and express the real-life situations into circles. Apply the concept of circles in daily life situations. Derive proofs of theorems in circles.	**Testing of Prerequisite Knowledge**  1.Equal chords of a circle subtend _____ angles at the Centre. 2.If angles Subtended by two chords of circle at the Centre are equal then what can you say about chords? 3. If a line drawn Perpendicular to the chord, then what is the ratio of chord will divide. 4 In the following figure OL=OM then what is the relationship between AB and CD.	Prove that Chords equidistant from the Centre of a circle are equal in length.	**GeoGeb**

Learning outcome:

1. Identify and express the real-
   life situations into circles.
2. Apply the concept of circles
   in daily life situation
3. Derive and proofs the
   theorem of circles
4. Understand the relation
   between Intersecting chords
   and angles.



Activity:

Measure $\angle AEQ \ and \ \angle QED$ write your observations. And also measure AB and CD also write your observations.

What is your conclusion.

Whole class activity
Teacher explains the theorem
Theorem:

If two intersecting chords of a circle make equal angles with the diameter passing through their point of intersection, prove that the chords are equal.

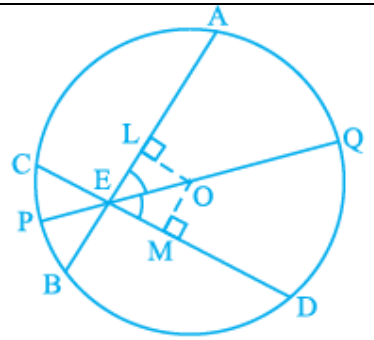
1. Draw Relevant figure?

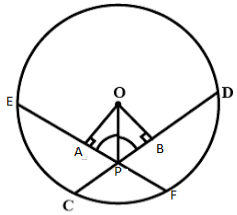
Activity:

Three girls Reshma, Salma and Mandip are playing a game by standing on a circle of radius
5m drawn in a park. Reshma throws a ball to Salma, Salma to Mandip, Mandip to Reshma. If
the distance between Reshma and Salma and between Salma and Mandip is 6m each, what is
the distance between Reshma and Mandip?

Maths - Eq chords of a circle are equidistant from the ce proof

Bodhagur

	 What is given the statement? What is to be proved? Is there any construction needed to prove so draw the construction? Are the angles $\angle LOE$ and $\angle MOE$ equal? $verify$? Now compare corresponding parts of triangles ΔOLE and ΔOME? ∠LEO = ∠MEO (Why?) ∠LOE = ∠MOE (Why?) EO = EO (Why?) ∴ $\Delta OLE \cong \Delta OME$(Why?) This gives OL = OM (How?) So, AB = CD (Why ?) **Application:** If two equal chords of a circle intersect within the circle, prove that the line joining the point of intersection to the Centre makes equal angles with the chords.	**Formative assessment:** 1. Two circles of radii 5 cm and 3 cm intersect at two points and the distance between their centers is 4 cm. Find the length of the common chord. **2.** If two equal chords of a circle intersect within the circle, prove that the segments of one chord are equal to corresponding segments of the other chord.	

	 In the above figure what about the lengths of chords? Is OA=OB? Give reasons? What is to be prove? Compare the triangles ΔAPO andΔ BPO OA=OB (Why?) OP=OP (Why?) ∠ OAP =∠OBP (Why?) By which congruent rule triangle APO and triangle BPO are congruent? ∠ APO =∠BPO (How?)		

Summative Assessment Plan

(Only… where relevant)

1. A circular park of radius 20m is situated in a colony. Three boys Ankur, Syed and David are sitting of equal distance on its boundary each having a toy telephone in his hands to talk each other. Find the length of the string of each phone?

Teachers' Reflections and Experiences:

(Teacher has to identify write down by own)

- **Did the lesson plan align with the curricular goals and competencies? if not how could be adjusted for better alignment?**
- **How well did the pedagogical strategies engage students and promote active participation in the learning process?**
- **How effective were the materials and resources used in this lesson?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Circles**

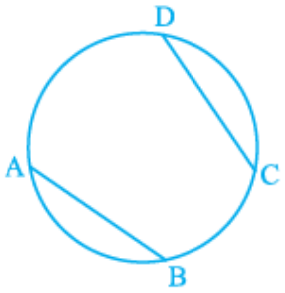
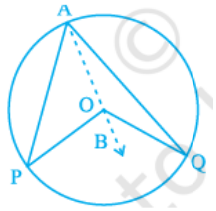
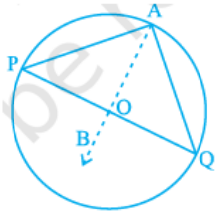
Total no. of periods for this chapter:6 **Period no :5/6**

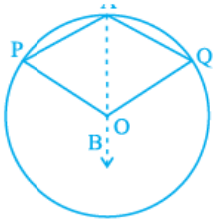
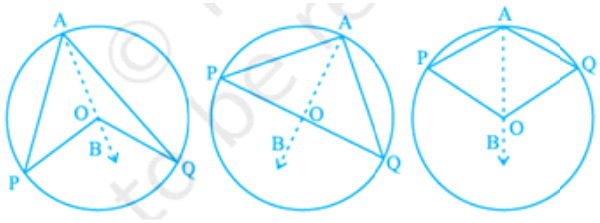
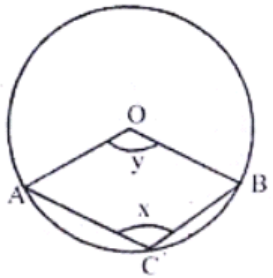
Subtopic: 1. Angle subtending by an arc of a circle

2. Angle subtended by an arc at the Centre is double the angle subtended by if at any point on the remaining part

3. Angles in the same segment are equal

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.	Materi requir
Learning outcome: Identifies/ classifies	Testing of Prerequisite knowledge 10 min 1. Define angle subtended by a chord at a point 2. If chords are equal then what about the angles subtended by the chords at the Centre. 3.If chords are equal in a circle, then what about the perpendiculars from the Centre to chords. 4.Define angle subtended by an arc of a circle 5. If two chords of a circle are equal then their corresponding arcs are congruent. verify by an activity. 6. Draw a circle with suitable radius.	Draw a circle with different radius and verify If two chords are equal then their corresponding arcs are congruent.	Angle Subtended an Arc of a Circle | Par 1/3 | Englis Class 9 TicTacLea English

	 7. Draw $\overline{AB}$ and $\overline{CD}$ two equal chords on the circle. 8.Now cut the AB arc and CD arc. 9.Now AB Arc put it on the CD arc. 10. What do you observe. 11.can, you get congruent arcs of a circle subtend equal angles at the Centre? **Activity: Teacher makes the students into groups and ask them to measure given angles and record it 10 min** Figure $\angle PAQ \angle POQ$  	Draw the figures of minor arc, semicircle and major arc.	

	 **Teacher asks the students based on the above activity** **Write a truth statement**. THEOREM: The angle subtended by an arc at the Centre is double the angle subtended by it at any point on the remaining part of the circle. What is given in the statement? Draw the relevant figure?  Wie the given data? . What is need to be Prove? [Teacher note: Consider the three different cases as given in Fig. In (i), arc PQ is minor; in (ii), arc PQ is a semicircle and in (iii), arc PQ is major. Let us begin by joining AO and extending it to a point B.] In all the cases Find $\angle BOQ$.	Formative Assessment: 1. If the angle subtended by an arc At Centre is 60° Then find angle subtended by remaining part of the circle? 2.C is point on the minor arc AB of the circle, with Centre O. Given $\angle ACB=x°$ and express y in terms of x. Calculate x, if ACBO is parallelogram.  3. Two circles of radius 10cm and 8cm intersect and the length of the common chord is 12cm.Find the distance between their centers.	**The angle subtended an arc at th centre is double the angle subtended at** **Video fro MathsInmy**

	∠BOQ = ∠OAQ + ∠AQO Give reasons? In triangle OAQ, OA is equal to which side? If so, $\angle OAQ$ =? Then find ∠BOQ. ∠BOQ=2 ∠OAQ……..(1) Similarly, ∠BOP=? ∠BOP = 2 ∠OAP……..(2) Find ∠∠BOQ+ ∠BOP. From the figure ∠BOQ+ ∠BOP=? Find ∠OAP + ∠ OAQ=? from the above write your conclusion.		

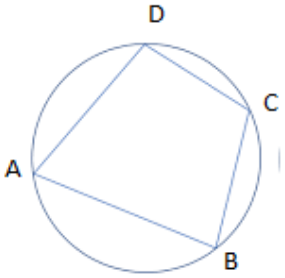
Summative assessment plan- only where relevant

1. John was struggling to understand the concept of circle. So, he asked Adam for help. Adam explained that a circle is round shaped figure that has no corners or edges and all

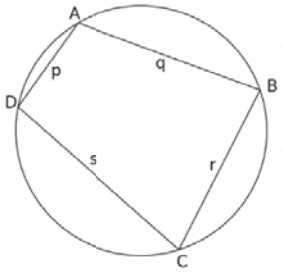
Teachers' Reflections and Experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

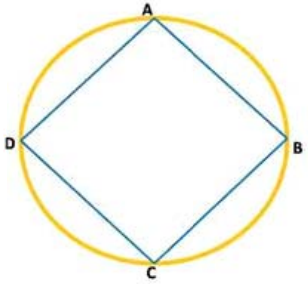
Class: 9th **Subject: Mathematics** **Chapter: Circles** **Total no. of periods for this chapter:6** **Period no :6/6** **Subtopic: Cyclic Quadrilateral**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
Learning outcome: **Students understand the concept of cyclic quadrilateral and its properties.**	**Introduction**: 10min Teacher will ask some of the following question to recall students period knowledge about Quadrilaterals: 1.What is boundary of notebook? 2.is the shape of the all types of doors are quadrilaterals? 3.what is the shape of the ceiling of a classroom? 4. if all verities of quadrilateral lie on a circle, then it has special properties. **Let has the following activity**. 10min Divide the students into group of 4-5. Instruction: Draw four different quadrilaterals and measure their angles on the in the book and discussed it with your group.	1.Is square a cyclic quadrilateral? Give reasons. 2.Can you say all parallelograms are cyclic? 3.If one angle of a cyclic quadrilateral is 40° then what is its opposite angle?	**Cyclic quadrilaterals models**



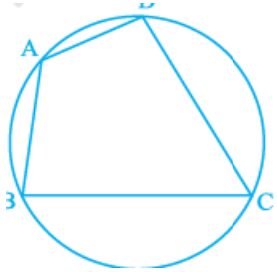
(i)



(ii)



(iii)



(iv)

S.No. of Quadrilateral	∠A	∠B	∠C	∠D	∠A +∠C	∠B +∠D
1						
2						
3						
4						

What do you infer from the table?

In each case ∠A + ∠C =? and ∠B + ∠D =?

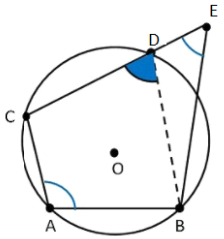
Can we say the sum of either pair of opposite angles of a cyclic quadrilateral is 180º.

Cyclic Quadrilats | Part 1/4 English | Class 9

TicTacLea English

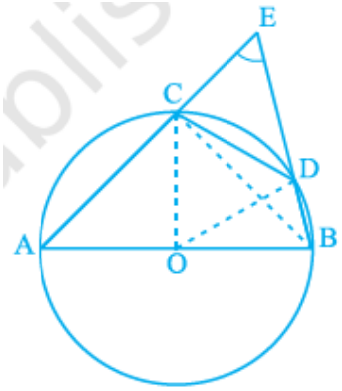
Cyclic Quadrilals

Cyclic Quadrilals

	What did you get from the activity? **Write the converse of the above conclusion.?** Teacher writes the statement and guide the students to prove **Statement:** . If the sum of a pair of opposite angles of a quadrilateral is 180º, the quadrilateral is cyclic.  What is given in the theorem? $\angle A + \angle C = 180°$ and $\angle B + \angle D = 180°$ What is to be prove? Suppose that D is not on the circle then there is a point E on the circle. Now ABED is which type of Quadrilateral? As per Known fact $\angle A + \angle C = ?$ and $\angle B + \angle E = ?$ But $\angle B + \angle D = ?$ Is it possible $\angle B + \angle E = \angle B + \angle D$ If it is equal what is the relationship between $\angle E$ and $\angle D$. E must coincide D.	Write your conclusion after completion of the activity? 1.Write two more statements in geometry and write their converse. .	Cyclic Quadrilate Mode probler tic ta

So, what is ABCD?

Problem: In Fig. given figure, AB is a diameter of the circle, CD is a chord equal to the radius of the circle. AC and BD when extended intersect at a point E. Prove that AEB = ∠60°.



Solution: Join OC, OD and BC.

Is Triangle ODC is equilateral? What is each angle?

$\angle CBD = \frac{1}{2} \angle COD$

Give reasons?

∠CBD =?

ACB = 90° (Why?)

Find $angle\ BCE$.

What is the value of ∠CEB

∠AEB =?

1.Identify the angle in semicircle and write its value.

2 How triangle OCD is an equilateral triangle.

What is the relation angle subtended by an arc at the Centre and anglesubtended by it at any point on the remaining part of the circle?

1.A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc.

2. If diagonals of a cyclic quadrilateral are diameters of the circle through the vertices of the quadrilateral, prove that it is a rectangle.

Summative assessment plan- only where relevant

1.If the diagonals of a cyclic quadrilateral are diameters of a circle through the vertices of quadrilateral, then prov that it is a rectangle.

2.If the non-parallel sides of a trapezium are equal prove that it is cyclic.

Teachers' Reflections and Experiences:

(Teacher has to identify write down by own)

For more practice/extended learning

WORK SHEET

Level 1

1. AD is a diameter of a circle and AB is a chord. If AD = 34 cm, AB = 30 cm, the distance of AB from the centre of the circle is :

(A) 17 cm (B) 15 cm (C) 4 cm (D) 8 cm

2) If AB = 12 cm, BC = 16 cm and AB is perpendicular to BC, then the radius of the circle passing through the points A, B and C is :

(A) 6 cm (B) 8 cm (C) 10 cm (D) 12 cm

Write True or False and justify your answer in each of the following:

1. Two chords AB and CD of a circle are each at distances 4 cm from the centre. Then AB = CD.

2. Two chords AB and AC of a circle with centre O are on the opposite sides of OA. Then $\angle OAB = \angle OAC$.

Level 2

1. If arcs AXB and CYD of a circle are congruent, find the ratio of AB and CD.

2. If the perpendicular bisector of a chord AB of a circle PXAQBY intersects the circle at P and Q, prove that arc PXA $\cong$ Arc PYB.

3. A, B and C are three points on a circle. Prove that the perpendicular bisectors of AB, BC and CA are concurrent.

Level 3

1. If two equal chords of a circle intersect, prove that the parts of one chord are separately equal to the parts of the other chord.

2. If non-parallel sides of a trapezium are equal, prove that it is cyclic.

Activity

Activity

10. Heron's Formula

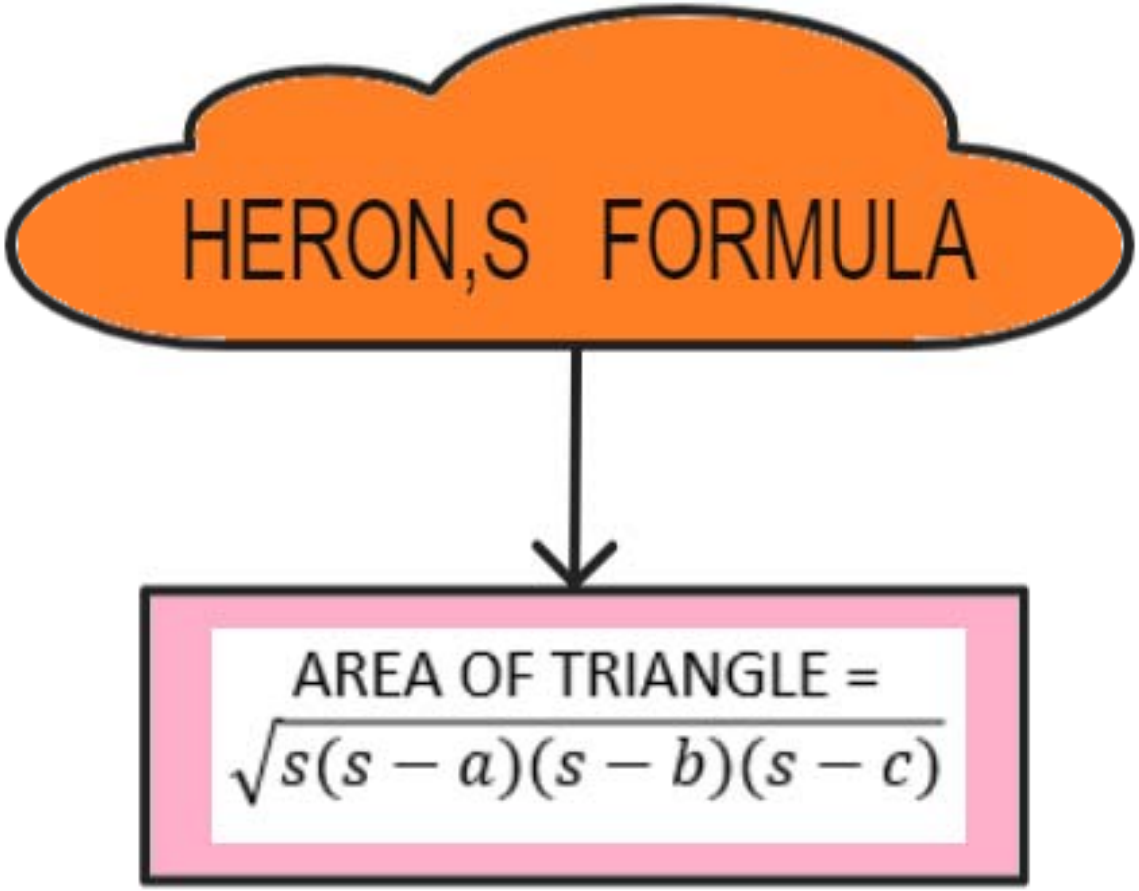
[Scan the QR Code]

[Go To https://epathshala.nic.in/ or https://epathshala.nic.in/topic-d.php?id=0962CH12]

THE FOLLOWING CURRICULAR GOALS (CG) AND COMPETENCIES (C) WILL BE DEVELOPED THROUGH THIS CHAPTER

CURRICULAR GOALS(CG)	COMPETENCIES (C)
CG-5 Derives and uses formulae to calculate areas of plane figures, and surface areas and volumes of solid objects.	**C-5.1 Visualizes, represents, and calculates the area of a triangle u Heron's formula and its generalization to cyclic quadrilaterals give Brahmagupta's formula.**
CG-10 Knows and appreciates important contributions of mathematicians from India and around the world.	**C-10.1 Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (su as the evolution of numbers, geometry, algebra).**

MIND MAP



PERIOD WISE PLAN

PERIOD (teaching topic)	LEARNING OUTCOMES
LP1: Find area of triangle especially scalene triangle by using Heron's Formula	**Identifies whether half base times height can be used to find area of triangle**
LP2: Heron's formula and its applications	**1.Applies Herons formula to find area of triangles** **2.Solve real life problems related to area of composite figures**
LP 3; Heron's formula and its applications	**1.Applies Herons formula to find area of triangles** **2.Solve real life problems related to area of composite figures**
LP4 Herons formula and its applications	**1.Applies Herons formula to find area of triangles** **2.Solve real life problems related to area of composite figures**
LP5 Herons formula and its applications	**1.Applies Herons formula to find area of triangles** **2.Solve real life problems related to area of composite figures**

Chapter Plan (Unit Plan / Lesson Plan)**Time: 40 minutes**

Class: 9thSubject: MathematicsChapter: Heron's Formula

Total no. of periods for this chapter:05 Period no:01/05

Subtopic: Area of triangle

Curricular Goals:

CG-5 Derives and uses formulae to calculate areas of plane figures, and surface areas and volumes of solid objects.

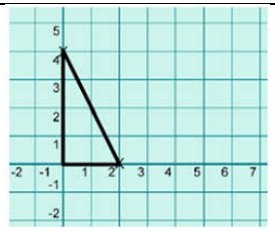
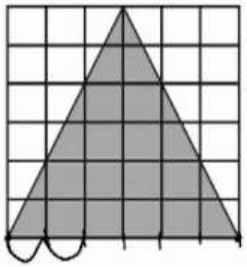
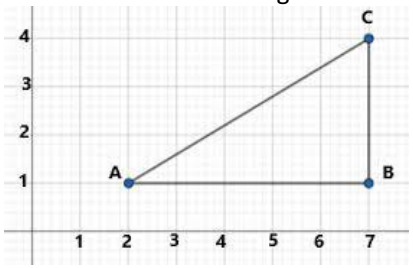
CG-10 Knows and appreciates important contributions of mathematicians from India and around the world.

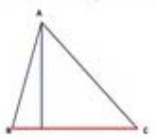
Curricular competencies:

C-5.1 Visualizes, represents, and calculates the area of a triangle using Heron's formula and its generalisation to cyclic quadrilaterals given by Brahmagupta's formula.

C-10.1 Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, algebra).

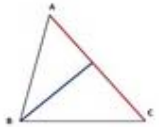
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
Competencies: C-5.1 Visualises, represents, and calculates the area of a triangle using Heron's formula and its generalization to cyclic quadrilaterals given by Brahmagupta's formula. C-10.1 Recognises the	**Teacher engages the students in recall of previous knowledge through series of computational questions/activity: (15 min)** Draw some triangles on graph sheet?		**GeoGebra** **1.Types of triangles models** **2.Graph sheets**

important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, algebra). **Learning Outcomes:** **Identifies whether half base times height can be used to find area of triangle**	 How many unit squares are there in triangle? What is the area of shaded region?  What do we call the region bounded by triangle? What is the area of triangle?  **Activity: (15 min)** **Measure base and corresponding height and write.**	Do this activity: In each figure identify base corresponding height and fin its area?	



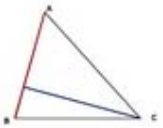
Base=

Corresponding Height=



Base=

Corresponding Height=

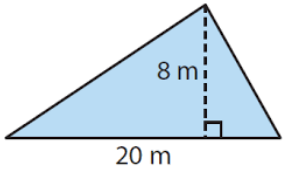


Base=

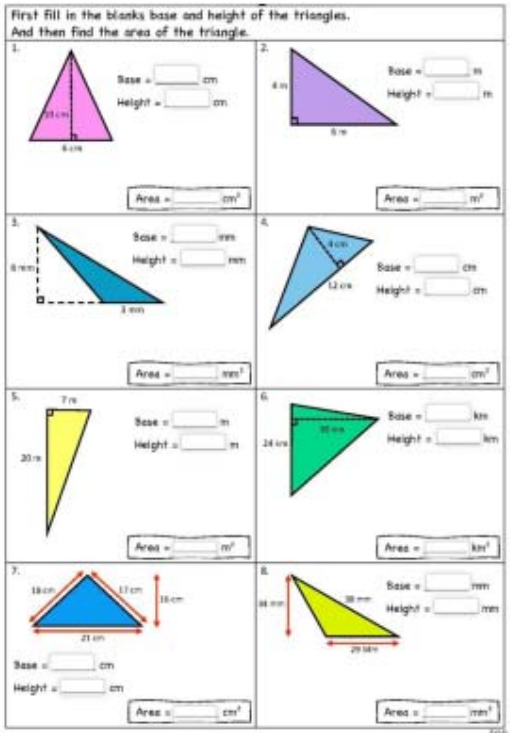
Corresponding Height=

What is the area of triangle when the base and corresponding heights are given?

What is the area of the given triangle?

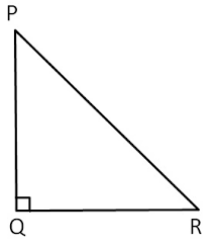


Identify the triangles based on types?



Find the corresponding height in each case?

What type of triangle is this?



write Pythagoras theorem?

In ΔPQR, $PR^2 = ?$

Activity 2: 15 min

1.Find the area of triangle having base 8cm and altitude 12cm.

Fill the following table?

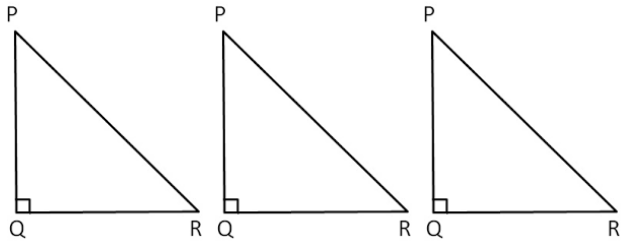


Figure 1. Figure 2. Figure 3.

PR=13cmPR=------ PR=25cm

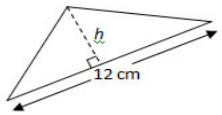
QR=5cmQR=15cm QR=----------

PQ=------ PQ= 8cm PQ=15cm

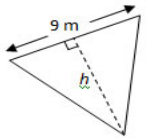
Two Cases: (10 min)

What is the area of equilateral triangle?

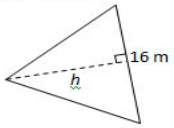
a) Area = 42 cm²

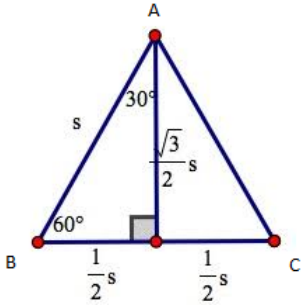


b) Area = 36 m²



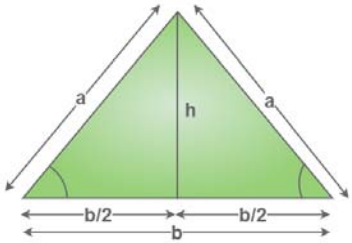
c) Area = 112 m²





$$Area\ of\ eqilateral\ triangle = \frac{1}{2} \times s \times \frac{\sqrt{3}}{2}s = \frac{\sqrt{3}}{4}s^2$$

What is the area of isosceles triangle?



Find height of the triangle.

$$h = \sqrt{a^2 - \frac{b^2}{4}}$$

Area of triangle=$\frac{1}{2} \times b\sqrt{a^2 - \frac{b^2}{4}} = \frac{1}{4} \times b\sqrt{4a^2 - b^2}$

$$h = \sqrt{s^2 - \frac{1}{4}s^2} = \sqrt{\frac{3}{4}s^2}$$

$\sqrt{3}$

1.find the area of equilateral triangle whose side is 20m.

The ratio of equal sides to the base of an isosceles triangle is 3:1. If the perimeter of the triangle is

		28cm,then find its area.	

Summative assessment plan- only where relevant

1.The base and hypotenuse of a right-angled triangle are respectively 5 cm and 13 cm. Find its area.
2.Find the area of an isosceles triangle having base 2cm and length of one of the equal sides is 4 cm.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

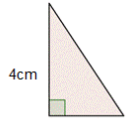
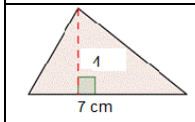
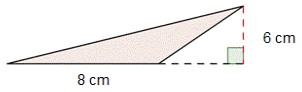
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

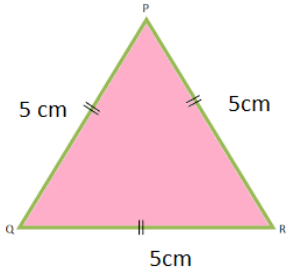
Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Heron's Formula**
Total no. of periods for this chapter:05 **Period no:2/5**
Subtopic: Find the area of scalene triangle using Heron's formula

Learning Outcomes & Indicators/micro-competencies	Teaching-Learning Process This should include activities to facilitate learning along with broad time duration	Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.	Material required
C-5.1 Visualizes, represents, and calculates the area of a triangle using Heron's formula and its generalization to cyclic quadrilaterals given by Brahmagupta's formula. C-10.1 Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, algebra). **Learning outcome:** **1.Applies Herons formula to find area of triangles** **2.Solve real life problems related to area of composite figures**	**Teacher engages the students in the following computational activity and questionnaire: (15 min)** Complete the table Figure / Area of triangle   		

What is formula for finding area of triangle?

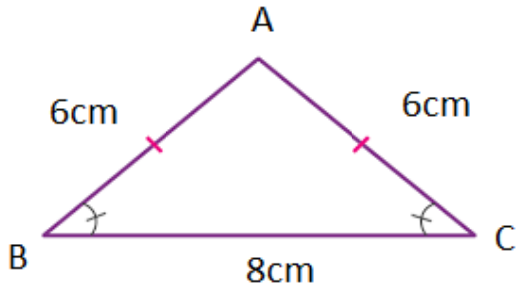
What is the area of adjacent figure?



Which type of triangle is given?

What is the length of each side?

What is the formula to find area of equilateral triangle?



What is the area of triangle ABC?

Which type of triangle is given?

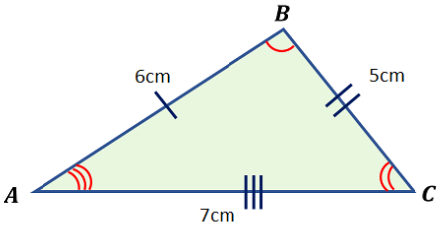
What is the length of each side?

1.An isosceles right triangle has area 8 cm^2. Find the length of its hypotenuse?

2.The perimeter of an equilateral triangle is 60 m. Find its area?

What is the formula to find area of equilateral triangle?

Observe the given triangle and name which type is it?

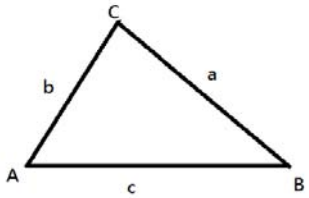


Can we find the area of above triangle by using above known methods?

Whole class activity: (10 min)

Techer will explain history of heron's by using video and any other material

Herons Formula for finding area of triangle



What is the perimeter of the triangle ABC?

[Teacher notes: whole class activity

Perimeter of the triangle represented by 2s.

$$2s = a + b + c$$

Heron's Formula Introduc y Video: CBSE Cl 9 Math

History heron'

https://e ikipedia. /wiki/He of_Alex ria

History heron

$$s = \frac{a+b+c}{2}$$

Heron's formula for area of triangle

$$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

Applications: (15 min)

Teacher makes the students int groups and ask them to solve

1.The sides of a triangular field are 41 m, 40 m and 9 m find its area.

What are the Lenths of sides given?

$a = ?$ $b = ?$ $c = ?$

What is the perimeter of the triangle?

Find Half of the perimeter?

Find the area of triangle?

Area of the triangle

Problem:

Teacher makes the students in to pairs and give suggestions while solving the problem

2.The perimeter of a triangular field is 420 m and its sides are in the ratio 6: 7: 8. Find the area of the triangular field.

What is the perimeter of the triangle?

What is the ratio of sides given?

Assessment:

1. Find the area of triangle whose sides are 3cm,4cm and 5cm. by using heron's formula?
2. Find the area of triangle two sides of which are 12m ,17m and the perimeter is 54m.
3. The sides of a triangular plot are in the ratio of 3: 5: 7 and its perimeter is 300 m. Find its area.
4. In a scalene triangle one side exceeds the other two sides by 4cm and 5cm respectively and the perimeter of the triangle is 36cm.find the area of triangle.

Express half of the perimeter 'S' in terms of sides a,

Heron's formula visual pr

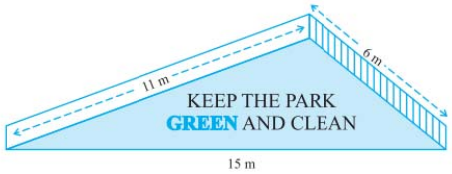
https://wv youtube.c watch?v=7 oOS7Bz6

Heron's formula

	Write lengths of sides in terms of x? Use perimeter as 420m find the value of x. Write Lenths of sides by substituting value of x? Now find 'S' and also find area of triangle.	b, c. [$\boldsymbol{a = 420 \times \frac{6}{21} = 120m}$ $\boldsymbol{b = 420 \times \frac{7}{21} = 140m}$ $\boldsymbol{c = 420 \times \frac{8}{21} = 160m}$]	https://w .youtube m/watch SbEXkh bh4

Summative assessment plan- only where relevant

1. There is a slide in a park. One of its side walls has been painted in some colour with a message "KEEP THE PARK GREEN AND CLEAN" If the sides of the wall are 15 m, 11 m and 6 m, find the area painted in colour.



2. The perimeter of a triangular field is 450m and its sides are in the ratio 13:12:5. Find the area of triangle.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

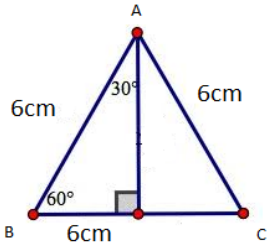
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

4.How effective were the Materials and resources used in the lesson?

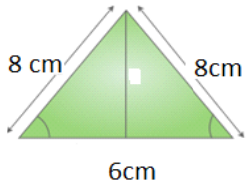
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Polynomials** **Total no. of periods for this chapter:5** **Period no :3/5** **Subtopic: Deduct the formulas of area of equilateral and isosceles triangle from heron's formula**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
Competencies: C-5.1 Visualises, represents, and calculates the area of a triangle using Heron's formula and its generalization to cyclic quadrilaterals given by Brahmagupta's formula. C-10.1 Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, algebra).	**Teacher engages the students through the questioning and computational activity (10 min)** 1.  What is the area of above triangle? 2.	1.Find the area of triangle whose sides are13cm,14cm and 15cm.2qa Write the following statements true or false. Justify your answer. 1.Area of triangle ABC is 8 cm^2in which AB=AC=4cm and $\angle A = 90°$ 2. The area of equilateral triangle is $16\sqrt{3}\ cm^2$who's each side is 8cm. 3. The base of an isosceles triangle is 24cm and its area is 192 cm^2. Its perimeter is 64cm.	NCERT Exemplar,

Learning outcome:

1.Applies Herons formula to find area of triangles
2.Solve real life problems related to area of composite figures



Area of triangle=$\frac{1}{2} \times b\sqrt{a^2 - \frac{b^2}{4}} = \frac{1}{4} \times b\sqrt{4a^2 - b^2}$

What is b=? what is a=?

Find area of triangle?
Write heron's formula for finding area of triangle?

3.Can we derive the area of equilateral triangle from heron's formula?

4.Can we derive the area of isosceles triangle from heron's formula?

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Whole Class Activity: (25 min)

1.

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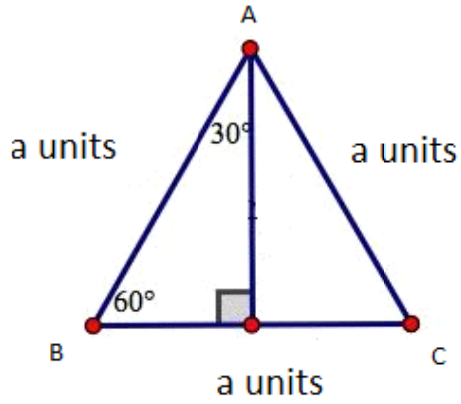


Find perimeter of triangle ABC?

2s=3a

Find s?

$$s = \frac{3a}{2}$$

Write heron's formula?

$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

Find area using formula.

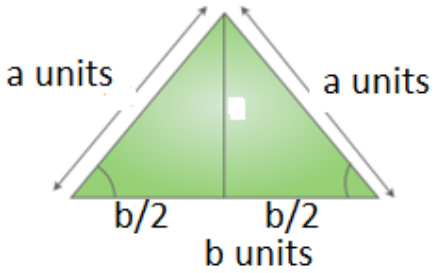
Teacher makes the students into groups instructed to find area of equilateral triangle and present Infront of the class.

{Teacher Note: after submitting the solution by students teacher will explain procedure.}

$$\left[\Delta = \sqrt{\frac{3a}{2}\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)}\right]$$

Heron' formul applicatic

Video fr TIC- Taclearne sh

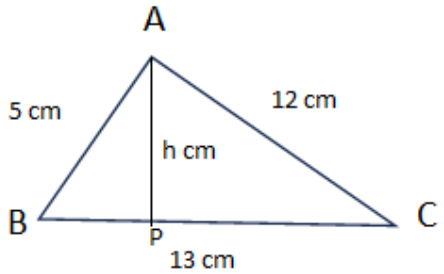
	$\Delta = \sqrt{\frac{3a}{2} \times \frac{a}{2} \times \frac{a}{2} \times \frac{a}{2}}$ $\frac{3a}{2} - a = \frac{3a-2a}{2} = \frac{a}{2}$ $\Delta = \frac{\sqrt{3}}{4} a^2$ **2.Now consider isosceles triangle the Length of equal sides are a units and its base is b units.**  What type of triangle is? Find S? Write heron's formula? $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ Replace s by $S = \frac{2a+b}{2}$ in the above formula. Teacher explains the simplification $\left(\Delta = \sqrt{\frac{2a+b}{2}(\frac{2a+b}{2} - a)(\frac{2a+b}{2} - a)(\frac{2a+b}{2} - b)}\right)$	Write the formula for area of isosceles triangle ? <u>Formative Assessment:</u> 1. How many times area is changed when sides of a triangle are tripled? 2. The edges of triangular board are 6cm,8cmand 10cm.What is the cost painting it at the rate of a 9 paise per cm^2 3. If the sides of a triangle are 35 cm,54cm, and 61cm, respectively. Then, find the length of its longest altitude.	

$$\left(\Delta=\sqrt{\frac{2a+b}{2}(\frac{b}{2})(\frac{b}{2})(\frac{2a-b}{2})}\right)$$

$$\Delta=\frac{\boldsymbol{b}}{\boldsymbol{4}}\sqrt{4a^2-b^2}$$

Model problem: whole class activity: (5 min)

1.The lengths of the sides of a triangle are 5cm,12cm, and 13cm.Find the length of Perpendicular from the opposite vertex to the side whose length is 13cm.



Write $a=?$ $b=?$ $c=?$

Find S.

Find the area of triangle ΔABC.

Using figure write base and its corresponding height?

Find the area of triangle.

Are the both areas represented same area?

Equating both the areas and find the value of corresponding height?

Summative assessment plan- only where relevant

1. The sides of a triangular park are 8m,10m, and 6m, respectively. A small circular area of diameter 2 m is to be left out and the remaining area is to be used for growing roses. How much area is used for growing roses? (Take $\pi = 3.14$)

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?

2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?

3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?

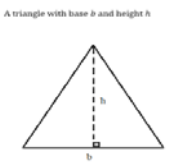
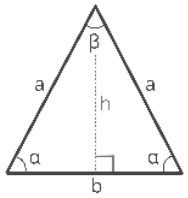
4.How effective were the Materials and resources used in the lesson?

5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: Heron's formula**
Total no. of periods for this chapter:5 **Period no :4/05**
Subtopic: Figure based questions

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
Competencies: **C-5.1 Visualises, represents, and calculates the area of a triangle using Heron's formula and its generalisation to cyclic quadrilaterals given by Brahmagupta's formula.** **C-10.1 Recognises the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of**	**Teacher makes the students engage in computational activity (15 min):** Complete the table.		**MODEL OBJECTS**

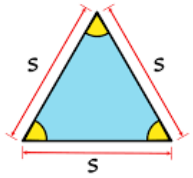
Figure	Formula for finding area
	
	

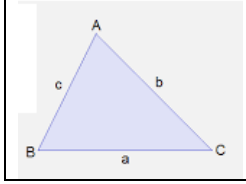
numbers, geometry, algebra).

Learning outcome:

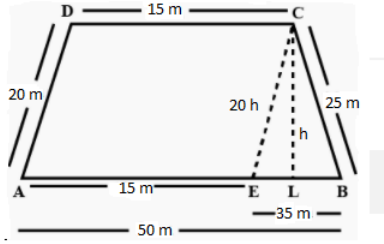
Applies Herons formula to find area of triangles

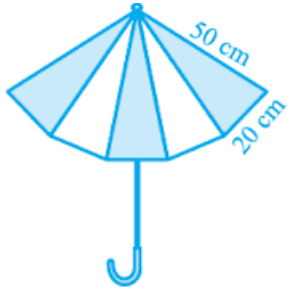
Solve real life problems related to area of composite figures

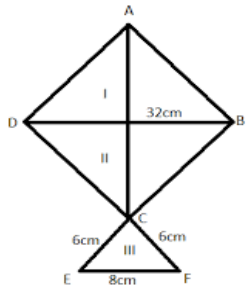




How to find the area of each object?





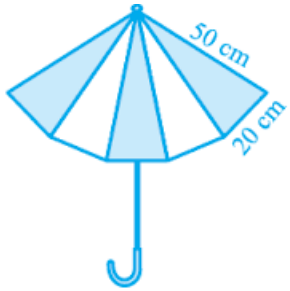


Whole class activity: (25 min)

Ask the students read the word problems.
Ask them to write new words. deposing the problem and ask them to draw appropriate figure and also discuss with the students for choosing appropriate formula.

Heron's formula -real life problems

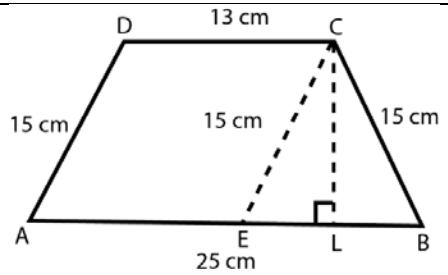
1. An umbrella is made by stitching 10 triangular pieces of cloth of two different colors (see the given figure), each piece measuring 20cm, 50cm and 50cm.How much cloth of each color is required for the umbrella?



Let's start with one triangle.
Write the sides of triangle?
$a = 50cm, b = 50cm, c = 20cm$

An umbrella is made by stitching 10 triangular pieces of cloth of two different colors (see the given figure), each piece measuring 20cm, 50cm and 50cm.How much cloth of each color is required for the umbrella? (Without using Heron's formula)

	Find $S = \frac{a+b+c}{2}$ Find area of one triangular piece of cloth By using Heron's formula. $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ How many pieces are there in each colour? What is the area of each colour required? 2.The triangular side walls of a flyover have been used for advertisements. The sides of the walls are 13 m, 14 m and 15 m. The advertisements yield an earning of Rs. 2000 per m^2 a year. A company hired one of its walls for 6 months. How much rent did it pay? Teacher makes the students into groups and ask them to solve the problem and present Infront of the class. Ask the students to find area f triangle using Heron's formula By given sides. Find advertisement yield earning for 84m^2 for a year. Find the yield of earning for 6 months. 2. Find the area of a trapezium whose parallel sides are 25 cm;13 cm and other sides are 15 cm each.	How much amount the company will pay?	



[Teacher Note: Teacher should support the students to draw$CE \parallel AD$]

What is the formula to find area of trapezium?

Write the lengths of parallel sides?

What is the distance between parallel sides.

Apply the formula to the above figure(trapezium).

How to find the length of CL?

CE=AD=15cm
BE=AB-AE=25-13=12cm
BC=15cm

Find semi perimeter of ΔBCE.

Find area of Find area of one triangle by using Heron's formula.
$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$
Write the area?
$\Delta = 18\sqrt{21}cm^2$ …… (1)

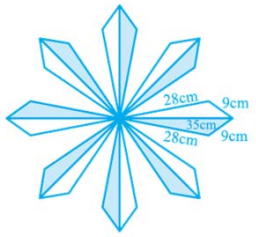
Now find the area of ΔBCE ,as base BE and height CL.
$\Delta BCE = \frac{1}{2} \times Base \times height$

Formative assessment:

1.The perimeter of an isosceles triangle is 42cm and its base is 3/2 times of each of equal sides. Find the length of each side of the triangle and area of the triangle. $Given$ ($\sqrt{7}$=2.646)

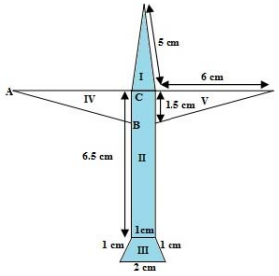
2.A Rhombus field has green grass for 18 cows to graze. If each side of the rhombus is 30m and its longer diagonal is 48m, how much area of grass field each cow be grazing?

3. A floral design on a floor is made up of 16 tiles which are triangular, the sides of the triangle being 9 cm, 28 cm, and 35 cm.Find the cost of polishing the tiles at the rate of 50p per cm^2.



	$\Delta BCE = \frac{1}{2} \times 12 \times CL = 6 \times CL$.....(ii) Equate (i) and (ii) and find the value of CL. CL=$3\sqrt{21}$ cm By the figure the height of trapezium same as to height of triangle ΔBCE. Using AB=25cm CD=13cm and CL=$3\sqrt{21}$ cm. Find area of given trapezium		

Summative assessment plan- only where relevant



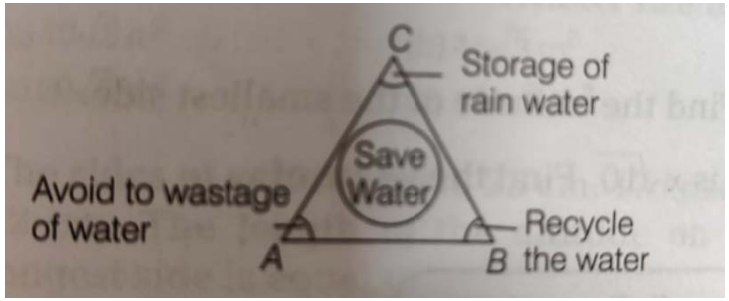
Radha made a picture of an aero plane with colored paper as shown in the figure. Find total area of the paper used.

Teachers' reflections and experiences:

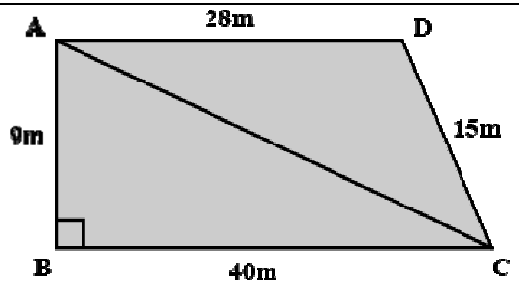
1. **Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?**
2. **How well did the pedagogical Strategies engage students and promote active participation in the learning process?**
3. **How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?**
4. **How effective were the Materials and resources used in the lesson?**
5. **Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback students?**

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th	**Subject: Mathematics**	**Chapter: Polynomials**
Total no. of periods for this chapter:5	**Period no :5/5**	
Subtopic: case-based questions		

Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Materi requir**
Competencies: **C-5.1 Visualizes, represents, and calculates the area of a triangle using Heron's formula and its generalization to cyclic quadrilaterals given by Brahmagupta's formula.** **C-10.1 Recognizes the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, algebra).**	**CASE STUDY PROBLEMS (40 min)** 1.A child prepares a poster on 'save water' on a triangular sheet whose each side measure 50cm. At each corner of the sheet, he draws an arc of radius 10cm in which he shows how, to save the water. At the Centre of the triangle, draw a circle of radius 6cm, where he writes the slogan "save water"  i) Find the area of the triangle sheet. ii) Find the area of poster in which the slogan 'Save water' is written.		**Geome box**

Learning outcome: **Applies Herons formula to find area of triangles** **Solve real life problems related to area of composite figures**	iii) Find the total area of the corner, where he writes, how to save the water. iv) Find the area of remaining sheet. In the above case study what child does think? What type of triangular sheet he took? What is the side of each side? What is area of equilateral triangle? Write the area of triangular sheet? Where slogan is written? What is the area of circular region? Write the area of circle? Find the area of circle? Find total area of corner of a triangle? Find the area of remining portion? What are regions subtracted from the area triangle? Find the area of remaining portion? 2.Students of a school staged a rally for a cleanliness campaign. They walked through the lanes in two groups. One group walked through the lanes AB, BC, and CA; where the Other through AC, CD, and DA. Then they cleaned the area enclosed within their lanes. If AB=9m, BC=40m, CD=15m, DA=28m and $\angle B = 90^\circ$, which group cleaned more area and by how much? Find the total area cleaned by the students.	<u>Formative assessment</u> In the marriage of Ram's brother Rajesh, a conical tent is made by stitching 12 triangular pieces of cloth of two different colours red and white alternatively, each piece measuring 10cm,20cm, and 20cm. 1. Write the formula find the area of triangle? 2. Find the semi-Perimeter red color triangle. 3. Find the area of one red colour triangle. 4. How much cloth of red colour is required to make a conical tent? 5. Find the total length of triangular pieces of	

	 What is the angle at B from the figure? What type of triangle ABC is? Write the lengths of AB and BC? Find the length of AC? Find the area of right triangle ABC. Now find the area of ΔACD using Heron's formula. Find perimeter of ΔACD. How much area cleaned by 1st group? How much area cleaned by 2nd group? Which group cleaned more area and by how much? What is the total area cleaned by all the students?	white colour?\	

Summative assessment plan- only where relevant

In my colony a park is situated in front of my house. This park is built is the shape of triangle with the following sides 150m,100m and 60m.Now-a-days, some animals enter the park and destroy the plants by eating them. So, our ward member of the area has decided to put a railing around the park for protecting plants and grass. Ward member ordered the gardener to place a railing all round this park and maintain grass inside the park. He also sanctior an amount to improve the park in a proper way for the public in a proper way for the public of that colony. Costing is decided at Rs.10 per meter for the railing around the park.

i)	Calculate the Semi-perimeter of triangle park, in which planting is needed.
ii)	Calculate the area, in which planting is needed.
iii)	Find the cost of railing with hurtful iron wires at the rate of Rs.10 per meter leaving a space 2m wide for a gate on one side of triangle park.
iv)	What is the perimeter of the park?
v)	Name the formula which is used for getting the area of triangle when sides known.

Teachers' reflections and experiences:

NCERT exemplar

For more practice/extended learning

Worksheet

Level 1

1. An isosceles right triangle has area 8 cm2 . The length of its hypotenuse is
   (A) 32 cm
   (B) 16 cm
   (C) 48 cm
   (D) 24 cm

2. The sides of a triangle are 56 cm, 60 cm and 52 cm long. Then the area of the triangle is
   (A) 1322 cm2
   (B) 1311 cm2
   (C) 1344 cm2
   (D) 1392 cm2
3. The sides of a triangle are 35 cm, 54 cm and 61 cm, respectively. The length of its longest altitude?

Level 2

Write True or False and justify your answer:

1. The area of a triangle with base 4 cm and height 6 cm is 24 cm2
2. The base and the corresponding altitude of a parallelogram are 10 cm and 3.5 cm, respectively. The area of the parallelogram is 30 cm2
3. The area of a regular hexagon of side 'a' is the sum of the areas of the five equilateral triangles with side a

Level 3:

Long Answer Questions:

1. Find the cost of laying grass in a triangular field of sides 50 m, 65 m and 65 m at the rate of Rs 7 per m^2
2. From a point in the interior of an equilateral triangle, perpendiculars are drawn on the three sides. The lengths of the perpendiculars are 14 cm, 10 cm and 6 cm. Find the area of the triangle.
3. The perimeter of an isosceles triangle is 32 cm. The ratio of the equal side to its base is 3 : 2. Find the area of the triangle.
4. 9 A rhombus shaped sheet with perimeter 40 cm and one diagonal 12 cm, is painted on both sides at the rate of Rs 5 per m^2. Find the cost of painting.
5. If each side of a triangle is doubled, then find the ratio of area of the new triangle thus formed and the given triangle.

CLASS: 9

Surface Areas and Volumes

https://epathshala.nic.in/topic.php?id=0962CH01

INTRODUCTION:

CURRICULAR GOALS	COMPETENCIES
CG-5: Derives and uses formulae to calculate areas of plane figures, and surface areas and volumes of solid	**C-5.2:** Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations)

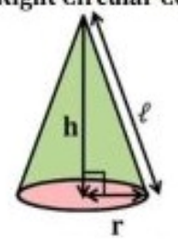
CLASS : 9

MIND MAP

Surface Areas and Volumes

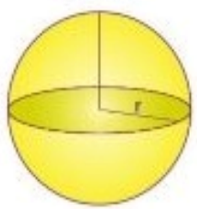
Radius : r units
Height : h units
Slant Height : ℓ units
TSA : Total Surface Area
CSA : Curved Surface Area

Right Circular Cone



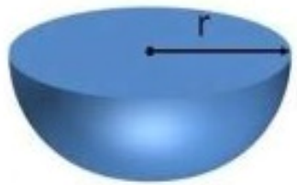
T. S. A.	$\pi r\ell + \pi r^2$ $\pi r(\ell + r)$	sq. units
C. S. A.	$\pi r\ell$	sq. units
Volume	$\frac{1}{3}\pi r^2 h$	cubic units
Slant Height	$\sqrt{r^2 + h^2}$	units

Sphere



T. S. A.	$4\pi r^2$	sq. units
C. S. A.	$4\pi r^2$	sq. units
Volume	$\frac{4}{3}\pi r^3$	cubic units

Hemisphere



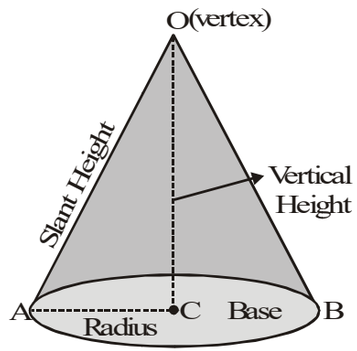
Total Surface Area = $2\pi r^2 + \pi r^2$ $= 3\pi r^2$ sq. units
Curved Surface Area = $2\pi r^2 + \pi r^2$ sq. units
Volume = $\frac{2}{3}\pi r^3$ cubic units

Period No.	Teaching Topic	Learning Outcomes / Objectives
1	**Surfacearea of aCone.**	1. Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 2. Numeracy and calculation skills while calculating surface area. 3. Procedural thinking while doing questions. 4. Developing connections between LSA and TSA 5. Visual and spatial ability
2	**Surface Area of a Right Circular Cone. Problems Part.1**	1. Able to find the formula for its Total Surface Area of Cone and Apply TSA + CSA in solving word problems 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 3. Numeracy and calculation skills while calculating surface area.
3	**SurfaceAreaofaRightCircularCone. Problems Part.2**	1. Able to find the formula for its Total Surface Area of Cone and Apply TSA + CSA in solving word problems, Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 2. Numeracy and calculation skills while calculating surface area. 3. Procedural thinking while doing questions about Developing connections between LSA and TSA.
4	**Surface Area of a Sphere**	1. Able to Derive the formula for TSA of hemisphere.Apply the formula in real life situations. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 3. Numeracy and calculation skills while calculating surface area.
5	**SurfaceAreaofaSphere**	1. Able to Derive the formula for TSA of hemisphere.Apply the formula in real life situations. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 3. Developing connections between LSA and TSA
6	**SurfaceAreaofaSphere and problems.**	1. Able to Derive the formula for TSA of hemisphere.Apply the formula in real life situations. Observational and identification skill while identifying the surfaces, edges and vertices of 3- D shapes. 3. Developing connections between LSA and TSA
7	**Volume of the right circular cone**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
8	**Problems on Volume of Cone**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
9	**Volumeof Cone – Problems related Day – to -day life**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
10	**Volume of Sphere**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
11	**Problems on volume of the sphere**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA

		andTSA.
12	**Some more Problems on Volume of Sphere**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
13	**Some more Problems of Volume of Sphere**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.
14	**Practicing Case based Questions**	1. Able to deduce the formula to find the volume of cone and its application to practical problems. 2. Observational and identification skill while identifying the surfaces, edges and vertices of 3- Dshapes. 3. Developing connections between LSA andTSA.

Key concepts: 1) CIRCLE 2) CONE 3) LSA OF CONE4) TSA OF CONE

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th Subject: Mathematics Chapter: SURFACE AREA AND VOLUMES **Total no. of periods for this chapter:14 Period no:1 /14** **Subtopic:Surfacearea of aCone.**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects. (cubes, cuboids, spheres, hemispheres, right circularcylinders/cones, and their combinations) Able to find the formula for its Total Surface Area of Cone and Apply TSA + CSA in solving word	**(5 mins)** Warm up Demonstration by facilitator on Black board Facilitator starts the lesson by asking some questions relating to the **LSA of a cone**. Doubts will be taken up in the class DRIVING QUESTION How would you find the total surface area of the cone? **Demonstration by Facilitator on Board** **Activity for the students with paper (25 mins)** **Activity:**(i)Cutoutaneatlymadepaperconethatdoesnothaveanyoverlappedpaper,straight alongitsside,andopeningitout,toseetheshapeofpaperthatformsthesurfaceofthecone. (Thelinealongwhichyoucuttheconeisthes*lantheight*oftheconewhichisrepresentedby *l*).Itlookslikeapartofaroundcake.	 	https://youtu.be/rd8tbD2eekM?si=4w1KbBgaEl3lkR_j SOURCE::https://www.youtube.com/@InfinityLearn_NEET **What is the Surface Area of a Right Circular Cone?** Teacher can use the above 5 min. video to demonstrate the activity on finding surface area

problems.

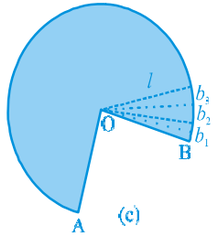
Expected skill development:

- Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes.
- Numeracy and calculation skills while calculating surfacearea.
- Procedural thinking while doingquestions.
- Developing connections between LSA andTSA
- Visual and spatialability

(ii) IfyounowbringthesidesmarkedAandBatthetipstogether,youcanseethatthecurved portionof(c)willformthecircularbaseofthecone.

A B

(iii) Ifthepaperliketheoneisnowcutintohundredsoflittlepieces,alongthe linesdrawnfromthepointO,eachcutportionisalmostasmalltriangle,whoseheightis theslantheight/ofthecone = 1/2Now the area of each triangle



Facilitator will tell that if the area of the top and the bottom is added

Example1: Findthecurvedsurfaceareaofarightcircularconewhoseslantheightis10cm andbaseradiusis7cm.

Example2: Theheightofaconeis16cmanditsbaseradiusis12cm.Findthecurvedsurface areaandthetotalsurfaceareaofthecone(Usep=3.14) .

of cone.

Let's Start!

https://youtu.be/rd8tbD2eekM?si=yizu2XaStkTH1-v8

SOURCE::https://www.youtube.com/@InfinityLearn_NEET

	then it is called Total Surface Area TSA = $\pi rl + \pi r^2$ The facilitator explains the practical situations where one has to calculate the TSA. **Activity: (10 mins)** **Exercise: Closure** Now the facilitator takes some question from Ex – 11.1 and explain the concept more clearly. **FORMULAE** **Area of the curved (lateral) surface = ($\pi r\ell$) sq. units. = $\left(\pi r\sqrt{h^2+r^2}\right)$ sq. units** **Total Surface Area of cone = (Curved surface Area + Area of Base)** **= ($\pi r\ell + \pi r^2$) sq. units = $\pi r(\ell + r)$ sq. units.** **Volume of cone = $\left(\frac{1}{3}\pi r^2 h\right)$ cubic units.**		

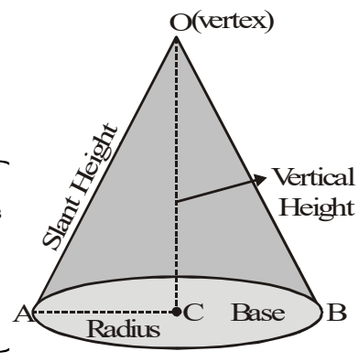
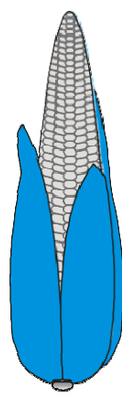
Summative Assessment plan- only where relevant

1. Find the vertical height of a right circular cone whose radius is 6 cm and slant height is 10 cm.

Teachers' reflections and experiences:

1.Did the lesson plan align with the curricular goals and competencies? If not How could be adjusted for better alignment?
2.How well did the pedagogical Strategies engage students and promote active participation in the learning process?
3.How well Did the assessment strategies measure student understanding and achievement of the learning outcomes?
4.How effective were the Materials and resources used in the lesson?
5.Did the lesson incorporate formative assessment Strategies to guide pedagogy and provide timely feedback to students?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :2 / 14** Subtopic: **Surface Area of a Right Circular Cone. problems**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations) Able to find the formula for its Total Surface Area of Cone and Apply TSA + CSA in solving word problems • Observational and identification skill while identifying the surfaces, edges and vertices of 3-	**Warm up Demonstration by facilitator on Black board (5 mins)** Facilitator starts the lesson by asking some questions relating to the LSA of a cone. Doubts will be taken up in the class DRIVING QUESTION **FORMULAE** **Area of the curved (lateral) surface = ($\pi r\ell$) sq. units. = ($\pi r\sqrt{h^2+r^2}$) sq. units** **Total Surface Area of cone = (Curved surface Area + Area of Base)** **= ($\pi r\ell + \pi r^2$) sq. units = $\pi r(\ell + r)$ sq. units.** **Volume of cone = ($\frac{1}{3}\pi r^2 h$) cubic units.** How would you find the total surface area of the cone? **(25 mins) Demonstration by Facilitator on Board** Facilitator will tell that if the area of the top and the bottom is added then it is called Total Surface Area TSA = $\pi rl + \pi r^2$ The facilitator explains the practical situations where one has to	 **Example3:** A corncob (see Fig. 11.5), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length (height) as 20 cm. If each 1 cm^2 of the surface of the cob carries an average of four grains, find	

Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	calculate the TSA. **Activity: (10 mins)** **Exercise: Closure** Now the facilitator takes some question from Ex – 11.1 and explain the concept more clearly. **From the videos of each 3 to 4 min. solve some interesting problems on surface area of cone.** **Teacher can use those videos to create interest among students in teaching learning process.**	howmanygrainsyouwouldfindontheentireco b. . 1. Diameterofthebaseofaconeis10.5c manditsslantheightis10cm.Findits curved surfacearea. 2. Findthetotalsurfaceareaofacone,if itsslantheightis21manddiameterof itsbaseis 24m.	https://youtu.be/j29K5ftKXzQ?si=t8j74mDzMydJEydE SOURCE::https://www.youtube.com/@TicTacLearnEnglish **https://youtu.be/9jiKr8FBO6g?si=ZPsojFc7bJ-AEKsr SOURCE::https://www.youtube.com/@TicTacLearnEnglish**

Summative assessment plan- only where relevant

1. The diameter of a cone is 14 cm and its slant height is 9 cm. Find the area of its curved surface.
2. Find the total surface area of a cone, if its slant height is 9 m and the radius of its base is 12 m.
3. The radius of a cone is 3 cm and vertical height is 4 cm. Find the area of the curved surface.
4. The radius and slant height of a cone are in the ratio 4 : 7. If its curved surface area is 792 cm^2, find its radius.
5. The lateral surface of a cylinder is equal to the curved surface of a cone. If the radius be the same, find the ratio of the height of the cylinder and slant height of the cone.

Teachers' reflections and experiences:

1 Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :3 / 14** **Subtopic: SurfaceAreaofaRightCircularCone. Problems**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/ assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations). Able to find the formula for its Total Surface Area of Cone and Apply TSA + CSA in solving word problems, Observational and identification skill while identifying the surfaces, edges and	**(5 mins)** **Warm up Demonstration by facilitator on Black board** Facilitator starts the lesson by asking some questions relating to the LSA of a cone. Doubts will be taken up in the class DRIVING QUESTION How would you find the total surface area of the cone? **(25 mins)** **Demonstration by Facilitator on Board** Facilitator will tell that if the area of the top and the bottom is added then it is called Total Surface Area TSA = $\pi rl + \pi r^2$ The facilitator explains the practical situations where one has to calculate the TSA. **Activity(10 mins)** **Exercise:** Now the facilitator takes some question from Ex – 11.1 and explain the concept more clearly.	1. Aconicaltentis10mhighandtheradius ofitsbaseis24m.Find	https://youtu.be/nyDq9Qzc3hw?si=6B4RdMaJGFckt9xx SOURCE::https://www.youtube.com/@TicTacLearnEnglish

vertices of 3- D shapes. 2. Numeracy and calculation skills while calculating surface area. 3. Procedural thinking while doing questions about Developing connections between LSA and TSA.	**3.** Curved surfacearea of a cone is 308 cm^2 and its slant height is 14 cm.Find (i) radiusofthebaseand(ii)totalsurfaceareaofthecone. **4.** Whatlengthoftarpaulin3mwidewillberequiredtomakeconicaltentofheight8mandbaseradius6m?Assumethattheextralengthofmaterialthatwillberequiredforstitchingmarginsandwastageincuttingisapproximately20cm(Useπ=3.14). **5.** Theslantheightandbasediameterofaconicaltombare25mand14mrespectively. Findthecostofwhite-washingitscurvedsurfaceattherateof₹210per 100m^2.	(i) slantheightofthetent. (ii) costofthecanvasrequiredtomakethetent,ifthecostof1m^2canvasis₹70.	

Summative assessment plan- only where relevant

1. 1 A joker's cap is in the form of a right circular cone of base radius 7 cm and height 24cm.Findtheareaofthesheetrequiredtomake10suchcaps.

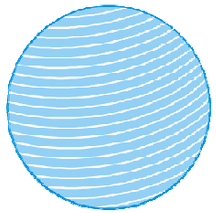
2. Abusstopisbarricadedfromtheremainingpartoftheroad,byusing50hollowcones madeofrecycledcardboard.Eachconehasabasediameterof40cmandheight1m.If theoutersideofeachoftheconesistobepaintedand the costofpaintingis₹12per m^2, what will be the cost of painting all these cones? (Use π= 3.14)

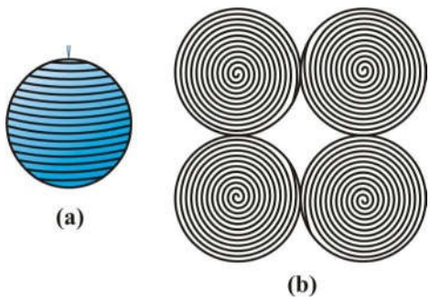
Teachers' reflections and experiences:

1. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
2. How well did I manage the classroom during the lesson?
3. Were there any disruptions or behavioral issues that I need to address?
4. What strategies can I implement to improve classroom management?
5. Did the students actively participate and show interest in the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter: 14** **Period no :4 /14** Subtopic: **Surface Area of a Sphere**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process** **This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations) Able toDerive the formula for TSA of hemisphere. Apply the formula in real life situations. • Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and	**(15 mins) Warm Up** (Individual Work) +Black Board Demonstration by Learners The facilitator shows a sphere to the learners. Whatisasphere? Isitthesameasacircle? Canyou drawacircleonapaper? Yes,youcan, becauseacircleisaplaneclosedfigurewhoseeverypoint liesataconstantdistance(called **radius**)fromafixedpoint,whichiscalledthe **center**ofthecircle.		 ps://youtu.be/9nZhXvWqhAM?si=lHqn_d4-tCzTlZoN URCE::https://www.youtube.com/@TicTacLearnEnglish leo regarding finding surface area of cube

calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	 Nowifyoupasteastring alongadiameterofacirculardiscandrotateitasyouhadrotatedthetriangleintheprevious section,youseeanewsolid  Whatdoesitresemble? Aball?Yes.Itiscalleda **sphere**. Canyouguesswhathappenstothecenterofthecircle,whenitformsasphereonrotation? Of course, it becomes the center of the sphere. *Conclusion: A sphere is a three-dimensional figure (solid figure), which is made up of all points in the space, which lie at a constant distance called the*	A sphere is like the surface of a ball. The word *solid sphere* is used for the solid whose surface is a sphere.	

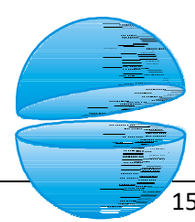
	radius, from a fixed point called the center of thesphere. **(25 mins)** Demonstration by Facilitator on Board She tells that in the sphere all the area is lateral area as the sphere has no base and no top and this is also called curved surface area as the surface iscurved. **Activity:**  (a) (b) Lateral Surface area of Sphere = $4 \pi r^2$ Total surface areaof Sphere $= 4 \pi r^2$	1. How many circles of areas equal to the area of the sphere? 2. Explain how a sphere is divided into 4 circles?	

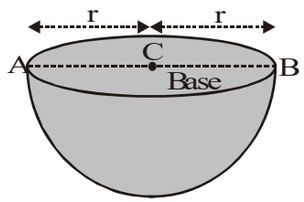
Summative Assessment plan- only where relevant

1. Calculate the cost required to paint a football which is in the shape of a sphere having a radius of 7 cm. If the painting cost of football is INR 2.5/square cm. (Take π = 22/7)

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no :5/ 14** Subtopic: **SurfaceAreaofaSphere**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations) Able toDerive the formula for TSA of hemisphere. Apply the formula in real life situations. • Observational and identification skill while identifying the surfaces, edges	(5 mins) Warm Up (Individual Work) +Black Board Demonstration by Learners (25 mins) Demonstration by Facilitator on Board Howmanyfacesdoyouseeinthesurfaceofasphere?Therei sonlyone,whichiscurved. Now,letustakeasolidsphere,andsliceitexactly‘throughth emiddle’ with a plane that passes through its center. What happens to the sphere? Yes,itgetsdividedintotwoequalp arts(seeFig.11.8)!Whatwilleach half be called? It is called a **hemisphere**. (Because ‘hemi’ 		ps://youtu.be/VOJ7sFhvezU?si=_R3AEml1DavIX6Ev URCE::https://www.youtube.com/@TicTacLearnEnglish ps://youtu.be/9D7EkNXHAWo?si=SUcJ0ufbxU3Z_YPT

and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	also means 'half')  And what about the surface of a hemisphere? How many faces does it have? Two!Thereisacurvedfaceandaflatface(base). The curved surface area of a hemisphere is half the surface area of the sphere, **10 mins closer** Lateral Surface area of Sphere = $4\pi r^2$ Total surface areaof Sphere = $4\pi r^2$ Curved/lateral surface Area of Hemisphere = $2\pi r^2$ Total surface Area of a Hemisphere = $3\pi r^2$ The facilitator explains the practical situations where one has to calculate the lateral surface **1.** Findthesurfaceareaofasphereofradius: 14cm **2.** Findthesurfaceareaofasphereofradius: 10.5 cm	1.Findthesurfaceareaofasphereofradius: (i) 10.5cm (ii)5.6cm 2. Find the surface area of a sphere of radius 7 cm. 3.Find(i)thecurvedsurfaceareaand(ii)thetotalsurfaceareaofahemisphereof radius 21cm.	URCE::https://www.youtube.com/@TicTacLearnEnglish

Summative assessment plan- only where relevant

1 : The hollow sphere, in which the circus motorcyclist performs his stunts, has a diameter of 7 m. Find the area available to the motorcyclist for riding.

2 :A hemispherical dome of a building needs to be painted (see Fig. 11.9). If the circumference of the base of the domeis 17.6m, find the cost of painting it, given the cost of painting is **7** 5 per 100cm^2.

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :6 /14** Subtopic: **SurfaceAreaofaSphere, problems.**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations) Able to Derive the formula for TSA of hemisphere. Apply the formula in real life situations. • Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes.	(5 mins) Warm Up (Individual Work) +Black Board Demonstration by Learners (25 mins) Demonstration by Facilitator on Board Teacher can use the 7min. video relating to finding surface area of sphere. Explain exercise problems **3.** Findthesurfaceareaofasphereofdiameter: (i) 14cm (ii)21cm (**4.** Findthetotalsurfaceareaofahemisphereofradius10cm.(Usep=3.14) **5.** Theradiusofasphericalballoonincreasesfrom 7cmto14cmasairisbeingpumped intoit.Findtheratioofsurfaceareasoftheballoo ninthetwocases. **6.** Ahemisphericalbowlmadeofbrasshasinnerdia	Assignment: 1. Findthesurfaceareaofasphereofdiameter: i. 14cm (ii)21cm 2. Findthetotalsurfaceareaofahemisphereofradius10cm.(Usep=3.14) 3. Theradiusofasphericalballooni ncreasesfrom7cmto14cmasairisbeingpumped intoit.Findtheratioofsurfacear easoftheballooninthetwocases	https://youtu.be/V9LEpsd4D5I?si=5JoaUjp7czihgTcD SOURCE::https://www.youtube.com/@TicTacLearnEnglish

• Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability Analytical thinking and problemsolving.	meter10.5cm.Findthecostoftin-platingitontheinsideattherateof716per100cm^2. Lateral Surface area of Sphere = 4 π r^2 Total surface areaof Sphere = 4 πr^2 Curved/lateral surface Area of Hemisphere = 2 π r^2 Total surface Area of a Hemisphere = 3 π r^2 **10 mins closer** The facilitator explains the practical situations where one has to calculate the lateral surface of sphere.	. 4. Ahemisphericalbowlmadeofbrasshasinnerdiameter10.5cm.Findthecostoftin-platingitontheinsideattherateof716per100cm^2. 5. Findtheradiusofaspherewhosesurfaceareais154cm^2	

Summative assessment plan- only where relevant

Arightcircularcylinderjustenclosesasphereofradius*r* .Findsurfaceareaofthesphere

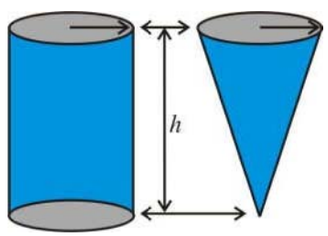
1. curvedsurfaceareaofthecylinder,

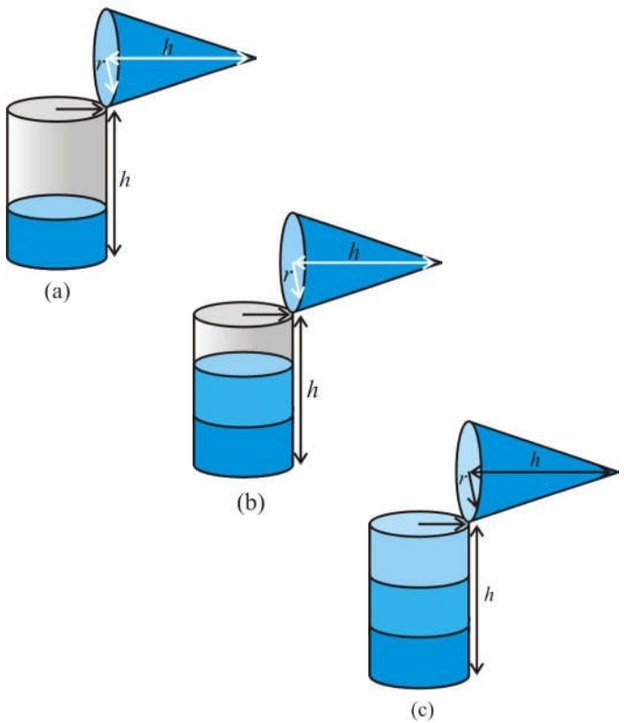
2. ratioofthe areasobtainedin(i)and(ii).

Teachers' reflections and experiences:

1 Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no :7/14** Subtopic: **Volume of a Right CircularCone**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations) Able to deduce the formula to find the volume of cone and its application to practical problems.	**(5 mins) Warm up** **(Individual work) + Black Board Demonstration by learners** Inearlierclasseswehavestudiedthevolumesofcube,cuboidand cylinder In the figure,canyouseethatthereisarightcircularcylinderandarightcircularconeofthesamebaseradiusandthesameheight? **(25 mins) Demonstration by facilitator on board** The facilitator will give the small demonstration of the activity and encourage them to do the same on their own at home.		**LINK** ps://youtu.be/ifaf_1yYbvo?si=UAjqBBTipJ-rAb5u **SOURCE::** ps://www.youtube.com/@TicTacLearnEnglish **The video explains garding finding volume of cone.**

2. Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. 3. Numeracy and calculation skills while calculating surfacearea. 4. Procedural thinking while doingquestions. 5. Developing connections between LSA andTSA 6. Visual and spatialability	**Activity:**Trytomakeahollowcylinderandahollowconelikethiswiththesamebaseradius andthesameheightThen,wecantryoutanexperimentthat willhelpus,tosee practicallywhatthevolumeofarightcircularconewould  be! By the above activity teacher conclude that 3 times of the volume of cone makes of the volume of cylinder **Volume of the cone = 1/3 $\pi r^2 h$** where r is the base radius and h is the height of the cone.	what is the volume of the cylinder? Explain the variables in the formula.	

	(5 mins) Problems: Closure Find the volume of the cone. If the height and the slant height of a cone are 18 cm and 21 cm, respectively. The height and the slant height of a cone are 21 cm and 28 cm respectively. Find the volume of the cone.		

Summative assessment plan- only where relevant

1. Monica has a piece of canvas whose area is 551 m2. She uses it to have a conical tent made, with a base radius of 7 m. Assuming that all the stitching margins and the wastage incurred while cutting, amounts to approximately 1 m2, find the volume of the tent that can be made with it.

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Teachers' reflections and experiences:

2. Did I use effective instructional strategies to engage students in the lesson?
3. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
4. How well did I manage the classroom during the lesson?
5. Were there any disruptions or behavioural issues that I need to address?
6. What strategies can I implement to improve classroom management?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no: 8/14** **Subtopic: Problems on Volume of Cone**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations. Able to Deduce the	**(5 mins) Warm up** **(Individual work) + Black Board Demonstration by learners** Recall the activity The facilitator takes some examples to tell the total quantity of substance that can be put into the cone, this quantity is called the capacity or the volume of the cone. Facilitator will show the relationship between VOLUME OF CONE AND VOLUME OF CYLINDER by pouring the sand in the container. It shows that one cylinder of radius 'r' and height 'h' can fill three cones of same radius 'r' and height 'h'. Volume of cone = 1/3 π r^2 h **(25 mins) Demonstration by facilitator on board** The facilitator explains some practical examples, where the learners are supposing to find the volume of a cone. The facilitator takes some questions and explains the	1. Identify the differences between volume of cylinder and cone?	ttps://youtu.be/GvaSiarw7Zw?si=-0ztBZZ02vK3Tfhw URCE:;https://www.youtube.com/@TicTacLearnEnglish

formula to find the volume of cone and its application to practical problems. Expected skill development: Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. Numeracy and calculation skills while calculating surfacearea. Procedural thinking while doingquestions. Developing connections between LSA andTSA Visual and spatialability	concept more clearly. 1. Findthevolumeoftherightcircularconewith i. radius6cm,height7cm (ii) radius 3.5 cm, height 12cm 2. Findthecapacityinlitersofaconicalvesselwith (i) radius7cm,slantheight25cm (ii) radius12cm,slantheight13cm **(10 mins) In class Exercise: Closure** **1.** The height of a cone is 15 cm. If its volume is 1570 cm^3, find the radius of the base. **2.** Ifthevolumeofarightcircularconeofheight9cm is48pcm^3,findthediameterofits base.		ps://youtu.be/yEVe8yNO9EM?si=VNJr3ur_c4l5qzVT URCE::https://www.youtube.com/@TicTacLearnEnglish

Summative assessment plan- only where relevant

1. Aconicalpitoftopdiameter3.5mis12mdeep.Whatisitscapacityinkiloliters?
2. Thevolumeofarightcircularconeis9856cm^3. Ifthediameterofthebaseis28cm, find
   (i) height ofthecone (ii) slant height ofthecone(iii)curvedsurfaceareaofthecone

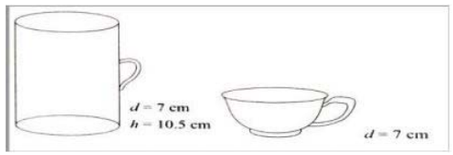
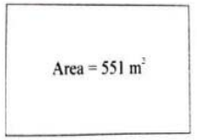
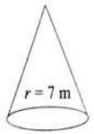
Teachers' reflections and experiences:

1. How can I ensure that students understand the objectives and can demonstrate their
2. knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to
5. different learning styles and needs?
6. How well did I manage the classroom during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no :9/14** **Subtopic: Volumeof Cone – Problems related Day – to -day life**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations Able to Deduce the formula to find the volume of cone and its application to practical problems. Expected skill development:	**(5 mins)** **(Individual work)** DEMONSTRATION The facilitator asks the learners to recall Volume of cone = 1/3 π r^2 h The facilitator takes some examples to tell the total quantity of substance that can be put into the cone, this quantity is called the capacity or the volume of the cone. Facilitator will show the relationship between VOLUME OF CONE AND VOLUME OF CYLINDER by pouring the sand in the container. It shows that one cylinder of radius 'r' and height 'h' can fill three cones of same radius 'r' and height 'h'. Volume of cone = 1/3 π r2 h **(25 mins) Demonstration by facilitator on board** The facilitator explains some practical examples, where the learners are supposing to find the volume of a cone. The facilitator takes some questions and explains the concept more clearly. **1.** IfthetriangleABCintheQuestion7aboveisrevolveda	1. ArighttriangleABCwithsides5cm,12 cmand13cmisrevolvedabouttheside 12cm.	SCAN ME https://youtu.be/GMC3fT-0Od8?si=D9FSlfQ6pXmbdx9X SOURCE::https://www.youtube.com/@dearlearnings

7. Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. 8. Numeracy and calculation skills while calculating surfacearea. 9. Procedural thinking while doingquestions. 10. Developing connections between LSA andTSA 11. Visual and spatialability	boutthe side 5cm, then find the volume of the solid so obtained. Find also the ratio of the volumes of the two solids obtained in Questions 7 and 8. **2.** A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas required. **(10 mins) In class Exercise: Closure** Now the facilitator takes some questions and explains the concept more clearly. **Case based Questions:** Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area 551m2. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to 1m2, the students put the tents. The radius of the tent is 7m.	Find the volume of the solid so obtained.	

	      **1. The volume of cylindrical cup is** a) 295.75 cm^3 b) 7415.5 cm^3 c) 384.88 cm^3 d) 404.25 cm^3 **2. The volume of hemispherical cup is** a) 179.67 cm^3 b) 89.83 cm^3 c) 172.25 cm^3 d) 210.60 cm^3 **3. Which container had more juice and by how much?** a) Hemispherical cup, 195 cm^3 b) cylindrical glass, 207 cm^3 c) Hemispherical cup, 280.85 cm^3 d) cylindrical glass, 314.42 cm^3 **4. The height of the conical tent prepared to accommodate four students is** a) 18m b) 10m c) 24m d) 14m **5. How much space on the ground is occupied by each student in the conical tent** a) 54 m^2 b) 38.5 m^2 c) 86 m^2 d) 24 m^2	1. Identify the shape of tea cup? 2. What is the shape of Tent? 3. Can you give some more real-life shapes related to cone and sphere?	

Summative assessment plan- only where relevant

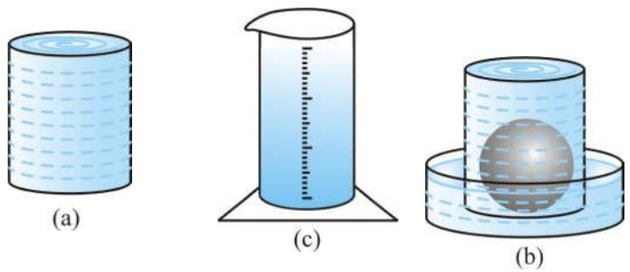
1. A tent is of the shape of a right circular cylinder up to a height of 3 metres and then becomes a right circular cone with a maximum height of 13.5 meters above the ground. Calculate the cost of painting the inner side of the tent at the rate of Rs. 2 per square metre, if the radius of the base is 14 meters.
2. A solid cube of side 7 cm is melted to make a cone of height 5 cm, find the radius of the base of the cone.
3. From a right circular cylinder with height 10 cm and radius of base 6 cm, a right circular cone of the same height and base is removed. Find the volume of the remaining solid.

Teachers' reflections and experiences:

1. What strategies can I implement to improve classroom management?
2. Did the students actively participate and show interest in the lesson?
3. How can I increase student engagement and create a more interactive learning environment?
4. Did I provide timely and constructive feedback to guide their learning?
5. How can I improve my assessment and feedback practices?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no :10/14** **Subtopic: Volumeof Sphere**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations Able to Deduce the formula to find the volume of sphere and its application to practical problems. Expected skill	**(5 mins) learners Activity** Learners recalls that Total/Lateral surface Area of a sphere = $4 \pi r^2$ Curved Surface Area of a hemisphere = $2 \pi r^2$ Total Surface Area of hemisphere = $3 \pi r^2$ Now the facilitator takes some examples to tell the total quantity of substance that can be put into the sphere, this total quantity is called the capacity or the volume of the sphere. **(25 mins) demonstration by facilitator on board activity**	Observe why the LSA and TSA of sphere are same?	ps://youtu.be/JBesOXe9w?si=uPzJtkhy5RwNRvcB. **OURCE::https://www.y**

development: • Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	Now, let us see how to go about measuring the volume of a sphere. First, take two or three spheresofdifferentradii,andacontainerbigenough tobeabletoputeachofthespheresinto it,oneatatime. . Also,takealargetroughinwhichyoucanplacethecontainer.Then,fillthe  containeruptothebrimwithwater. Now, carefully place one of the spheres in the container. Some of the water from the containerwilloverflowintothetroughinwhichitiskept Carefullypour outthewaterfromthetroughintoameasuringcylinder(i.e.,agraduatedcylindricaljar)and measurethewateroverflowed Supposetheradiusoftheimmersedsphere	Find the volume of a sphere of radius 11.2 cm. $\frac{}{3}$	tube.com/@TicTacLearnEnglish

	is *r* (you can find the radius by measuring the diameter of the sphere). Then evaluate. Do you find this value almost equal to the measure of the volume over flowed? **Teacher conclude that** Volume of the Sphere = $4/3\ \pi\ r^3$ Volume of the hemisphere = $2/3\ \pi\ r^3$ **(10 mins) Activity:** Once again repeat the procedure done just now, with a different size of sphere. **Write your observations in this activity. And give conclusions.**		

Summative assessment plan- only where relevant

1. A shot-putti sa metallic sphere of radius 4.9cm. If the density of the metal is 7.8 gper cm^3, find the mass of the shot-putt.
2. A hemispherical bowl has a radius of 3.5cm. What would be the volume of water it would contain?

Teachers' reflections and experiences:

1. Was the pacing of the lesson appropriate?
2. Did I cover all the planned content without rushing or leaving gaps?
3. How can I better manage the time allocated for each activity?
4. What were my strengths during the lesson?
5. In what areas can I improve as a teacher?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14 Period no :11 / 14** **Subtopic:** Problems on volume of the sphere			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations Able to Deduce the formula to find the volume of sphere and its application to practical problems. Expected skill development: • Observational	**(5 mins) Demonstration** Learners recalls that Total/Lateral surface Area of a sphere = $4 \pi r^2$ Curved Surface Area of a hemisphere = $2 \pi r^2$ Total Surface Area of hemisphere = $3 \pi r^2$ Volume of the Sphere = $4/3 \pi r^3$ Volume of the hemisphere = $2/3 \pi r^3$ **(25 mins) demonstration by facilitator on board** **Explain some problems** A metallic sphere of radius 10.5 cm is melted and thus recast into small cones, each of radius 3.5 cm and height 3 cm. Find how many cones are obtained. 1. A cone, a hemisphere and a cylinder stand on	Assignment: **1.** Findthevolumeofaspherewhoseradiusis (i) 7cm (ii) 0.63m **2.** Findtheamountofwaterdisplacedbyasoli	 ps://youtu.be/yQCUSjO 4?si=c5EK396hz0Ah64Tp JRCE::https://www.youtu com/@TicTacLearnEnglis h

and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	equal bases and have the same height. Show that their volumes are in the ratio 1 : 2 : 3. **(10 mins) In class Exercise: Closure** Now the facilitator takes some questions and explains the concept more clearly. 1. **For a sphere the volume is given by $V = (4/3)\pi r^3$ and the surface area is given by $A = 4\pi r^2$. If the sphere has a surface area of 256π, what is the volume?** 2. **A typical baseball is 76mm in diameter. Find the baseball's volume in cubic centimeters.**	dsphericalballofdiameter (i)28cm (ii) 0.21m 3. Thediameterofametallicballis4.2cm.W hatisthemassoftheball,ifthedensityof themetalis8.9gpercm^3?	ps://youtu.be/DGorvMW WYM?si=4-iofiJnJt8vjCSc URCE::https://www.youtu com/@TicTacLearnEnglis h

Summative assessment plan- only where relevant

1. The diameter of the moon is approximately one-fourth of the diameter of the earth. Whatfractionofthevolumeoftheearthisthevolumeofthemoon?
2. Howmanylitersofmilkcanahemisphericalbowlofdiameter10.5cmhold?

Teachers' reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How well did I manage the classroom during the lesson?

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :12/14** **Subtopic: Some more Problems on Volume of Sphere**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
CG-5: Derives and uses formulae to calculate areas of plane figures, and surface areas and volumes of solid Able to Deduce the formula to find the volume of sphere and its application to practical problems. Expected skill development:	**(5 mins)** **Recall** Learners recalls that Total/Lateral surface Area of a sphere = $4 \pi r^2$ Curved Surface Area of a hemisphere = $2 \pi r^2$ Total Surface Area of hemisphere = $3 \pi r^2$ Now the facilitator takes some examples to tell the total quantity of substance that can be put into the sphere, this total quantity is called the capacity or the volume of the sphere. Volume of the Sphere = $4/3 \pi r^3$ Volume of the hemisphere = $2/3 \pi r^3$ **(25 mins) demonstration by facilitator on board** Explain some problems	Give the formulae for surface area of Sphere? Give the formulae for surface area of Hemisphere?	ps://www.youtube.com/live/xxyS U8fAc0?si=u-YTKqgHwGq99tKc UERCE::https://www.youtube.com/@BYJUSClass910

• Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	**4.** Ahemisphericaltankismadeupofanironsheet1cmthick.Iftheinnerradiusis1m, thenfindthevolumeoftheironusedtomakethetank. **5.** Adomeofabuildingisintheformofahemisphere.Frominside,itwaswhite-washedat thecostof74989.60.Ifthecostofwhite-washingis 720persquaremetre,findtheinsidesurfaceareaofthedome, (ii) volumeoftheairinsidethedome. **(10mins) Inclass Exercise: Closure** Now the facilitator takes some questions from the exercise and explains the concept more clearly. 1. Findthevolumeofaspherewhosesurfaceareais154cm^2. 2. To the nearest tenth of a cubic centimeter, give the volume of a sphere with surface area 1,000 square centimeters.	 	

Summative assessment plan- only where relevant

1. Twenty-sevensolidironspheres,eachofradius*r*andsurfaceareaSaremeltedtoform aspherewithsurfaceareaS¢.Findthe (i) radius*r*¢ofthenewsphere,(ii)ratioofSandS¢.
2. A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine(inmm^3)isneededtofillthiscapsule?

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :13/14** **Subtopic: Some more Problems of Volume of Sphere**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments /assignments/self-assessment checklists/etc.**	**Material required**
Expected Learning Outcome: The learners will be able to: Deduce the formula to find the volume of sphere and its application to practical problems. Expected skill development: • Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating	**(5 mins) Warm up Demonstration by learners** **recall** Learners recalls that Total/Lateral surface Area of a sphere = $4 \pi r^2$ Curved Surface Area of a hemisphere = $2 \pi r^2$ Total Surface Area of hemisphere = $3 \pi r^2$ Now the facilitator takes some examples to tell the total quantity of substance that can be put into the sphere, this total quantity is called the capacity or the volume of the sphere. **(25 mins) demonstration by facilitator on board** Explain some problems **6.** Ahemisphericaltankismadeupofanironsheet1 cmthick.Iftheinnerradiusis1m, thenfindthevolumeoftheironusedtomakethe	1. Explain the formulae for Surface area and volume of the Sphere with explanation of the terms in the formula. 2. Give the relation between Volume of the cone and sphere when heights of cone and sphere are same?	ps://youtu.be/_xpo8itq0w?si=SJ-ZnfZGJIzmPtK1 SCAN ME URCE::https://www.yout

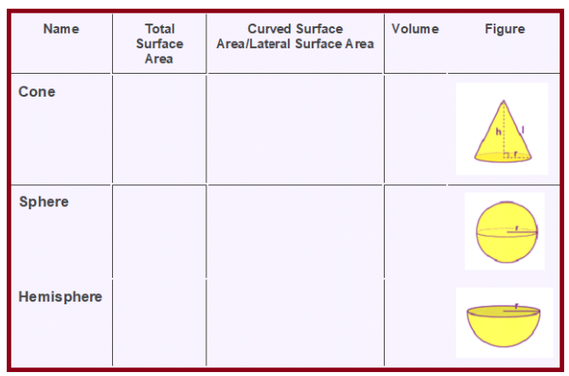
surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability	tank. 7. Findthevolumeofaspherewhosesurfaceareais154cm^2. 8. Adomeofabuildingisintheformofahemisphere .Frominside,itwaswhite-washedat thecostof Rs 4989.60.Ifthecostofwhite-washingis Rs.20persquaremeter, (i) findthe insidesurfaceareaofthedome, (ii) volumeoftheairinsidethedome. **(10 mins) In class Exercise: Closure** Now the facilitator takes some questions and explains the concept more clearly. 1. A vessel in the form of a hemispherical bowl is full of water. Its contents are emptied in a right circular cylinder. The internal radii of the bowl and the cylinder are 3.5 cm and 7 cm respectively. Find the height to which the water will rise in the cylinder. 2.**Find the volume of a sphere whose surface area is 154 cm2.**		e.com/@MathTeacherGon

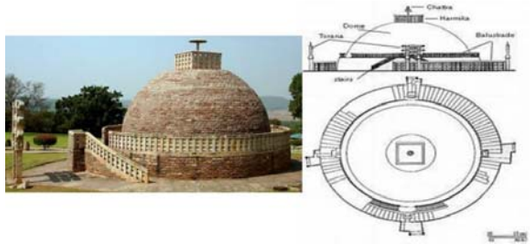
Summative assessment plan- only where relevant

1. Twenty-seven solidironspheres,eachofradius*r*andsurfaceareaSaremeltedtoform aspherewithsurfaceareaS′.Findthe (i) radius*r*′ofthenewsphere,(ii)ratioofSandS′.
2. A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine(inmm^3)isneededtofillthiscapsule?

Teachers' reflections and experiences:

Chapter Plan (Unit plan/ lesson plan) Period plan (40 mins class)

Class: 9th **Subject: Mathematics** **Chapter: SURFACE AREA AND VOLUMES** **Total no. of periods for this chapter:14** **Period no :14 /14** **Subtopic: Practicing Case based Questions**			
Learning Outcomes & Indicators/micro-competencies	**Teaching-Learning Process This should include activities to facilitate learning along with broad time duration**	**Pointers for formative assessment- this should include strategies that will be used to Check for Understanding - e.g., questions/worksheets/experiments/assignments/self-assessment checklists/etc.**	**Material required**
C-5.2: Visualizes and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations Able to: Deduce the formula to find the volume of sphere and its application to practical problems. Expected skill development:	**(5 mins) Warm up Demonstration** **recall** Learners recalls that the formulae for Cone, Sphere and Hemisphere through the recall of all the formulae. Now the facilitator takes some examples to tell the total quantity of substance that can be put into the sphere, this total quantity is called the capacity or the volume of the sphere. **(25 mins) demonstration by facilitator on board** Explain some problems by answering:	Fiil up the blanks with suitable formulae:  	ps://youtu.be/KXKyeA0PY?si=8i9VPK2DCsgmJtb0  URCE::https://www.youtbe.com/@mrmaisonet

• Observational and identification skill while identifying the surfaces, edges and vertices of 3-Dshapes. • Numeracy and calculation skills while calculating surfacearea. • Procedural thinking while doingquestions. • Developing connections between LSA andTSA • Visual and spatialability Analytical thinking and problemsolving.	**1. Calculate the volume of the hemispherical dome if the height of the dome is 21 m –** a) 19404 cu. Mb) 2000 cu .m c) 15000 cu. m d) 19000 cu. m **2. The formula to find the Volume of Sphere is -** a) 2/3 πr^3b) 4/3 πr^3 c) 4 πr^2 d) 2 πr^2 **3. The cloth require to cover the hemispherical dome if the radius of its base is 14m is** a) 1222 sq.m b) 1232 sq.m c) 1200 sq.m d) 1400 sq.m **4. The total surface area of the combined figure i.e. hemispherical dome with radius 14m and cuboidal shaped top with dimensions 8m 6m 4m is** a)1200 sq. m b) 1232 sq. m c) 1392 sq.m d) 1932 sq. m **5. The volume of the cuboidal shaped top is with dimensions mentioned in question 4** a) 182.45 m^3b) 282.45 m^3c) 292 m^3 **Activity:(10 minutes)** To make the learning process more interesting creative and innovative teacher brings clay in the classroom, to teach the topic. Surface Areas and Volumes. With clay, forms a cylinder of radius 4 cm and height 18 cm. Then, she molds the cylinder into a sphere and ask some		

	question to students.  (i) The radius of the sphere so formed is (a) 4 cm (b) 6 cm (c) 7 cm (d) 8 cm (ii) The volume of the sphere so formed is (a) 905.14 cm^3 (b) 903.27 cm^3 (c) 1296.5 cm^3 (d) 1156.63 cm^3 (iii) Find the ratio of the volume of sphere to the volume of cylinder. (a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 3 : 1 (iv) Total surface area of the cylinder is (a) 553.14 cm^2 (b) 751.52 cm^2 (c) 625 cm^2 (d) 785.38 cm^2		

Summative assessment plan- only where relevant

1. Find the diameter of each sphere if fifteen identical spheres are made by melting a solid cylinder of radius 10 cm and height 5.4 cm.

Teachers' reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. Did I use effective instructional strategies to engage students in the lesson?
3. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
4. How well did I manage the classroom during the lesson?
5. Did the students actively participate and show interest in the lesson?

WORK SHEET:1 on SURFACE AREAS & VOLUMES

Volume and Surface Area of Cones and Spheres

Leave answers to 2 decimal places where necessary.

Work out the volume, surface area or radius of the cones and spheres as required.

1)

Volume =

2)

Volume =

3)

Volume =

180 cm^3

4)

Surface area =

25 mm^2

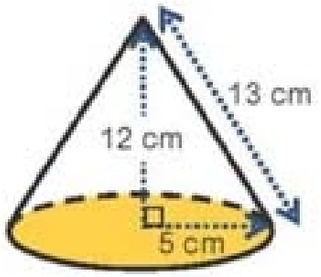
Surface area =

Surface area =

Radius =

Radius =

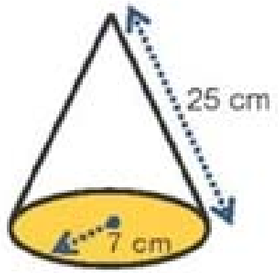
5)



Curved surface area =

Total surface area =

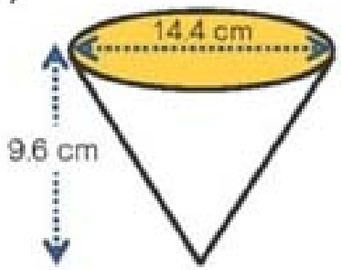
6)



Volume =

Total surface area =

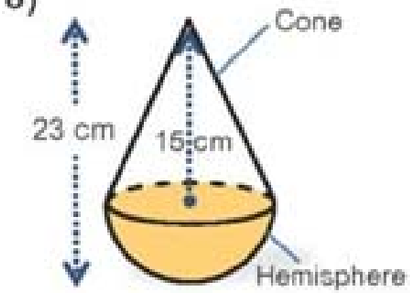
7)



Volume =

Total surface area =

8)



Volume =

Total area =

WORKSHEET. 2

SURFACE AREAS AND VOLUMES

1. Find the volume of a sphere whose radius is:

   (i) 2 cm

   (ii) 3.5 cm

   (iii) 10.5 cm
2. Find the volume of a sphere whose diameter is:

   (i) 14 cm

   (ii) 3.5 dm

   (iii) 2.1 m
3. A hemispherical tank has inner radius of 2.8 m. Find its capacity in litres.
4. A hemispherical bowl is made of steel 0.25 cm thick. The inside radius of the bowl is 5 cm. find the volume of steel used in making the bowl.
5. How many bullets can be made out of a cube of lead, whose edge measures 22 cm, each bullet being 2 cm in diameter?
6. A shopkeeper has one laddoo of radius 5 cm. With the same material, how many laddoos of radius 2.5 cm can be made.
7. A spherical ball of lead 3 cm in diameter is melted and recast into three spherical balls. If the diameters of two balls be 3232 cm and 2 cm, find the diameter of the third ball.
8. A sphere of radius 5 cm is immersed in water filled in a cylinder, the level of water rises 5353 cm. Find the radius of the cylinder.
9. If the radius of a sphere is doubled, what is the ratio of the volume of the first sphere to that of the second sphere?
10. A cone and a hemisphere have equal bases and equal volumes. Find the ratio of their heights.

WORKSHEET. 3

SURFACE AREAS AND VOLUMES

1. A vessel in the form of a hemispherical bowl is full of water. Its contents are emptied in a right circular cylinder. The internal radii of the bowl and the cylinder are 3.5 cm and 7 cm respectively. Find the height to which the water will rise in the cylinder.
2. A cylinder whose height is two thirds of its diameter, has the same volume as a sphere of radius 4 cm. Calculate the radius of the base of the cylinder.
3. A vessel in the form of a hemispherical bowl is full of water. The contents are emptied into a cylinder. The internal radii of the bowl and cylinder are respectively 6 cm and 4 cm. Find the height of water in the cylinder.
4. A cylindrical tub of radius 16 cm contains water to a depth of 30 cm. A spherical iron ball is dropped into the tub and thus level of water is raised by 9 cm. What is the radius of the ball?
5. A cylinder of radius 12 cm contains water to a depth of 20 cm. A spherical iron ball is dropped into the cylinder and thus the level of water is raised by 6.75 cm. Find the radius of the ball. (Use $\pi = 22/7$ $\pi = 22/7$.
6. The diameter of a coper sphere is 18 cm. The sphere is melted and is drawn into a long wire of uniform circular cross-section. If the length of the wire is 108 m, find its diameter.
7. A cylindrical jar of radius 6 cm contains oil. Iron spheres each of radius 1.5 cm are immersed in the oil. How many spheres are necessary to raise the level of the oil by two centimetres?
8. A measuring jar of internal diameter 10 cm is partially filled with water. Four equal spherical balls of diameter 2 cm each are dropped in it and they sink down in water completely. What will be the change in the level of water in the jar?
9. The diameter of a sphere is 6 cm. It is melted and drawn into a wire of diameter 0.2 cm. Find the length of the wire.
10. The radius of the internal and external surfaces of a hollow spherical shell are 3 cm and 5cm respectively. If it is melted and recast into a solid cylinder of height 223 223 cm. Find the diameter of the cylinder.

CHAPTER: 12

STATISTICS

Chapter Plan (Unit plan/ lesson plan)

PERIODWISE LESSON PLANS

9

Class

http://epathshala.nic.in/ OR/?id=0962CH14

Chapter Plan (Unit Plan / Lesson Plans)

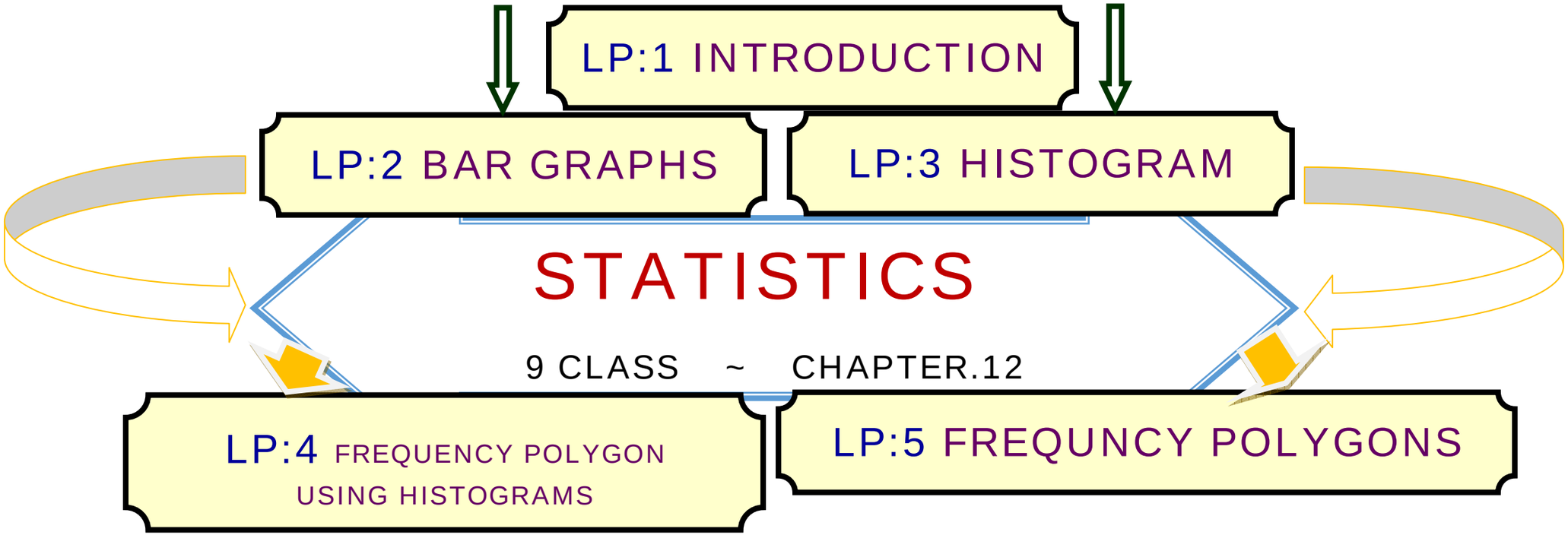
The following **Curricular Goals (C.G.)** & **Competencies (C)** will be developed through teaching of this chapter.

Curricular Aims:

C.A. 1: ***Basic Numeracy*****; C.A. 2:** ***Mathematical Thinking*****.; C.A. 3:** ***Problem Solving*****. C.A. 4:** ***Mathematical Intuition*** **C.A.5:** ***Joy, curiosity, and wonder:***

Curricular Goals (C.G.)	Competencies (C)
C. G. - 8 *Builds skills such as visualisation, optimisation, representation, and mathematical modelling along with their* **C.G. - 11** *Explores connections of Mathematics with other subjects. application in daily life.* **C.G. - 11** *Explores connections of Mathematics with other subjects*	**C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1** *Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science, Visual Arts, Music, Vocational Education, and Sports.*

MIND MAP:



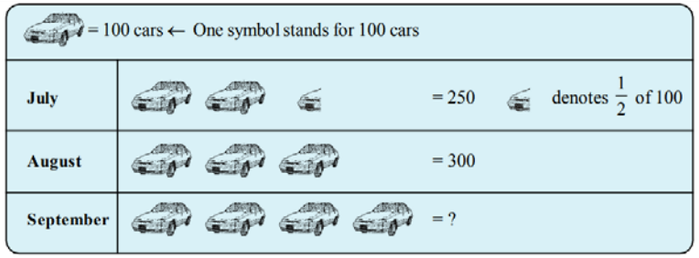
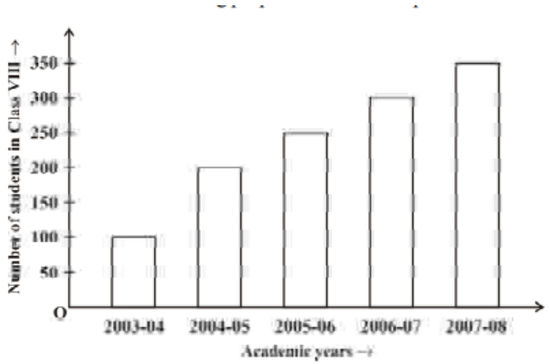
Also discuss
Contextual Problems based on STATISTICS related to day-to-day situations.

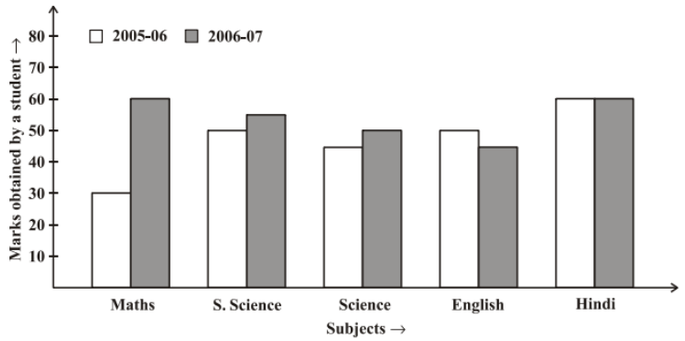
LP No:	TEACHING TOPIC	LEARNING OUTCOMES
1	**LP.1 – Introduction of Statistical Graphs**	1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Analyses data by representing it in a tabular form (grouped or ungrouped).
2	**LP.2 – Bar Graphs**	1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs bar graph from ungrouped tabulated (qualitative) data. 3. Retrieves data-values (ungrouped and grouped) with a given frequency from a given frequency table.
3	**LP.3 - Histogram**	1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs histogram for grouped data with equal class size and with varying class-size. 3. Recognizes that any grouped data can be represented through a histogram and a frequency polygon. 4. Retrieves data-values (ungrouped and grouped) with a given frequency from a given frequency table. 5. Students will be able to create, compare, and interpret histograms
4	**LP.4 – Frequency Polygon using Histograms**	1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs histogram for grouped data with equal class-size. 3. Constructs histogram for grouped data with varying class-size. 4. Recognizes that any grouped data can be represented through a histogram and a frequency polygon. 5. Constructs frequency polygon for grouped data through the mid values of histograms.
5	**LP.5 – Frequency Polygons**	1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Analyses data by representing it in a tabular form (grouped or ungrouped) 3. Constructs frequency polygon for grouped data through the mid values of histograms. 4. Retrieves data-values (ungrouped and grouped) with a given frequency from a given frequency table.

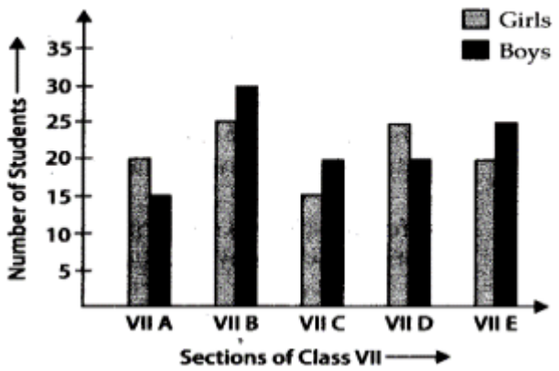
Chapter Plan (Unit plan/ lesson plan)

Period plan (40 Minutes)

Class: **09**	**Subject: Mathematics**	Chapter: **12. STATISTICS**	
Total no. of periods for this chapter: **05**	Period No: **01 / 05**	**Subtopic:** **Introduction of Statistical Graphs**	
Learning Outcomes & Indicators / Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions / worksheets / experiments / assignments / self-assessment checklists/etc.	**Material Required**
Curricular Competencies: **C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1***Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science,*	**Introduction: (***35 minutes)* **Teacher asks the following questions and testing of previous knowledge** (Individual work followed by pair sharing and whole grouping sharing). **The students ask for retrieval the previous knowledge by the following activities.** **Activity 1:** The student asks to observe the figure and give answers for the following questions:	1. How many cars were produced in the month of July? 2. In which month were maximum number of cars produced?	**Statistical Graphs in daily life situations.**

Visual Arts, Music, Vocational Education, and Sports. **LEARNING OUTCOMES:** 1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Analyses data by representing it in a tabular form (grouped or ungrouped).	 **Activity 2:** The student asks to observe the figure and give answers for the following questions:  **Activity 3:**	1. What is the information given by the bar graph? 2. In which year is the increase in the number of students maximum? 3. In which year is the number of students maximum? 4. State whether true or false: 'The number of students during 2005-06 is twice that of 2003-04.' 1. What is the information given by the double bar graph? 2. In which subject has the performance improved the most? 3. In which subject has the performance deteriorated? 4. In which subject is the performance at par? 1. Give one daily life situation for	Understanding Statistical Graphs

	 The student has to retrieval the knowledge of various graphs which are we observe in daily life situations. 1. **Pictograph**: Pictorial representation of data using symbols. 2. **Bar graph**: A display of information using bars of uniform width, their heights being proportional to the respective values. 3. **Double Bar Graph:** A bar graph showing two sets of data simultaneously. It is useful for the comparison of the data. **ASSIGNMENT:** *(5 minutes)* Study the double bar graph and answer the questions that follow:	Pictograph which you observed in your life. 2. Give one daily life situation for Bar graph which you observed in your life. 3. Give one daily life situation for Double bar graphs.	



(a) What information does the double bar graph represent?

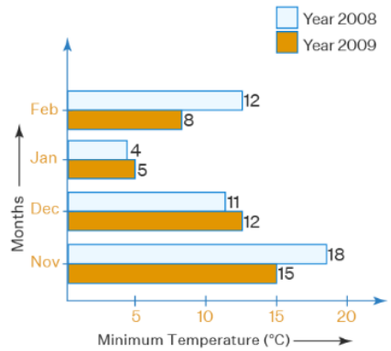
(b) Find the total number of boys in all sections of Class VII.

(c) In which sections, the number of girls is greater than the number of boys?

Summative Assessment Plan

(Only… where relevant)

Study the double bar graph given below and answer the questions that follow:



(a) What information is compared in the above given double bar graph?

(b) Calculate the ratio of minimum temperatures in the year 2008 to the year 2009 for the month of November.

(c) For how many months was the minimum temperature in the year 2008 greater than that of year 2009? Name those months.

(d) Find the average minimum temperature for the year 2008 for the four months.

(e) In which month is the variation in the two temperatures maximum?

Teachers' reflections and experiences:

1. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
2. How well did I manage the classroom during the lesson?
3. Were there any disruptions or behavioural issues that I need to address?
4. What strategies can I implement to improve classroom management?
5. Did the students actively participate and show interest in the lesson?

Chapter Plan (Unit plan/ lesson plan)

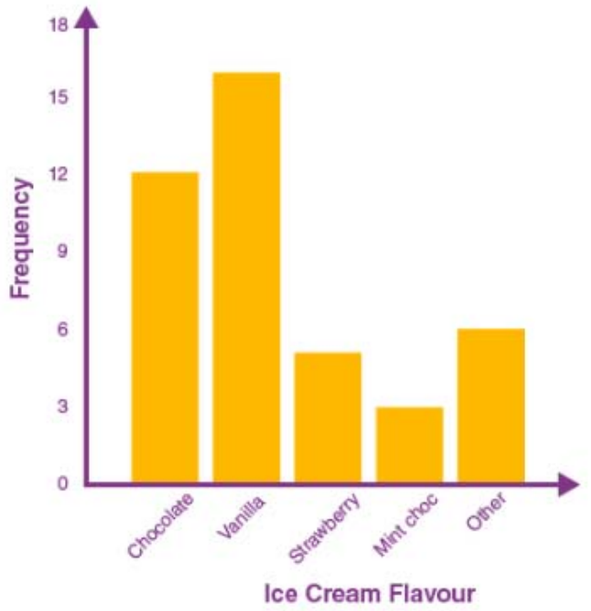
Period plan (40 Minutes)

Class: **09** **Subject: Mathematics** Chapter: **12. STATISTICS**

Total no. of periods for this chapter: **05** Period No: **02 / 05**

Subtopic: Drawing of Bar Graphs

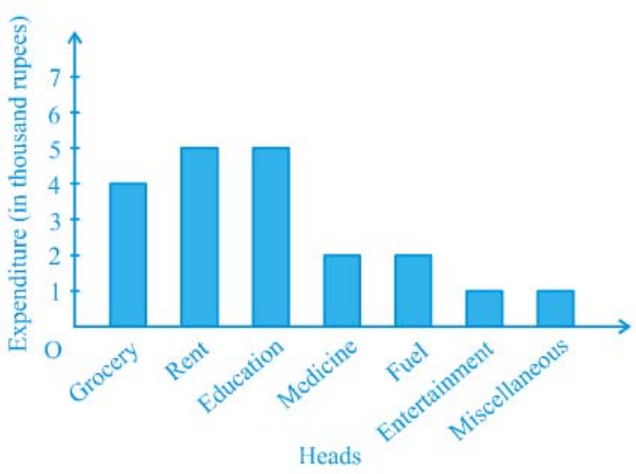
Learning Outcomes & Indicators / Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions / worksheets / experiments / assignments / self-assessment checklists/etc.	**Material Required**
Curricular Competencies: **C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1***Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science,*	**Introduction: (***10 minutes)* **Teacher asks the following questions and testing of previous knowledge** (Individual work followed by pair sharing and whole grouping sharing). **Activity:** *(10 minutes)* *Teacher has to recollect the information by asking questions for recall that a bar graph is a pictorial representation of data in which usually bars of uniform width are drawn with equal spacing between them on one axis (say, the X-axis), depicting the variable. The values of the variable are shown on the other axis (say, the Y-axis) and the heights of the bars depend on the values of the variable.*		**Statistical Graphs in daily life situations.**

Visual Arts, Music, Vocational Education, and Sports. **LEARNING OUTCOMES:** 1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs bar graph from ungrouped tabulated (qualitative) data. 3. Retrieves data-values (ungrouped and grouped) with a given frequency from a given frequency table.	 [Teacher play all videos and explain the concept and asks the students to write their observations] **Demonstration:** (25 minutes) A family with a monthly income of 20,000 had planned the following expenditures per month under various heads:	1. What are items involved in the bar graph.? 2. What we call the line of Ice cream flavor shown in the figure? 3. What we call the line of frequency shown in the figure? 4. Is common interval shown for denoting frequency on Y-axis or not? 5. Each bar shows for what? 6. How many children likes chocolate? 7. Which item less likely shows in the graph. 1. What do you observe for drawing the Bar graph? 2. How much budget expenditure amount allotted for Grocery? 3. Which item is allotted highest expenditure?	All about Bar Graphs **All videos in the following from tic tac learn English YouTube**

Heads	Expenditure (in thousand rupees)
Grocery	4
Rent	5
Education of children	5
Medicine	2
Fuel	2
Entertainment	1
Miscellaneous	1

Draw a bar graph for the data above.

By giving instructions students will draw the Bar graph:



ASSIGNMENT: *(5 minutes)*

The table below shows the favourite colour of 200 kids in a class.

Favourite Colours	Red	Green	Blue	Yellow	Orange

4. How much amount is allotted for entertainment?
5. For what heading is used for X-axis and Y- axis?
6. Is total income equal to expenditure?

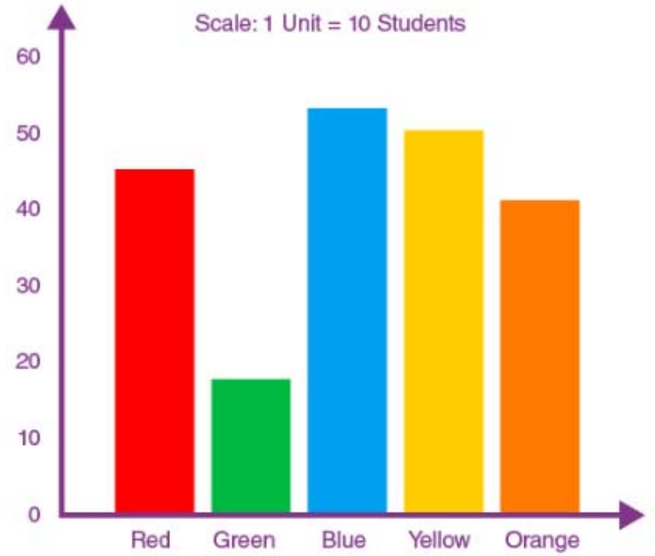
1. What are the items are given for drawing Bar Graph?
2. Mention the items for X-axis and Y-axis?

Bar Graph

Bar graph 2

Number of students	45	17	50	48	40

(1) Using the information provided, create a bar graph.
(2) Which colour is the most preferred and which colour is the least preferred?
(3) How many kids chose red as their favorite color?



3. What is the scale for drawing for bars?
4. Do you use colors for each bar?

Bar graph 3

Bar graph4

Summative Assessment Plan

1. Draw a bar graph using the information in the table below.

A	B	C	D	E	F
200	300	225	350	275	325

(i) Which of the letters A, B, C, D, E, and F has the highest value?

(ii) Which of the following is greater: A + D or B + E?

Teachers' reflections and experiences:

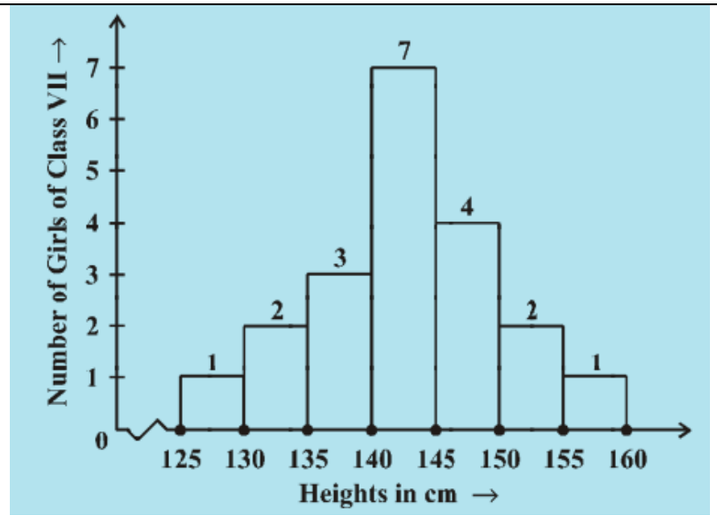
Chapter Plan (Unit plan/ lesson plan)

Period plan (40 Minutes)

Class: **09** **Subject: Mathematics** Chapter: **12. STATISTICS**

Total no. of periods for this chapter: **05** Period No: **03 / 05** **Subtopic: Construction of Histogram**

Learning Outcomes & Indicators / Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions / worksheets / experiments / assignments / self-assessment checklists/etc.	**Material Required**
Curricular Competencies: **C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1***Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science, Visual Arts, Music, Vocational*	**Introduction:** *(35 minutes)* **Teacher asks the following questions and testing of previous knowledge** (Individual work followed by pair sharing and whole grouping sharing). **The students ask for retrieval the previous knowledge by the following activities.** 1. Observe the Histogram and answer the questions given below.	1. What information is being given by the histogram? 2. Which group contains maximum girls? 3. How many girls have a height of 145 cms and more? 4. If we divide the girls into the following three categories, how many would there be in each? - 150 cm and more – Group A - 140 cm to less than 150 cm - Group B - Less than 140 cm — Group C	**Statistical Graphs in daily life situations.**

Education, and Sports. **LEARNING OUTCOMES:** 1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs histogram for grouped data with equal class-size. 3. Constructs histogram for grouped data with varying class-size. 4. Recognizes that any grouped data can be represented through a histogram and a frequency polygon. 5. Students will be able to create, compare, and interpret histograms	 **Demonstration:** (25 minutes) **Activity 1:** Teacher will give suggestions for drawing Histogram of the following problem when students drawing Histogram.	1. Identify the ranges of weights are given. 2. How many students are there? 3. What is the scale for number of students?	BYJU'S construction of histogram **Histogram of Uniform and Varying Widths**

Weights (in kg)	Number of students
30.5 - 35.5	9
35.5 - 40.5	6
40.5 - 45.5	15
45.5 - 50.5	3
50.5 - 55.5	1
55.5 - 60.5	2
Total	36

Student represent the weights on the horizontal axis on a suitable scale.

Students can choose the scale as 1 cm = 5 kg. Also,

Student represent the number of students (frequency) on the vertical axis on a suitable scale. Since the maximum frequency is 15, we need to choose the scale to accommodate this maximum frequency.

Students ask to draw rectangles (or rectangular bars) of width equal to the class-size and lengths according to the frequencies of the corresponding class intervals.

ASSIGNMENT: *(5 minutes)*

Identify whether the following statements are True or False:

A. Histograms represent a continuous form of data.

https://www.youtube.com/watch?v=ll-1OQM4nAA

	B. Bars are made with no gaps in between them to show the continuity of the data. C. The height of the bars represents the frequency of the data point, whereas the width represents the length of the class or interval. D. It is required that the calibrations on axes should begin with zero keeping equal intervals. Sometimes, we use a kink or a zig-zag line to show a break in the axes. E. If the chosen class intervals are uniform, then the area of bars directly varies according to the frequency of the class interval.		

Summative Assessment Plan

Question: The following table gives the lifetime of 400 neon lamps. Draw the histogram for the below data.

Lifetime (in hours)	Number of lamps
300 – 400	14
400 – 500	56
500 – 600	60
600 – 700	86
700 – 800	74
800 – 900	62
900 – 1000	48

Teachers' reflections and experiences:

1. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
2. How well did I manage the classroom during the lesson?
3. Were there any disruptions or behavioural issues that I need to address?
4. What strategies can I implement to improve classroom management?
5. Did the students actively participate and show interest in the lesson?

Chapter Plan (Unit plan/ lesson plan)

Period plan (40 Minutes)

Class: **09** **Subject: Mathematics** Chapter: **12. STATISTICS**

Total no. of periods for this chapter: **05** Period No: **04 / 05**

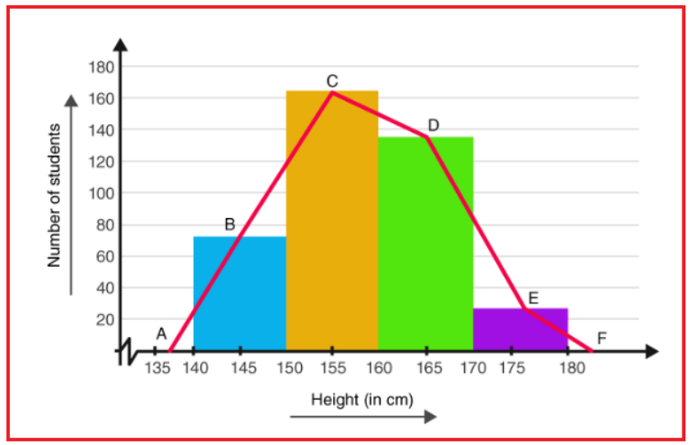
Subtopic: Frequency Polygon through Histograms.

Learning Outcomes & Indicators / Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions / worksheets / experiments / assignments / self-assessment checklists/etc.	**Material Required**
Curricular Competencies: **C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1***Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science, Visual Arts, Music, Vocational*	**Introduction: (***10 minutes)* **Teacher asks the following questions and testing of previous knowledge** (Individual work followed by pair sharing and whole grouping sharing). **Activity:** *(10 minutes)* 1. What's the purpose of a histogram? 2. What is the shape of the histogram? 3. Is the width of the rectangles of histogram equal? 4. Where do we use histogram in real life? 5. Which one of the following is not the graphical representation of statistical data: (a) Bar graph (b) Histogram (c) Frequency polygon (d) Cumulative frequency distribution 5. In a histogram the area of each rectangle is proportional to:		**Statistical Graphs in daily life situations.** **How to Draw a Frequency Polygon** BYJU'S

Education, and Sports. **LEARNING OUTCOMES:** 1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon. 2. Constructs histogram for grouped data with equal class-size. 3. Constructs histogram for grouped data with varying class-size. 4. Recognizes that any grouped data can be represented through a histogram and a frequency polygon. 5. Constructs frequency polygon for grouped data through the mid values of histograms.	(a) the class mark of the corresponding class interval (b) the class size of the corresponding class interval (c) frequency of the corresponding class interval (d) cumulative frequency of the corresponding class interval **Demonstration:** (25 minutes) Teacher will demonstrate the drawing of frequency polygon through Histogram by the following steps: To draw frequency polygons, first we need to draw histogram and then follow the below steps: • **Step 1**- Choose the class interval and mark the values on the horizontal axes • **Step 2-** Mark the mid value of each interval on the horizontal axes. • **Step 3**- Mark the frequency of the class on the vertical axes. • **Step 4**- Corresponding to the frequency of each class interval, mark a point at the height in the middle of the class interval • **Step 5**- Connect these points using the line segment. • **Step 6**- The obtained representation is a frequency polygon. **Activity:** In a batch of 400 students, the height of students is given in the following table. Represent it through a frequency polygon. **Height (in cm)** | **Number of Students**	1. How many are the children? 2. Identify the age groups? 3. How many rectangles are to draw? 4. What is the mid value of 140 – 150? 5. Draw the histogram for the given problem?	**Frequency Polygon | Part 1/3 | English | Class 9 TicTacLearn English** **Examples**

140 -150	74
150 - 160	163
160 - 170	135
170 - 180	28
Total	400

Construct the histogram and draw frequency polygon:



ASSIGNMENT: *(5 minutes)*

Draw the histogram and the Frequency polygon in the same figure for the following distribution:

class Interval	0-30	30-60	60-90	90-120	120-150	Total
Frequency	7	4	5	10	6	32

6. Point the mid value of the first rectangle of the histogram.
7. Join the all midpoints which marked on top of the rectangles.

Describe about frequency polygon in your own words?

1. What are the class intervals are given?
2. How many rectangles of Histogram can we draw?
3. What is class interval of the highest rectangle?

Examples

Summative Assessment Plan

1. Draw histogram for the following and draw frequency polygon

Class Interval	15	45	75	105	135	Total
Frequency	7	4	5	10	6	32

Teachers' reflections and experiences:

1. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
2. How well did I manage the classroom during the lesson?
3. Were there any disruptions or behavioural issues that I need to address?
4. What strategies can I implement to improve classroom management?
5. Did the students actively participate and show interest in the lesson?

Chapter Plan (Unit plan/ lesson plan)

Period plan (40 Minutes)

Class: **09** **Subject: Mathematics** Chapter: **12. STATISTICS**

Total no. of periods for this chapter: **05** Period No: **05 / 05**

Subtopic: Drawing of Frequency Polygon

Learning Outcomes & Indicators / Micro-Competencies	**Teaching-Learning Process** This should include activities to facilitate learning along with broad time duration	**Pointers for formative Assessment** This should include strategies that will be used to Check for Understanding - e.g., questions / worksheets / experiments / assignments / self-assessment checklists/etc.	**Material Required**
Curricular Competencies: **C - 6.1** *Applies measures of central tendencies such as mean, median, and mode* **C - 8.1** *Models daily-life phenomena and uses representations such as graphs, tables, and equations to draw conclusions* **C - 11.1***Applies mathematical knowledge and tools to analyze problems/ situations in multiple subjects across Science, Social Science, Visual Arts, Music, Vocational*	**Introduction:** *(10 minutes)* **Teacher asks the following questions and testing of previous knowledge** (Individual work followed by pair sharing and whole grouping sharing). **1.** How can you obtain frequency polygon through Histogram? **2.** Can you draw a frequency polygon without histogram? **3.** Do you know how can you draw a frequency polygon? **4.** How can you obtain frequency polygon through Histogram? **5.** What are the mid values/class marks for the classes: 10 – 20; 20 – 30; 30 – 40; **Demonstration:** (25 minutes)		**Statistical Graphs in daily life situations.**

Education, and Sports.

LEARNING OUTCOMES:

1. Analyses data by graphically representing it as bar graph, histogram (with equal and varying width and length), and frequency polygon.
2. Analyses data by representing it in a tabular form (grouped or ungrouped)
3. Constructs frequency polygon for grouped data through the mid values of histograms.
4. Retrieves data-values (ungrouped and grouped) with a given frequency from a given frequency table.

Teacher will demonstrate the drawing of frequency polygon without Histogram by the following steps:

The steps required to construct a frequency polygon in the case of continuous series without the help of a histogram are

1. Take the midpoints of the X-axis for class intervals and the Y-axis for frequency.
2. Plot the different frequencies, joining the points with a straight line.

Activity:

In a city, the weekly observations made in a study on the cost-of-living index are given in the following table:

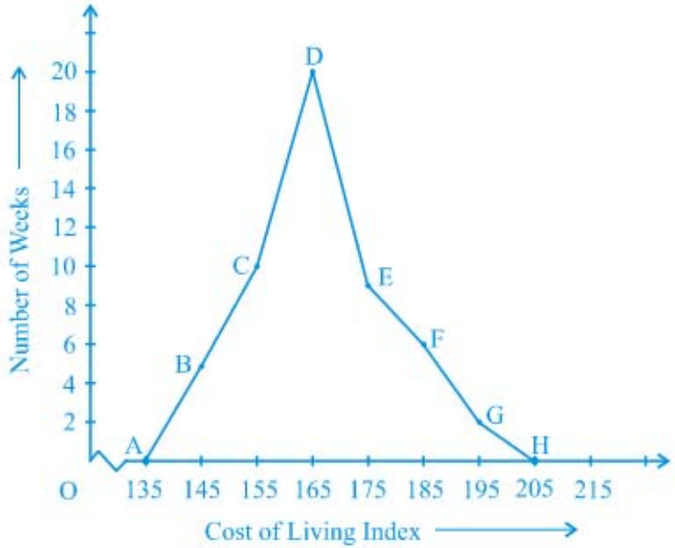
Cost of living Index	Number of weeks
140 - 150	5
150 - 160	10
160 - 170	20
170 - 180	9
180 - 190	6
190 - 200	2
	52

Draw the frequency polygon without drawing Histogram:

1. What are the class intervals?
2. How many are the class intervals?
3. What are the class marks for given class intervals?
4. Fill up the table with class marks for the class intervals.

Cost of living Index	Number of weeks	Class marks (Mid values)
140 - 150	5	...
150 - 160	10	...
160 - 170	20	...
170 - 180	9	...
180 - 190	6	...
190 - 200	2	...
	52	

What Is And How To Construct Make Draw A Frequency Polygon In Statistics - How To Find Class Midpoint Whats Up Dude



ASSIGNMENT: *(5 minutes)*

Draw the Frequency polygon without using Histogram:

class Interval	0-30	30-60	60-90	90-120	120-150	Total
Frequency	7	4	5	10	6	32

Summative Assessment Plan

1. Draw frequency polygon without constructing Histogram:

Class Interval	15	45	75	105	135	Total
Frequency	7	4	5	10	6	32

Teachers' reflections and experiences:

1. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
2. How well did I manage the classroom during the lesson?
3. Were there any disruptions or behavioural issues that I need to address?
4. What strategies can I implement to improve classroom management?
5. Did the students actively participate and show interest in the lesson?

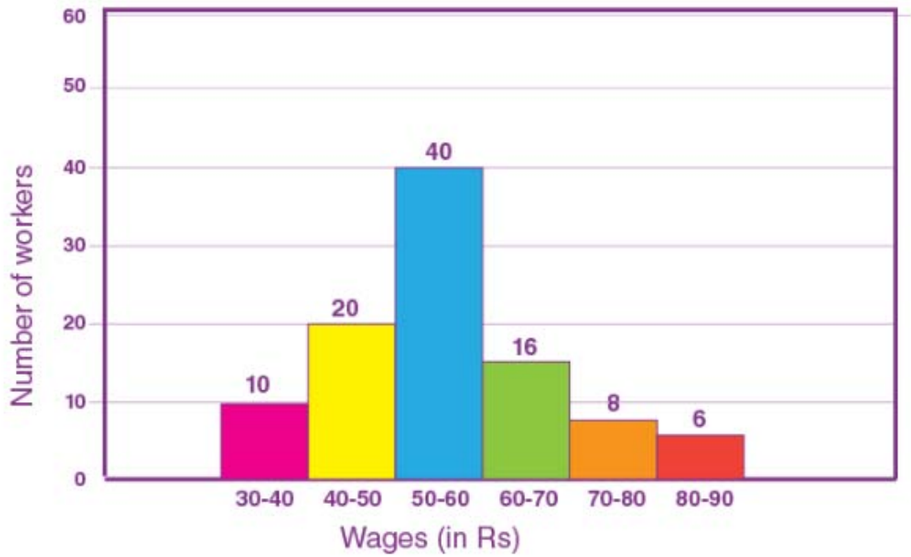
- Teachers utilize remaining periods for explaining exercise problems activities and for extended learning as per availability

For more practice and for extended learning

NCERT Exemplar

WORKSHEET ON STATISTICS

1. The below histogram shows the weekly wages of workers at a construction site:



Answer the following questions:

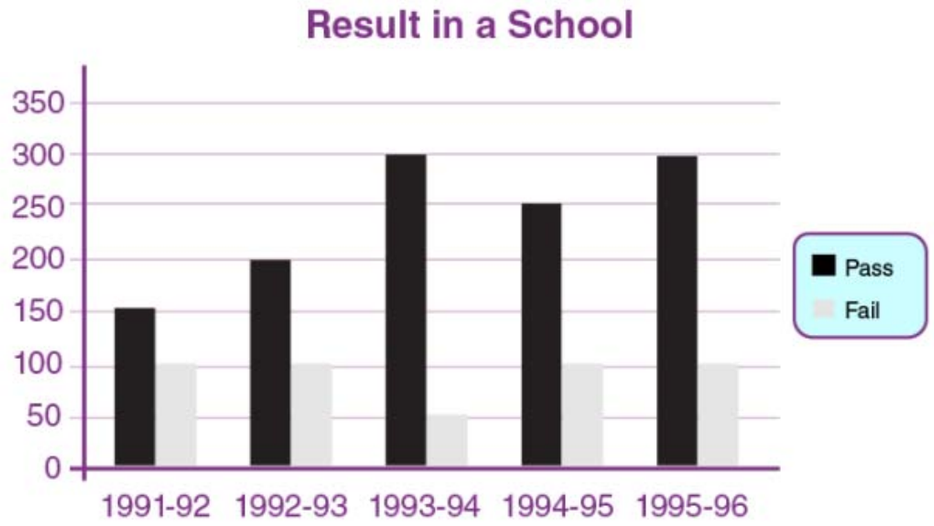
(i) How many workers get wages of ₹ 60-70?

(ii) Construct a frequency distribution table.

(iii) What is the cumulative frequency for the class 50-60?

(iv) What is highest frequency?

2. Examine the graph below carefully and answer the following questions. The graph depicts the results of a school's students.



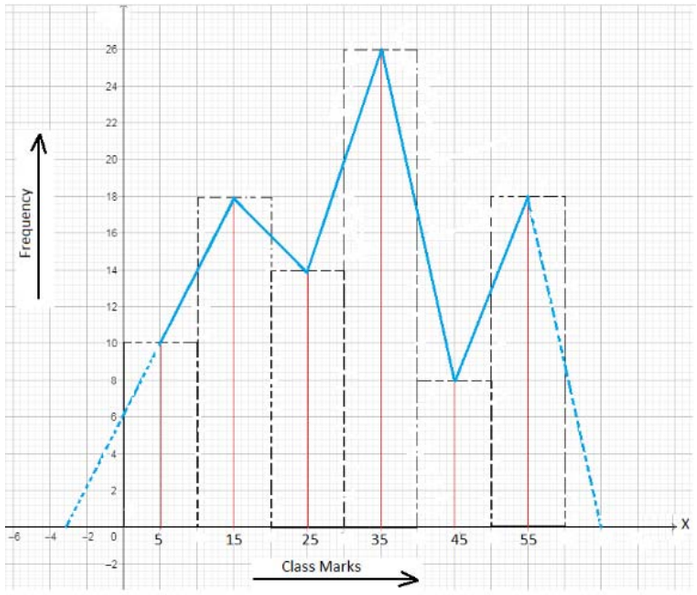
Answer the following questions:

(a) Which year has the smallest difference between the number of kids who passed and those who failed?

(b) In the last five years, what was the average number of kids who failed in school?

(c) How many times have the same number of kids failed?

3. The frequency polygon of a frequency distribution is shown below. Observe and answer the questions.



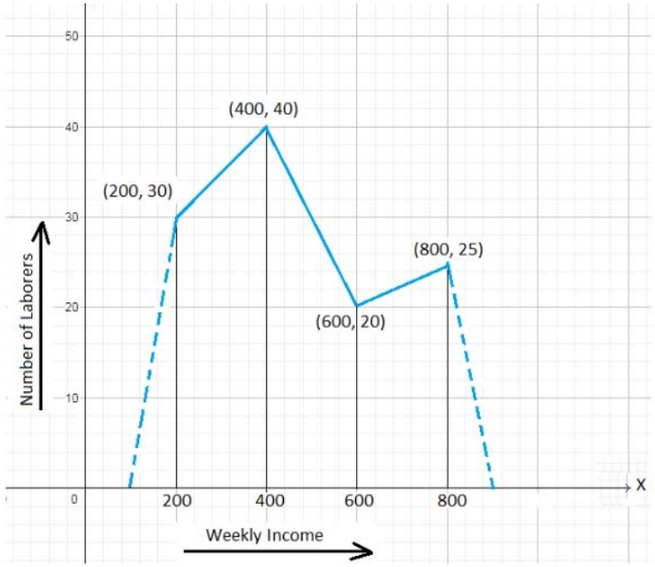
Answer the following questions:

(i) What is the frequency of the class interval whose class mark is 15?

(ii) What is the class interval whose class mark is 45?

(iii) what is the highest frequency?

5. The frequency polygon of a frequency distribution is shown below. Observe and answer the questions.



Answer the following questions:

(i) Find the class interval whose frequency is 25.

(ii) How many labourers have a weekly income of at least Rs 500 but not more than Rs 700?

(iii) How many members available for weekly income Rs 400.

REMEDIAL INSTRUCTION FOR THE CHAPTER STATISTICS

If necessary remedial reteaching the following concepts:

1. Introduction of Statistical Graphs
2. Construction of Bar Graphs
3. Constructions of Histogram
4. Frequency Polygon using Histogram
5. Frequency Polygons without using Histogram

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