TRAINING MODULE
MATHEMATICS
Class-IX

$$1729 = 12^3 + 1^3$$
$$1729 = 10^3 + 9^3$$

West Bengal Board of Secondary Education

School Education Department, Govt. of West Bengal

Planning and Development: Expert Committee, Department of School Education

TRAINING MODULE
MATHEMATICS
CLASS IX

School Education Department
Govt. of West Bengal

Bikash Bhavan, Kolkata- 700 091

West Bengal Board of Secondary Education

77/2, Park street, Kol- 700 016

July, 2020

The Teachers' Training Programme under RMSA will be conducted according to this module, developed by the Expert Committee and approved by the WBBSE, which will be coordinated by the SCERT.

About the Board

In 2011 the Honourable Chief Minister Smt. Mamata Banerjee constituted the Expert Committee on School Education of West Bengal. The Committee was entrusted upon to develop the curricula, syllabi and textbooks of the school level of West Bengal. The Committee therefore had developed school textbooks from Pre-Primary level, Class I to Class VIII based on the recommendations of National Curriculum Framework (NCF) 2005 and Right to Education (RTE) Act 2009. In 2016 the new curriculum and syllabus of 'Ganit' for Class IX came into effect and textbooks were developed accordingly. However, certain questions evoke in our minds: (i) How will the competencies of the learners modified, refined or improved in Class IX? (ii) How far can the learners establish themselves as citizens of value and responsibility at the end of Class IX? (iii)How far can the learners go beyond the limits of academic disciplines to apply knowledge in their social life? And in trying to find suitable answers for these questions the Expert Committee developed the framework of the Constructivist methodology for knowledge construction.

Following the recommendations of Samagra Shiksha Abhiyan (SSA), the Govt. of West Bengal has arranged an orientation programme of 'Ganit' for Class IX on the method of learning and evaluation. This 'Training Module' has been developed for the said orientation programme.

The Hon'ble Minister in Charge for Education, Dr. Partha Chatterjee, has enriched with his views and comments. We express our sincerest gratitude to him.

We hope that the orientation programme will be successful and have a lasting effect in the teaching-learning process of the future.

Kalyanmoy Ganguly

July, 2020

77/2, Park Street,

Kolkata - 700 016

President

West Bengal Board

of

Secondary Education

Preface

The Honourable Chief Minister Smt. Mamata Banerjee constituted the Expert Committee on School Education of West Bengal in 2011. The Committee was given the responsibility to review, reconsider and reconstitute all the aspects of the school curriculum, syllabi and textbooks. The new curriculum, syllabi and textbooks were developed based on the recommendations of the Expert Committee.
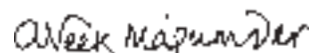
The school textbooks for all classes, from Pre-Primary level to Class VIII, were developed following the guidelines of NCF 2005 and RTE Act 2009. The textbooks for Class IX were developed based on the new curriculum and syllabus.

Following the recommendations of Samagra Shiksha Abhiyan (SSA), the Govt. of West Bengal has organized an orientation programme on the method of learning and evaluation of 'Ganit' for Class IX. This 'Training Module' has been developed for the said orientation programme.

The Hon'ble Minister in Charge for Education, Dr. Partha Chatterjee, has enriched us with his views and comments. We express our gratitude to him.

The State level Teachers' orientation programme on the methodology of learning and evaluation has been planned and executed in assistance with School Education Department, Govt. of West Bengal, West Bengal Board of Secondary Education and Samagra Shiksha Abhiyan (SSA). It is hoped that the 'Training Module', developed on behalf of School Education Department, Govt. of West Bengal, West Bengal Board of Secondary Education and Samagra Shiksha Abhiyan (SSA), will help in the effective implementation of the methodology of learning and evaluation.

July, 2020   Chairman
Nivedita Bhavan,   Expert Committee
5th Floor, Bidhannagar,   School Education Department
Kolkata- 700091   Govt. of West Bengal

Textbook Development Committee under Expert Committee

Planning and Development

Prof. AveekMajumder (Chairman, Expert Committee)

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Samagra Shiksha Abhiyan (SSA)

Introduction

The Right of Children to Free and Compulsory Education (RTE) Act, 2009, seeks to ensure that children enjoy the benefits of the three aspects of Access, Equity and Quality in school education across the nation. To this effect, the Ministry of Human Resource & Development (MHRD) in line with the proposal of the Union Budget, 2018 -2019 has initiated the scheme of SAMAGRA SHIKSHA ABHIYAN (SSA). The scheme takes a holistic stance in treating school education from Pre-Primary to Class XII as a continuum by merging the erstwhile Sarva Shiksha Abhiyan and Rashtriya Madhyamik Shiksha Abhiyan schemes in one, unified whole.

Scope of SSA

The Samagra Shiksha Abhiyan (SSA) collates the three Schemes of Sarva Shiksha Abhiyan, Rashtriya Madhyamik Shiksha Abhiyan and Teacher Education.The SSA scheme aims at improving school effectiveness measured in terms of equal prospects for schooling and equitable learning outcomes. In harmonizing the different and major effectual factors of school education, the SSA scheme provides for the operational mechanisms and transaction costs at all levels, particularly in using state, district and circle level systems and resources, besides envisioning one comprehensive strategic design for advancement of school education. The shift in the focus is from project objectives to refining systems level performance and schooling outcomes which will be the emphasis of the SSA scheme, alongwith encouraging States towards improving quality of education.

Major Objectives of SSA

The holistic nature of the scheme envisages Universal Access, Equity and Quality, promotion of Vocational Education, refurbishment of the use of Soft or e-Materials in schools and strengthening of Teacher Education.

The major objectives of the scheme are summarized below:

- **Provision of Quality Education and enhancing learning outcomes of students**

- **Bridging Social and Gender Gaps in School Education**

- **Ensuring Equity and Inclusion at all levels of School Education**

- **Ensuring minimum standards in schooling provisions**

- **Support States in implementation of Right of Children to Free and Compulsory Education (RTE) Act, 2009**

FEATURES OF CLASS IX TEXTBOOK (GANIT PRAKASH) AND METHODOLOGY OF KNOWLEDGE CONSTRUCTION

● Known to Unknown

According to the recommendations of National Curriculum Framework (NCF) 2005 the child should always be able to synthesize her/his school life and beyond. When the child comes to the classroom she/he brings with her/him some knowledge acquired from society and sourroundings. In the classroom she/he analyses the previous knowledge with mathematical logic and reconstructs it. The application of her/his reconstructed knowledge is also found and beyond the classroom scenario.

Hence, it is anticipated that the teachers will always start a lesson keeping in view on this aspect of learning (knowledge acquired beyond the classroom! reconstruction of knowledge in school! application of knowledge beyond the classroom).

In respect to the concept of Profit and Loss the child acquires knowledge (10% profit or loss or rebate etc.) beyond the classroom. In the classroom the child reconstructs knowledge of profit or loss percentage and thereby solves various real life problems. Again she/he applies this concept beyond the school premises.

● Learner Centric Education

In Learner centric education both the teacher and the learners are extremely active. The teacher has to make different types of Teaching Learning Materials (TLM) to keep the learners active. Observing the different level of progress of every learner the teacher facilitates them in knowledge construction for every lesson and encourages them for innovative thinking so that they can themselves invent something. For instance, in trying to solve Profit and Loss problems they will be encouraged to form linear simultaneous equations and solve the problem through graph

● Constructivist Learning

The learners should never learn anything by heart without understanding or knowing the reason behind it. In other words, knowledge should be constructed gradually by integrating the information from the environment and society on a particular topic with that from the teacher.

For instance, if the cost price and profit percentage is provided through graph, then the students should also learn to work out the selling price from the graph.

● Concrete to abstract

In teaching Mathematics, if the concept of Concrete to Abstract is developed among the learners they form clear concept on that lesson. Hence, the teacher should gradually lead the students from the concept of concrete to the concept of abstract.

For example if a book costs Rs.100 is sold at a profit/ loss of 10%, at what price will it be sold? In this way as the learners move from simple to complex abstract problems in concrete situations, clear concept is developed in them and mentally they can see the abstract in concrete form. Thus it is hoped that the learners will be able to solve real life problems.

- ## Activity Based Learning

Concept developed through activities help the learners to form clear idea on that lesson. If the teacher provides them activities or asks them to frame activities in excess of the ones given in the textbook, then the learners will be able to develop concept with more enjoyment and they can also explore the abstract concepts inherent in the lesson.

- ## Joyful learning

Learning can only be acquired if the students learn about a lesson in joyful environment. The teacher goes to the class with proper lesson plan on a specific topic, activities of the students etc. but unless the classroom environment becomes joyful the learners will be incapable of participating in the lesson in the appropriate frame of mind. Hence if the teacher makes the class environment joyful then it is hoped that the learners will be able to develop their concept about the topic with much ease and comfort.

- ## Integration of Curricular and Co-Curricular Activities

It is expected that the teachers of Mathematics will make use of various activities (like drawing, drama, music, debate etc) for knowledge construction since it has been advised for holistic development of the learners through different curricular and co-curricular activities. For example, various geometrical designs can be used for stage arrangement.

- ## Peer Learning

In the classroom situation if students are engaged into group activities on a particular topic, they can develop their concept themselves through group discussions. Many a time learners who develop concept at slow pace seek help from their peers who develop concept fast. In fact, it is through group learning practice of mutual cooperation develops among the learners.

For example while discussing on profit and loss, students may be divided into small groups and involved in an activity of finding out the profit or loss from the different data of buying price and selling price of the same commodity. Then they may be given the task to compare the data. The teachers may devise many other such activities for group learning.

- ## Integration of different subjects

After developing concept on a lesson of mathematics it is taken care of that the learners are able to integrate different subjects and issues of the society with their concept. As for instance the application of indices in different problems of Physical Science etc.

- ## Learning without Burden

Education becomes a burden to learners when they are considered to be participants of knowledge testing and textbook-centred examination. But now in learner centric education when students can construct knowledge from their experience and apply it for solving problems in real life, education becomes joyful and learning becomes burden free.

Looking at the number of pages or chapters of Mathematics textbook at the Madhyamik level, it may appear that mathematics has become much burdensome for the students of class IX. But a closer look will reveal that in every page, while discussing a topic, effort has been made so that the learners can themselves understand the topic and develop knowledge which can be applied logycally in solving different problems. Thus they also realise its importance in real life. Effort has been made to make the Mathematics textbook attractive for the learners by including a good collection of pictures.

In the Primary and Upper-Primary level if the knowledge construction of the learners is proper, then as the learners grow up to the Madhyamik level they can construct knowledge fast. Following the concept of National Cevel Curriculum Framework the burden of syllabus has been diminished in the Primary level but it has been gradually increased in the Upper Primary and Madhyamik level. Besides, to commensurate with the syllabus of Mathematics in classXI there has been changes in the mathematics syllabus for class IX.

The textbook at the Madhyamiklevel has not been loaded with information, intricate calculations and for solving problems. Instead it provides tales from the learners' known areas of knowledge, hands-on activities, solving problems through simple calculations which necessitates in real life thereby making the textbook burden free and enjoyable.

● **Quality Education**

According to the recommendations of RashtriyaMadhyamikSikshaAbhiyan (RMSA) it is hoped that there is no incompleteness in the knowledge building of the learner on any topic and also in its application. In other words it is hoped that the teacher would take care that the learner would reach the level of learning competency of that lesson. For example after developing the concept on Profit and Loss through problems related to percentage of profit, percentage loss, percentage of rebate, cost price, selling price, marked price etc. every student can solve different problems herself/himself or they themselves can select problems from real life and solve them.

● **Equity**

The teacher should be careful that in course of discussion on a topic while narrating a tale or of a problem there is no reference to any discrimination (gender, economic etc.).

● **Values**

The objectives of formal school education are to develop knowledge and on the other hand to make the learners socially responsible and true citizens of our nation. That is, she/he should not be a citizen separated from the society.

Hence, in various lessons of the textbook efforts have been made to develop values of different types through anecdotes like 'Planting of trees programme'(for reducing environment pollution), 'Celebration of birth anniversary of famous personalities' (knowing about them and their advice to become honest, true citizen), 'Let's share the food equally' (living alone is not life), 'Going to the market with grandfather' or 'Let's go to aunt's place' or Let's go to village house'(mainting good social and family relationship) etc.

● General idea of the textbook

Every lesson of the Mathematics textbook has started with a familiar environment of the learner. It is followed with innumerable hands-on activities so that the learners take part actively to get an initial idea of the lesson and feel the need of the lesson. Along with the hands-on activities some problems of real life are also provided so that they can logically solve the problems on the basis of the concept developed through hands-on activities. After that, in order to construct knowledge certain nomenclature and symbols of mathematics are provided at proper place. All the possible areas of learning in that lesson are provided so that the learners can easily and perfectly understand the topic to form knowledge. Finally, problems on critical thinking and solutions on abstract problems are also given. It is to be noted that modern education is not result oriented; it is Process and Product based. Hence, in the textbook emphasis has been given on methodology.

In short, the book deals with developing concept of a lesson through familiar knowledge, realizing the necessity of the lesson, developing logical concept through hands- on activities, developing analytical skill by solving simple problems, developing the skill to use logic by solving complex problems and finally manifestation of absolute logic by solving abstract problems of mathematics.

In spite of all these, the textbook is only a single tool of learning. In fact, it is not possible to make learner-centric education joyful for students in all schools across the state with a single textbook. But unfortunately, in our country textbook is considered to be the only means of education. ("The present day classroom practices, in almost all schools of the country, totally dominated by textbook... The textbook emerges as the single solution to all these problems."—National Curriculum Framework 2005, Position paper 2.3, Article no. 4.2.5, page no. 37). Hence, it is hoped if the teachers of all schools prepare different types of TLMs (including anecdotes) and various problems beyond the textbook, with respect to the quality of students of their respective schools, then teaching-learning would be truly joyful and the quality of education would be enhanced.

● Support according to specific requirement and gradual withdrawal of support

The textbook has been so designed that the learners can themselves construct knowledge and take help from their teacher when required.

● Anecdotes at lesson introduction followed by hands-on activity

If an abstract concept of mathematics is introduced at the very outset of the lesson, it is observed that mathematics becomes a phobia for most learners.However, if a lesson of mathematics begins with an anecdote on the problem of real life, the learners are able to understand the necessity of the lesson and so mathematics ceases to become a subject of phobia. Rather it becomes an interesting subject. Besides, most learners love to play, so they are involved in various hands-on activities which help them to develop logical construction of knowledge.

But this does not mean that in classroom transaction a lesson should always be started with the anecdote or activity included in the textbook. It is expected that the teacher will start the lesson with an anecdote or real life problem of her/his own considering the geographical, cultural position of the school and thus making the lesson attractive and interesting.

- **Empty spaces in the pages of the textbook**

If a learner reads and understands every page of the textbook and is able to construct knowledge logically, she/he will be able to fill up the empty spaces. The spaces are provided to assess whether the logical thinking of the learner is developed gradually. Besides, spaces are also provided so that the learner reads the textbook from the first page to the last page. Thus, a book of mathematics does not mean a book to solve problems in the section Let us calculate. The concept of reading a mathematics book has also to be developed.

Different branches of mathematics are not clubbed together.

In the textbook after a sequence of chapters on arithmetic there is a chapter on algebra followed by a chapter on geometry, then statistics after that on algebra.

The reason is different branches of mathematics often has connection with each other. For example, after acquiring the concept of area of a triangle in geometry if the learner develops the same concept of area of a triangle in mensuration, then the will be able to develop the concept in two branches and she/he will be able to prove it correctly. Hence, the chapters are arranged in this manner.

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- **Multiple choice questions and Short answer type questions**

If the learners are able to develop a concept of a lesson logically, they can think and expeditiously work out the solution of a problem. Hence, multiple choice questions and short answer type questions are provided in the textbook at the end of every lesson

- **Open Ended Question**

When various solutions are found for the same question on mathematics due to varied analytical thoughts and applications ofdifferent learners, then such questions are called Open ended. Remembering a particular information or re-execution of a particular skill is not enough to answer these type of questions. Whether the learners were able to construct their knowledge could be easily assessed in classroom with the help of Open ended questions. For this reason Open ended questions are included in the textbook

- **ICT based education**

According to the recommendations of RashtriyaMadhyamikSikshaAbhiyan (RMSA) for concept development on a topic of mathematics the use ICT (Information and Communication technology) along with other TLMs by the teachers would help the learners by making the abstract concepts of mathematics to concrete ones and so learning becomes enjoyable. In this respect the teachers may refer to some websites and demonstrate to the learners when it is possible.

Addressing Naive Concept

Some naive concepts of the learners are to be heeded with much care. They have to be advised that their notion is to some extent correct but it has certain flaws. They have to be facilitated to modify such naïve ideas into appropriate concepts. This method requires three steps:

(i) **Catch**

- The naive concept of the learners should not be promptly changed; rather they should be allowed to express themselves and their queries should be carefully listened.
- The learners should be encouraged to interact among themselves. Their discussion should be attended carefully.

(ii) **Challenge (to contradict and present problems initiating interest)**

- Logical explanation should be asked from the learners for substantiating their naive concept.
- They should be encouraged to express their opinions based on facts.

(iii) **Change (to facilitate in developing concept by replacing naive ideas)**

- Doubts should be generated among their minds about such naive concepts and thereby they should be guided towards proper concept.
- They should be encouraged to apply the proper concept for solving problems.
- They should be encouraged to implement their newly changed concept for solving real life problems.

For example, while solving problems on equation a number changes its sign by transposing. This naive concept often leads to errors like the following:

$$3 + 2x = 9$$
$$\Rightarrow \quad 2x = 9 - 3$$
$$\Rightarrow \quad 2x = 6$$
$$\Rightarrow \quad x = 6 - 2$$
$$\Rightarrow \quad x = 4$$

There should be discussion why this process is wrong and the reason behind it. By the application of the axioms of real numbers the learners should be helped to develop proper concept gradually.

Syllabus

1. **Real Numbers :**
   (i)   Concept of natural numbers, whole numbers, Integers, Rational Numbers, Algebric numbers.
   (ii)   Conversion of rational numbers to decimal number
   (iii) Representing real numbers on the number line.
   (iv)   Addition, Subtraction, Multiplication, Division of real numbers.
   (v)   Concept of the axioms on real numbers and solution of simple practical problems using that axioms.

2. **Laws of Indices**
   (i)   Concept of base, index, root, power.
   (ii)   Concept of index as integers, fractions.
   (iii) Fundamental laws of indeces and their applications.
   (iv)   Equation and Identity on indices

3. **Graph**
   (i)   Concept of rectangular cartesion plane and co-ordinates.
   (ii)   Concept of co-ordinates of point and represent it on cartesion plane.
   (iii) Concept of linear equations with one variable and two variables and the drawing of their graphs.
   (iv)   Solution of linear simultaneous equations by graph. Concept of one solution, many solutions and no solution.

4. **Co-ordinate geometry (Distance formula)**
   (i)   Concept of the formula of distance between two points on a cartesion plane and its application.

5. **Linear simultaneous equations (with two variables)**
   (i)   Solution of liner simultaneous equations (Elimination, Comparison, Substitutions and cross-multiplication method.
   (ii)   Solution of practical problems of linear simultaneous equation.

6. **Properties of parallelogram**
   (i)   Concept of quadrilaternal, trapezium, parallelogram, rectangle, square and rhombus.
   (ii)   Opposite sides and opposite angles of a parallelogram are equal and each diagonal divides it into two congruent triangles.—proof
   (iii) The diagonals of a parallelogram bisect each other. —proof
   (iv)   If the opposite sides of a quadrieateral are equal then the quadrilateral is a parallelogram—proof.
   (v)   If the opposite angles of quadrilateral are equal then the quadrilateral is a parallelogram—proof.
   (vi)   If a pair of opposite sides of a quadrilateral are equal and parallel then the quadrilateral is a parallelogram—proof.
   (vii) If the diagrals of a quadrilateral bisect each other then the quadrilateral is a parallelogram—proof
   (viii) Applications of the above statements.

7. **Polynomials:**
   (i)   Concept of polynomials of one or more than one variables
   (ii)   Concept of addition, subtraction, multiplication and division of polynomials

(iii) Concept of functions from polynomial

(iv) Concept of zero of polyamials

(v) Remainder theorem

(vi) Factor theorem

(vii) Concept of zero polynomial

(viii) Application of each of the above concepts

8. Factarisation : $a^2 - b^2$, $a^3 + b^3$, $a^3 - b^3$, $a^3+b^3+c^3-3abc$, vanishing method

9. Theorems on transvarsal and mid-point :

(i) The line-segment joining the mid-points of any two sides of a triangle is parralled to and half of the third side–proof.

(ii) The straight line drawn through the mid-point of a side of a triangle paralleled to second side bisects the third side and the intercept thus obtained from the paralleled straight line by two sides of the triangle is half of the second side—proof.

(iii) If the lengths of the intercepts made by three or more parallel straight lines on a transversal are equal, then the lengths of the intercepts made by them on any other transversal will also be equal—No proof is required, only verification

(iv) Application of the above statements

10. Profit & Loss : Concept and application of Cost-price, selling-price, Profit, Loss, Marked price, percentage of profit and loss on selling-price, Discount, Equivalent discount etc.

11. Statistics :

(i) Concept of tabulation of data.

(ii) Concept of formation of frequency distribution table.

(iii) Concept of cumulative frequency.

(iv) Construction of Histogram.

(v) Construction of frequency Polygon.

12. Theorems involving area

Concept of the Axiom : Area of a rectangle = length × breath

(i) "Parallelograms on the same base and between the same parallel are equal in area"—proof

(ii) Parallelograms on the equal bases and between the same parallels are equal in area. [Corollary]

(iii) Area of a parallelogram = Base of the parallelogram × Height [Corollary]

(iv) If a triangle and a parallelogram are on the same base and between the same parallels, the area of the triangle is half that of the parallelogram. — Proof

(v) Area of a triangle = ½ × Base × Height [Corollary]

(vi) Triangles on the same base and between the same parallels are equal in area — Proof.

(vii) Triangles on equal bases and between the same parallels are equal in area. [Corollary]

13. Construction : Construction of a parallelogram equal in area to a triangle whose one angle is given and its application.

14. Construction : Construction of a triangle equal in area to a quadrilateral and its application.

15. Determination of the perimeter and area of a triangle and quadrilateral :

    (i)   Determination of the perimeter and area of a triangle. Concept of Heron's formula. Application in practical problems.

    (ii)   Determination of the perimeter and area of Rectangle, Square, Parallelogram, Rhombus, Trapezium and application in practical problems.

16. Circumference of Circle : Ditermination of the circumference of circle. Concept of π and solution of practical problems using the formula of circumference of circle.

17. Concurrent : Theorems on Concurrence.

    (i)   The perpendicular bisectors of the sides of a triangle are concurrent. — Proof. concept of Circum centre, Circum radius, Circum circle.

    (ii)   The perpendiculars on the sides of a triangle from its opposite vertices are concurrent – Proof.

    (iii) The internal bisectors of the angles of a triangle are concurrent. — Proof. Concept of in-centre, in-radius and in-circle.

    (iv) The medians of a triangle are concurrent. Proof. Concept of centroid and centroid divides each memedian in the ratio 2 : 1.

    (v)   Applications of the above Statements.

18. Area of Circle : Concept of the formula of the area of a circular region, concept of the formula of the area of Sector of a Circle and Solution of practical problems.

19. Co-ordinate Geometry : Concept of the determination of formula of coordinates of a point when a Straight line Segment is divided internally or externally in a given ratio.

20. Co-ordinate Geometry :

    (i)   Area of triangular region formed by three points.

    (ii)   Area of quadrilateral shaped region formed by four point.

    (iii)   Condition of collinearity of three points.

    (iv)   Determination of the centroid of a triangle.

21. Logarithm :

    (i)   Necessity

    (ii)   Definition

    (iii)   Concept of Common Logarithm and Natural Logarithm.

    (iv)   Properties of Logarithm

    (v)   Application of Common Logarithm

Addenda : (Not for Evaluation)

22. Concept of Set theory.

23. Concept of Probability theory.

SELECTED LEARNING AREAS, KNOWLEDGE CONSTRUCTION AND LESSON FRAMEWORK

Topic: Real Numbers

Step 1: Learning areas of the students

The students will be able to identify different types of real numbers like natural numbers, whole numbers, integers, rational numbers, and irrational numbers and they will be able to understand that all these numbers are real numbers. They will learn that natural numbers are required for counting and what type of real numbers are needed for measuring length.

Methodology

The students will be given Activity sheets. They will answer the questions by working in groups. The answers of one group will be assessed by the other group and their comments will be given to the teacher. The teachers will try to understand whether the students have understood the concept on the basis of the answers and the comments given the students and thereby will facilitate the students to develop their knowledge.
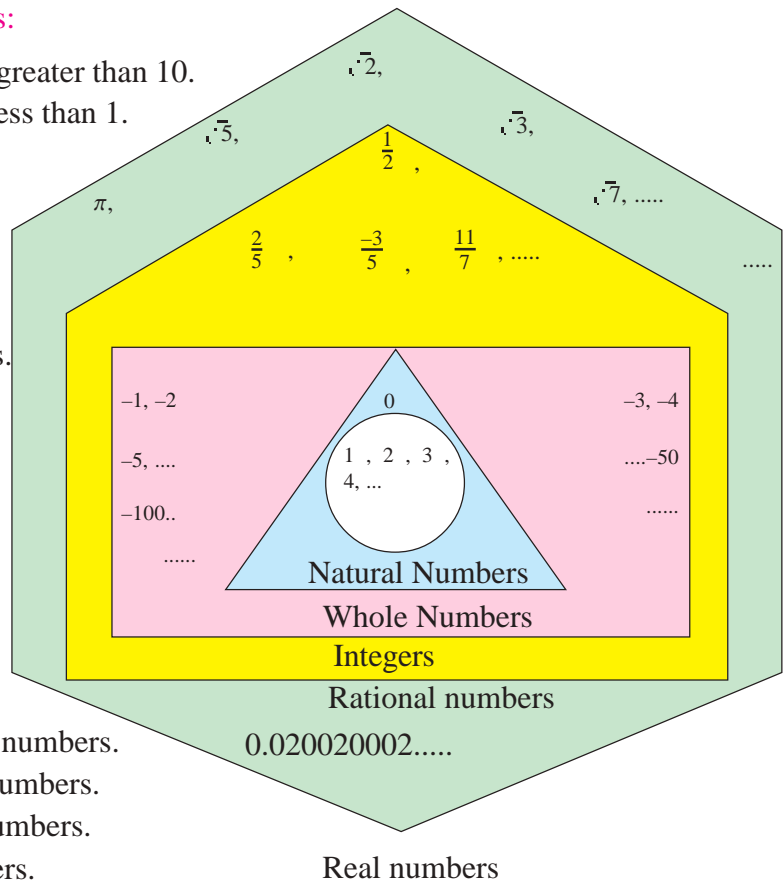
Worksheet - 1

1. Observe and answer:

There are different types of real numbers given in the following picture. Observe the picture carefully and answer the following questions:

- i) Write a natural number that is greater than 10.
- ii) Write a whole number that is less than 1.
- iii) Write four integers which are not natural numbers.
- iv) Write seven rational numbers which are not integers.
- v) Write seven real numbers which are not rational numbers.

2. Write whether the followings are True or False: (one is shown)

- i) All natural numbers are integers. (True)
- ii) All integers are rational numbers.
- iii) All rational numbers are real numbers.
- iv) All irrational numbers are real numbers.
- v) All real numbers are rational numbers.
- vi) All real numbers are natural numbers.
- vii) All rational numbers are integers.

$\sqrt{2}$, $\sqrt{5}$, $\sqrt{3}$, $\sqrt{7}$, ...

π,

$\frac{1}{2}$,

$\frac{2}{5}$, $\frac{-3}{5}$, $\frac{11}{7}$, ...

−1, −2   0   −3, −4

−5, ...   1 , 2 , 3 , 4, ...−50

−100..   ......

......

Natural Numbers

Whole Numbers

Integers

Rational numbers

0.020020002.....

Real numbers

11

viii) All irrational numbers are integers.

ix)   0 is a real number.

x)   1 is a real number.

xi)   -1 is a real number.

xii) 0 is a rational number.

xiii) 1 is a rational number.

xiv) 0 is an integer.

xv)   -1 is an integer.

xvi) 0 is an irrational number.

3. Fill in the blanks with words 'natural', 'whole', 'integer', 'rational', 'irrational' and 'real': (one is shown)

i)   Number 7 is a <u>real</u> number, a <u>rational</u> number, an <u>integer</u>, a <u>natural</u> number but not an <u>irrational</u> number.

ii)   Number -100 is neither a _____ number nor a _____ number but it is an _____ and also a _____ number.

iii) Number $\frac{3}{5}$ is neither a _____ number, nor a _____ number nor an _____ but it is a _____ number and also a _____ number.

iv)   Number 2.37 is a _____ number and also a_____ number but it is neither a_____ number, nor an _____ number nor a _____ number.

v)   Number 5 is a _____ number, a_____ number, an_____, a _____ number but it is not an _____ number.

4. Identify the correct answer:

i)   The lengths of the two adjacent sides containing the right angle of a right angled triangle are 1 cm. and 2 cm. respectively. The numerical value of the length of the hypotenuse of the triangle is

(a) an integer (b) a natural number (c) a rational number (d) an irrational number

ii) The length of one side of a square is $1/\sqrt{2}$ m. The numerical value of the area of the square is

(a) an integer (b)a natural number (c) a rational number (d) an irrational number

Step 2:

Learning areas of the students

i)   They will learn to plot the rational numbers on the number line.

ii)   They will learn to plot a rational number between two rational numbers on the number line.

iii) They will learn to plot infinite number of rational numbers between two rational numbers on the number line.

iv)   They will learn to plot irrational numbers like √2, √3, √5 on the number line.

v)   They will learn the method to plot irrational number between two rational numbers on the number line.

The teacher will help the students to learn the concepts. Worksheets are to be provided to the students and the teacher will try to assess whether the students have understood the concepts

(For placing numbers on the number line 0 and 1 are to be plotted on the number line soon after the straight line is drawn.)

1. i) Plot the numbers 1/4 and -1/2 on the number line by using compass.

    ii) Explain with reason that there are infinite rational numbers between 0 and 1.

2. i) Plot the numbers √2, √3 and √5 on the number line by using compass.

    ii) Explain with reason that there are infinite irrational numbers between 0 and 1.

    iii) Plot the numbers -√6, -√8 and -√11 on the number line by using compass.

Step 3:

Learning areas of the students

    i) Learning to express a vulgar fraction into decimal.

    ii) Learning to express some irrational numbers into decimal.

    iii) Learning about the types of vulgar fractions that become terminating decimals when expressed into decimals and also about the types of vulgar fractions that become recurring decimals when expressed into decimals.

    iv) Irrational numbers when expressed into decimals become non-terminating and non-repeating decimals.

The teacher will help the students to learn the concepts. Worksheets are to be provided to the students and the teacher will try to assess whether the students have understood the concepts.

Worksheet - 3

1. i) Express the following vulgar fractions 17/2, 17/5, 17/20, 17/6, 17/14 into decimals and say which of them are terminating, recurring

    ii) Express the following irrational numbers √3, √11and √7into decimals and say which of them finite/infinite, recuring/non-repeating.

Step 4:

Learning areas of the students

    i) The concept of different laws followed by the real numbers with respect to addition and multiplication like Associative law, Commutative law and Distributive law etc.

    ii) The different laws followed by real numbers in respect to = and < sign.

The teacher will help the students to learn the concepts. Worksheets are to be provided to the students and the teacher will try to assess whether the students have understood the concepts.

1. Write whether the followings are True or False: a, b, c are any three real numbers:

i) $a = b, b = c \Rightarrow a = c$

ii) $a < b, b < c \Rightarrow a < c$

iii) $a = b \qquad \Rightarrow a + c = b + c$

iv) $a < b \qquad \Rightarrow a + c < b + c$

v) $a = b \qquad \Rightarrow a \times c = b \times c$

vi) $a < b \qquad$ and $0 < c \Rightarrow a \times c < b \times c$

vii) $a < b \qquad \Rightarrow a \times c < b \times c$

viii) $a < b$, $b = c \Rightarrow a = c$

ix) $a = b$, $b < c \Rightarrow a = c$

x) $a < b \qquad \Rightarrow a \times 0 < b \times 0$

2. Put ($\checkmark$) sign beside the correct and ($\times$) sign beside incorrect ones: a, b, c are three real numbers. Explain with examples which are incorrect. (one is shown)

i) $a + b \quad = b + a$

ii) $a - b = b - a \qquad \times \quad$ (e.g., $5 - 3 \neq 3 - 5$)

iii) $a \times b = b \times a$

iv) $a \div b = b \div a$

v) $a + (b + c) = (a + b) + c$

vi) $a - (b - c) = (a - b) - c$

vii) $a \times (b \times c) = (a \times b) \times c$

viii) $a \div (b \div c) = (a \div b) \div c$

ix) $a \times (b + c) = a \times b + a \times c$

x) $a + (b \times c) = (a + c) \times (b + c)$

xi) $a + 0 = 0 + a$

xii) $a + 1 = 1 + a$

xiii) $a \times 1 = 1 \times a$

xiv) $a + (- a) = (- a) + a = 0$

xv) $a \times \dfrac{1}{a} = \dfrac{1}{a} \times a = 1$, when $a \neq 0$

Learning methodology : 5E model

Engagement

Ellaboration → Evaluation ← Exploration

Explanation

Topic : Real Numbers

Steps	Examples
Engage : [Generate interest] To encourage the need of different real numbers	For instance, explaining the importance of all types of numbers , from natural number to irrational number for counting and measurement , with the help of examples
Explore : [Establish relationship and understanding] To explore the relationship of different kinds of real numbers	For instance, (i) creation of negative integer due to the subtraction of two natural numbers;(ii) creation of rational number due to the division of two integers (divisor is non- zero)
Explain : [Communicate new understanding] To understand the rules followed by the real numbers with respect to addition, subtraction, multiplication, division and $<, >, =$ etc.	For instance, $a+b = b+a$, $a(b+c) = ab+ac$, $a=b \Rightarrow a+c = b+c$, $a=b \Rightarrow ac = bc$; and $a > b, c > 0$ $\Rightarrow ac>bc$ etc.
Extend/Elaborate : [Apply new learning to a new or similar situation] To be able to apply the understanding about real numbers in problem solving	For instance, solution of the equation $x+3 = 2(x+5)$ $\Rightarrow x+3 = 2x+10$ [Distributive law] $\Rightarrow -2x+x+3 = -2x+2x+10$ $\Rightarrow -x+3 = 0 +10$ $\Rightarrow -x+3 = 10$ $\Rightarrow -x+3-3= 10-3$ $\Rightarrow -x+0 = 7$ $\Rightarrow -x =7$ $\Rightarrow (-1) . (-x) = (-1) . 7$ $\Rightarrow x = -7$
Evaluate : [Apply within problem situation] To be able to apply the concept of real numbers in overcoming various real life problems	For instance, Hari's profit is Rs. 5 more than of mine. If Rs. 3 is added to my profit then it becomes double the sum of Hari's profit. Let's calculate my profit. (Learning to solve by forming Linear equation) (In this case my profit is Rs. -7, that is my loss is Rs.7)

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LINEAR SIMULTANEOUS EQUATIONS (TWO VARIABLES)

Syllabus

(i)   Solving simultaneous equations by graph

(ii)   Nature of solving simultaneous equations

(iii) Solving simultaneous equations by algebraic method

(iv) Solving real life problems of simultaneous equations

Key words

(i)   Linear simultaneous equations

(ii) Graph of simultaneous equations

(iii) Solving simultaneous equations by graph

(iv) Solvability of simultaneous equations

(v)   Solving by elimination method

(vi) Solving by comparison method

(vii) Solving by substitution method

(viii) Solving by cross-multiplication method

Previous Knowledge

(i) Equations (ii) Graph (iii) Co-ordinates (iv) Cartesian plane (v)Abscissa (vi)Ordinate (vii) x- axis (viii) y-axis (ix) algebraic expressions (x) algebraic equations (xi)solution of one variable equations

Learning Competency [LC]

LC-1 Developing concept of Linear Simultaneous Equations

LC-2 Developing concept of solvability of Linear Simultaneous Equations and number of solutions

LC-3 Developing concept of Linear Simultaneous Equations through graph

LC-4 Developing concept of common solvability from the ratio of the co-efficients of Linear Simultaneous Equations

LC-5 Developing concept of solutions of Linear Simultaneous Equations by the method of Elimination

LC-6 Developing concept of solutions of Linear Simultaneous Equations by the method of Comparison

LC-7 Developing concept of solutions of Linear Simultaneous Equations by the method of Substitution

LC-8 Developing concept of solutions of Linear Simultaneous Equations by the method of Cross multiplication

LC-9 Developing concept of the application of Linear Simultaneous Equations in real life problems

LINEAR SIMULTANEOUS EQUATIONS (TWO VARIABLES) — LESSON FRAMEWORK

Identification of axis, quadrant, co-ordinates in graph paper	→ Worksheet 1

↓

Plotting co-ordinates in graph paper

↓

Construction of straight line segment in graph paper	→ Worksheet 2

↓

Linear equation of one variable	→ Linear equation of two variables

↓

Linear equations (with one variable, two variables)	→ Worksheet 3

↓

Linear simultaneous equations

↓

LC-1 ←	Graph of linear simultaneous equations

↓

Relation between different graphs

↓

LC-2 ←	Consistency of common solution of linear simultaneous equations and concept of number of solutions	→ Worksheet 4

↓

LC-3 ←	Solution of linear simultaneous equations using graph	→ Worksheet 5

↓

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┌─────────────────────────────┐
│   Relation of the ratio of the   │
│  coefficients of the same variables │
│        and the constants        │
└─────────────────────────────┘
                │
                ▼
┌─────────────────────────────┐        ┌──────────────────┐
│  Inference regarding the solution of  │ ───▶ │   Worksheet 6    │
│     the simultaneous equations     │        └──────────────────┘
└─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-4  │ ◀── │  Concept of consistency of the common  │ ───▶ │   Worksheet 7    │
└────────┘     │   solution of simultaneous equations   │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-5  │ ◀── │      Solution by the method      │ ───▶ │   Worksheet 8    │
└────────┘     │         of elimination          │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-6  │ ◀── │    Solution by the method of     │ ───▶ │   Worksheet 9    │
└────────┘     │         comparison              │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-7  │ ◀── │    Solution by the method        │ ───▶ │  Worksheet 10    │
└────────┘     │       of substitution           │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-8  │ ◀── │    Solution by the method        │ ───▶ │  Worksheet 11    │
└────────┘     │    of cross-multiplication       │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
┌────────┐     ┌─────────────────────────────┐        ┌──────────────────┐
│  LC-9  │ ◀── │ Application of the solution of simulta- │ ───▶ │  Worksheet 12    │
└────────┘     │ neous equations in real life problems   │        └──────────────────┘
                └─────────────────────────────┘
                │
                ▼
        ┌──────────────────────┐
        │  Worksheet - Multiple   │
        │   choice questions      │
        └──────────────────────┘
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Activity Skill Matrix

Activity	Topic of Activity	Skills to be developed
Worksheet - 1	Identification of axes, quadrants and co-ordinates	(i) Concept of geometry (ii) Construction (iii) Concept of Cartesian plane
Worksheet - 2	Plotting of co-ordinates in graph paper and construction of straight line segment	(i) Concept of geometry (ii) Concept of construction in graph paper
Worksheet - 3	Elementary topics on Linear simultaneous equations	(i) Knowledge of Linear simultaneous equations (ii) Idea about what is linear simultaneous equations
Worksheet - 4	Graph of simultaneous equations	(i)Concept of Cartesian plane (ii) Concept of geometry
Worksheet - 5	Solution of simultaneous equations through graph	(i) Construction of graph (ii) Solution through constructions in graph
Worksheet - 6	From the relation of the ratio of the co-efficients of the same variables and the constants in simultaneous equations and the algebraic expression of solution	(i)Application
Worksheet - 7	Solvability of common solution of simultaneous equations in respect to the ratio of the coefficient of the variables of the simultaneous equations	(i) Knowledge of simultaneous equations (ii) Concept of simultaneous equations (iii) Application
Worksheet - 8	Method of Elimination	(i) Concept of the word Elimination (ii) Skill of calculation
Worksheet - 9	Method of Comparison	(i) Concept of the word Comparison (ii) Skill of calculation

Activity	Topic of Activity	Skills to be developed
Worksheet - 10	Method of Substitution	(i) Concept of the word Substitution (ii) Skill of calculation
Worksheet - 11	Method of Cross multiplication	(i) Concept of the word Cross multiplication (ii) Skill of calculation
Worksheet - 12	Real life problems	(i) Formation of simultaneous equations (ii) Concept of solution
Worksheet— MCQ	All chapters	(i) Skill of logical knowledge construction

Worksheet - 1

Name of the student:_____   Roll no._____

Tick (√)in the correct box: (one is shown)

Co-ordinates of the point	Position					
	First quadrant	Second quadrant	Thirdquadrant	Fourthquadrant	x- axis	y-axis
1. (0,5)						√
2.(-2,5)						
3.(-2,-5)						
4.(2,5)						
5.(5,0)						
6(-5,0)						
7.(-5,-7)						
8.(10,10)						
9.(5,5)						
10.(0,0)						

Worksheet - 2

Name of the student:_____   Roll no._____

1. Plot the points in the graph paper:

(i) (1, 2)   (ii) (–2, 5)   (iii) (5, –5)   (iv) (5, 0)

(v) (0, 7)   (vi) (–7, –7)   (vii) (7, 8)   (viii) (5, 5)
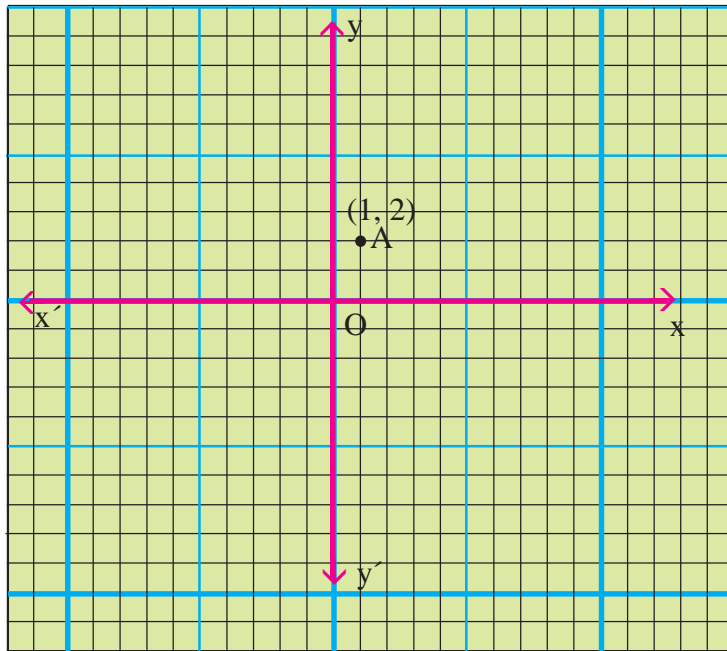
2. Write the co-ordinates of the points given in the graph:
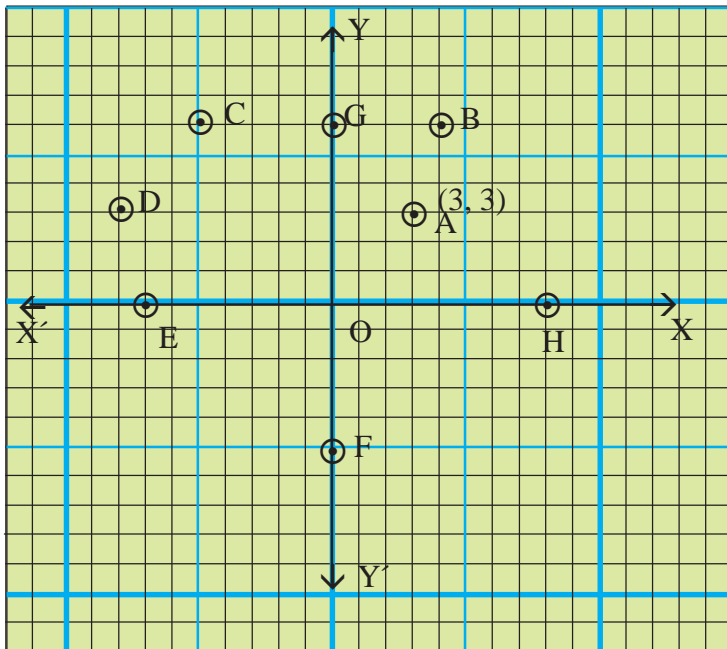
A :

B :

C :

D :

E :

F :

G :

H :

3. Plot the points in the graph paper and draw the line segments:

(i) A : (5, 7),   B : (– 5, 5)   C : (2, 3)

(v) D : (5, 0),   (vi) E : (0, 7)   F : (–2, –5)

AB, BD, EF, CD, DF Draw the straight line segments
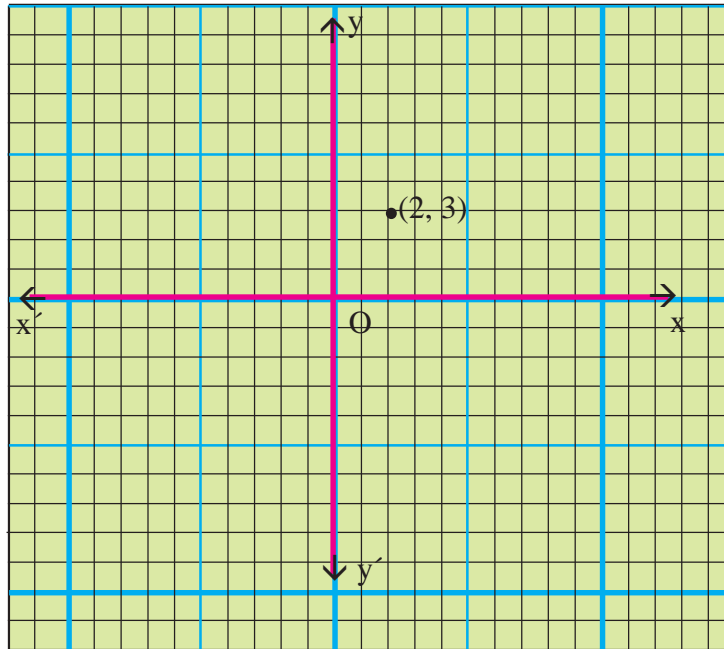
Worksheet - 3

Name of the student:_____   Roll no._____

Tick (√) in the correct box: (one is shown)

Linear equation	One variable	Two variables	Variable(s)	Co-eff. of x	Co-eff. of y
1. $5x + 3 = 10$					
2. $x = 5$					
3. $\frac{5}{7}x + 3 = 10$					
4. $x + y = 15$					
5. $8x + 10y = 86$					
6. $5x = 7y$					
7. $\sqrt{2}x + 7y = 3$					
8. $7x + 8 = 3x$					
9. $8x - 5y = 0$		√	x, y	8	−5
10. $-2x - 5y = 10$					

Name of the student:_____   Roll no._____

1. Answer the following questions form the graph:
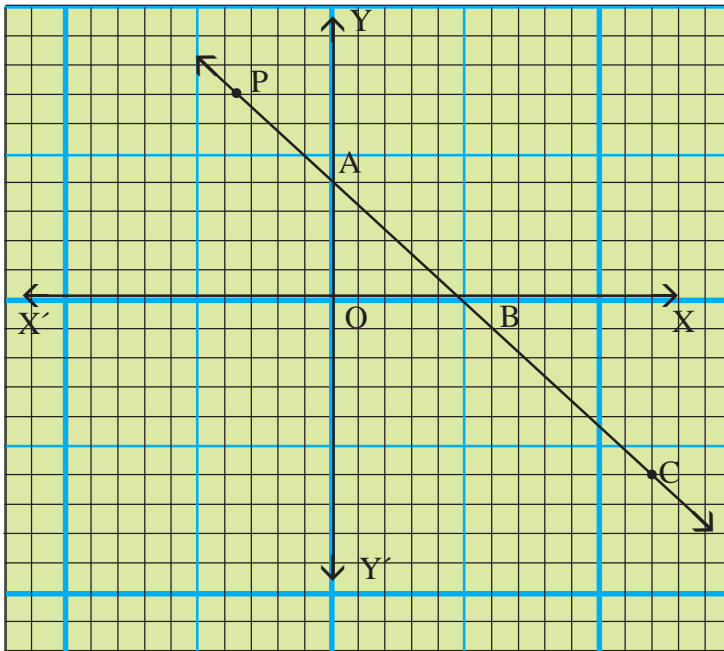
Graph of the equation

$4x + 5y = 20$

(i) Write the co-ordinates of the points A, B, C

(ii) Write two solutions of the equation 4x+5y=20

(iii) Write how many solutions do you find for the equation 4x+5y= 20

2. In the graph draw the following simultaneous equations and write the relation between the graphs of the equations in each case:

      (i) $x + y = 20,\ 10x + 5y = 140$

      (ii) $2x + 3y = 28,\ 4x + 6y = 56$

      (iii) $3x + 5y = 12,\ 3x + 5y = 20$

1.Draw the following simultaneous equations in the graph paper and find out the common solutions:
    (i) $2x + 3y = 7$, $3x + 2y = 8$
    (ii) $7x + 3y = 42$, $21x + 9y = 42$
    (iii) $p - q = 3$, $8p - 8q = 5$

1.   Find out the ratio of the coefficients of the same variables and constants in the given pair of equations and state whether the lines of the graphs will be parallel, intersecting, or coinciding:

    (i) $4x - 3y = 6$

        $4y - 5x = -7$

    (ii) $2x + 3y = 10$

        $5x + 4y = 11$

    (iii) $x + y = 0$

          $x - y = 2$

    (iv) $4x + 3y = 11$

          $4x + 5y = 13$

1.   Examine the consistency of the following simultaneous equations.

    (i) $4x + 3y = 20$

       $8x + 6y = 40$

    (ii) $2x + 3y = 10$

          $5x + 4y = 11$

    (iii) $p - q = 3$

        $\dfrac{p}{3} + \dfrac{p}{3} = 6$

1.   Solve the following simultaneous equations by the method of elimination:

    (i) $x + y = -4$

       $3x - 5y = -1$

    (ii) $x + y = 3$

         $-3x + 2y = 1$

    (iii) $\dfrac{4}{y} + \dfrac{3}{x} = 8$

         $\dfrac{6}{y} + \dfrac{5}{x} = 13$

1. Solve the following simultaneous equations by the method of comparison:

(i) $4x - 3y = 23$

    $3x + 4y = 11$

(ii) $\dfrac{4}{p-3} + \dfrac{6}{q-4} = 5$

    $\dfrac{5}{p-3} \quad \dfrac{3}{q-4} = 1$

(iii) $x - y = 3$

    $+ \dfrac{x}{3} = 6\dfrac{y}{2}$

1. Solve the following simultaneous equations by the method of substitution:

(i) $2x - y = 3$

    $4x + y = 3$

(ii) $x + y = 7$

    $2x - 3y = 9$

(iii) $-3x + 2y = 5$

    $4x + 5y = 2$

1. Solve the following simultaneous equations by the method of cross-multiplication:

(i) $3a + 4b = 43$

    $-2a + 3b = 11$

(ii) $5x + \dfrac{4}{y} = 7$

    $4x + \dfrac{3}{y} = 5$

1. Answer the following questions:

    i. Shubhodeep will write a two-digit number and sum of the two digits will be 11. If 63 is added to the number the two digits interchange their positions. Let's form the simultaneous equation and solve it. Also find out the two digits number.

    ii. Last year in the Bakultala Panchayat election Rahulbabu and Sanjaybabu were candidates. Rahulbabu defeated Sanjaybabu by 75 votes. If 20% people who voted in favour of Rahulbabu had cast their votes for Sanjaybabu, then Sanjaybabu would have won the election by 19 votes. Form the simultaneous equation and work out how many votes each of them got.

1. Multiple Choice Questions (MCQ)

(i) The two equations $8x+5y=11$ and $3x-4y=10$ have—

    (a)   a unique common solution   (b) infinite common solutions

    (c)   no common solution   (d) two unique common solutions

(ii) The two equations $5x+8y=12$ and $10x+16y=24$ have—

    (a)   a unique common solution   (b) infinite common solutions

    (c)   no common solution   (d) two unique common solutions

(iii) The two equations $3x+7y=20$ and $6x+14y=30$ have—

    (a)   a unique common solution   (b) infinite common solutions

    (c)   no common solutions   (d) two unique common solutions

(iv) The common solution of the two equations $4x+3y=25$ and $5x-2y=14$ is—

    (a) $x=4, y=3$ (b) $x=3, y=4$

    (c) $x=3, y=3$ (d) $x=4, y=-3$

(v) The number of common solutions of the two equations is—

    (a)   0   (b) 1   (c) infinite   (d) none of these

(vi) The two equations $x+2y-4=0$, $2x+4y-12=0$ will be graphically presented as—

    (a) two straight lines intersect with each other   (b) two parallel straight lines

    (c) two straight lines coincide with each other   (d) all of these

(vii) The two equations $Px+3y+1=0$, $2x+y+3=0$ will have only one common solution if—

    (a) $P=6$ (b) $P\neq6$ (c) $P=3$ (d) $P\neq3$

(viii) The number of common solutions of the two equations $x=0$ and $x=-5$ is—

    (a) one   (b) two   (c) infinite   (d) none of them

(ix) The number of common solutions of the two equations $x=5$, $y=-5$ is—

    (a) one   (b) two   (c) infinite   (d) none of them

(x) To have a single common solution for the two equations, $rx-y=2$ and $6x-2y=3$, the value of r should be—

    (a) $r=3$ (b) $r\neq3$ (c) $r=0$ (d) $r\neq0$

(xi) The graphically presented line for the equation $2x+3y=6$ is parallel to straight line whose equation is —

    (a) $2x+3y=6$ (b) $2x+3y=12$ (c) $4x+6y=12$ (d) $x+3y=12$

The teacher will form groups and make the students solve the worksheet in groups. The answer sheet of one group will be assessed by other group who will present their opinion on it. In this way the teacher will understand the cognitive level of the students and then facilitate them in knowledge construction.

Topic: MEASURING THE AREA AND PERIMETER OF A TRIANGLE

Stage - 1

previous knowledge
- Concept of different types of triangle
- Constructing different types of triangle and knowing their respective names
- Making different types triangular shapes by cutting paper
- Marking the height of a triangle with respect to its base
- Concept of Pythagoras theorem

Learning Competency (Skills to be developed by the learners)
- Constructing the formula of the area of a triangular region from the concept of the area of a rectangle
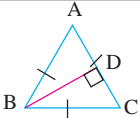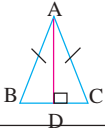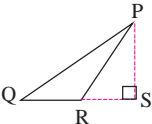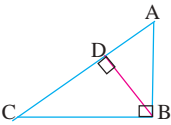
(Area of a rectangle= length x breadth, this is an axiom)

- Calculating the height of a triangle with respect to its base by folding the paper and measuring with a scale
- Calculating the area and perimeter of a triangular region by measuring the length of its sides using a scale
- Application of Pythagoras theorem
- Calculating the height and area of different triangular regions on the basis of the length of the sides (without using the scale)

Work Sheet-1

Q. 1. Complete the table: (one is done)

Plane geometrical figure	Name of the figure	Base of the given figure	Height with respect to base of the given figure
(a)	Equilateral triangle	AC	Height BD with respect to base AC
(b)			
(c)			
(d)			

Q. 2 **Different instances of application of area:**

(i)   Measurement of the area of a triangular shaped park (ii)_____ (iii)_____

Q. 3 Write the name and length of a base of the given △ ADC. **Q.4.** Write the length of side PR of the given right angled triangle.
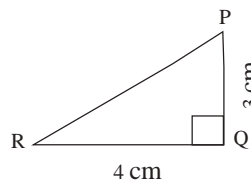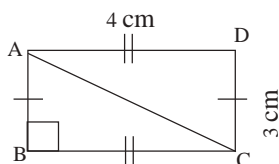
The teacher will form different groups of students and engage them in group for working out the worksheets. The worked out worksheet of one group will be assessed by the other group and will express their opinion to the teacher. In this way the teacher will understand how much knowledge has been constructed and will facilitate them likewise.

Stage - 2

Task Framing and Execution of Task
Measuring the area and perimeter of different triangular regions

- The students will draw different types of triangles on white page.

- They will cut triangular shaped figures using scissors, measure the length of their sides using a scale and write them. They will calculate the perimeter of the triangles and know the reason.

- They will write the heights of the triangle by folding the papers and measuring them.

- They will calculate the area of the triangle with respect to the measurement of its sides and heights of the triangle. They will notice that in each case the area remains same.

Method of calculating the height and area of an equilateral triangle if the length of the sides are known. (Without using scale)
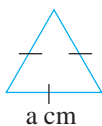
Explore the relation of the length of side of the equilateral triangle with the height and area of the triangle.

- An equilateral triangular page is taken where the length of side is a cm.

- At first, fold the page and draw the height. The learner will know that the height of a triangle bisects the base equally. Then they will know the reason.

- Measure the height of the triangle with respect to Pythagoras theorem and know the reason.

- Work out the area of the equilateral triangular region and know the reason.

- Supposing the side length is 'a' unit they will explore the relation between length of the side of the triangle with the height and area of the triangle and know the reason.

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The method of calculating the height and area of an isosceles triangle if the length of the sides are known (without using scale).
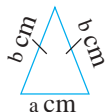
Exploring the relation of the height and area of isosceles triangle with the length of its sides.

If the length of the sides of any triangle are known then the area of the triangle can be calculated and the usefulness of Heron's formula will be realized. Now, the height of the triangle will be calculated by taking any side as the base of the triangle.

Application of the concept of area of a triangular region

- The length of equal sides of an isosceles triangle are supposed to be 'b'cm each and the third side is 'a' cm. The area of such an isosceles triangle is taken.

- The area and height of the unequal side of the isosceles triangular region will be calculated like the equilateral triangular region.

- Supposing the length of each equal side of an isosceles triangle is 'b' unit and the third side is 'a' unit, the relation of the length of the sides with the height and area of the triangle will be explored and the reason is learnt.

- The formula is to be worked out with the help of the teacher and the reason is learnt.

In the given figure the length of QR, PR and MN of the rectangular land is 18 m,30 m and 5√10 m respectively. If PN=SN, then calculate the area of the region PQMN.
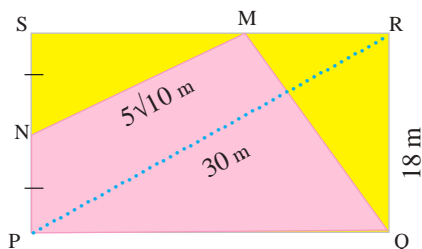
Stage : 3
Work sheet - 2

Q.1. . Tick (✓) the correct answer:

(i) If Rs. 1000 per metre has to be spent to build up a wall around the park of the given picture, the total expenditure will be—

(a) Rs.72000   (b) Rs. 7200   (c) Rs. 13000   (d) Rs. 130000
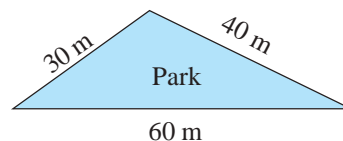
(ii) In the figure given below the length of each side of an equilateral triangle ABC is 20 cm. BD=DC and DE ⊥ AB, so the length of DE is—

(a) $\dfrac{1}{4} \times \dfrac{\sqrt{3}}{4} \times 20$ cm. (b) $\dfrac{\sqrt{3}}{4} \times (20)$ cm. (c) $\dfrac{1}{2} \times \dfrac{\sqrt{3}}{4} \times (20)^2$ cm. (d) $\dfrac{1}{2} \times \dfrac{\sqrt{3}}{4} \times 20$ cm.
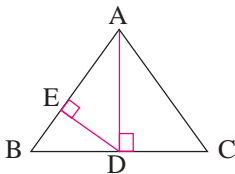
(iii) If the area of a right angled isosceles triangle is 18 sq. cm, then the length of the hypotenuse of the triangle is—

(a) $9\sqrt{3}$ cm. (b) $3\sqrt{3}$ cm. (c) $6\sqrt{2}$ cm. (d) $6\sqrt{3}$ cm.

Q. 2. Write True or False:

(i) If the perimeter of a triangular region is increased, the area might not increase.

(ii) Suppose the height of a triangular region is doubled with respect to its base and the length of its base becomes half, the area of the triangle remains the same.

(iii) A betel nut tree fell down due to storm. The lesser the height at which the tree will break, the farther away will the top of the tree fall from its base.
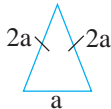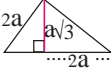
Q.3. Fill in the blanks:

(i) If the area of a triangular region is zero, then the three different vertices of the triangle will be _____.

(ii) In a triangular region keeping the length of the base constant if the height is reduced with respect to base the area of the triangular region will _____.

(iii) The length of three sides of a triangle are a, b and c unit respectively. If its perimeter is s unit, then the area of the triangular region will be _____ sq. unit.

Q.4. Answer the following questions:

(i) If a wire of 3m. long is converted into an equilateral triangle, then what will be the height of the triangle?

(ii) The length of the three sides of a right angled triangle are 15 cm., 12 cm. and 9 cm. respectively. Write the shortest distance between the vertex opposite to the greater side and the greater side of the triangle.

(iii) The perimeter of a triangle is greater than its sides by 3 cm, 4 cm and 5 cm respectively. If the area of the triangular region is 60 sq. cm, what will be the perimeter of the triangle?

Q. 5. Match the first column with the second column and the second column with the third column:

ΔABC	Perimeter of ΔABC	Area of the triangular region ΔABC
2a, 2a, a (triangle)	$5a + a\sqrt{7}$	$\dfrac{\sqrt{3}}{4}\, a^2$
a, a, a (triangle)	$2a + a\sqrt{2}$	$\dfrac{a^2}{4}\sqrt{15}$
a, a (right triangle)	$5a$	$\dfrac{3\sqrt{3}\, a^2}{2}$
2a, a√3, 2a (triangle)	$3a$	$\dfrac{1}{2}\, a^2$

Q.6. Answer the following questions:

(i) If an equilateral triangle of the side of length 6 cm is converted into a scalene triangle of the same area, then write the length of the base and height of the converted scalene triangle.
[Open ended quations]

(ii) Write the measurement of three sides of a scalene triangle and find the area of the triangle by Heron's formula.
[Open ended quations]

(iii) Find the area of the quadrilateral shaped region PQRS given in the picture.

[Application]

P, 7 cm, S, 28 cm, Q, 5 cm, R
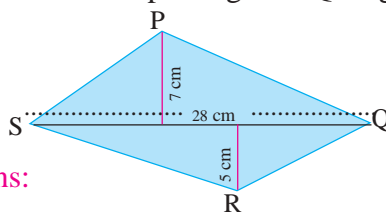
Q.7 Answer the following questions:
(previous knowledge)

(i) Give two examples where the perimeter of the triangular region increases but not the area.
[Higher order thinking skill]

(ii) ABC is an equilateral triangle. The length of one its sides is 5 cm. The midpoints of the sides AB,BC and CA are P, Q and R respectively. Calculate what will be the area of the triangular region PQR.
[HOTS]

(iii) The length of each side of equal sides of an isosceles triangle is 5 cm and the area of the triangular region is 12 sq. cm. Calculate the perimeter of the triangle.
[Mental Math]

(iv) Find out what will be the area of the triangular region in the picture given here.

8 cm, 4 cm, 4 cm, 4 cm, 4 cm, 4 cm, 4cm, 4 cm, 4 cm
[Mental Math]

32
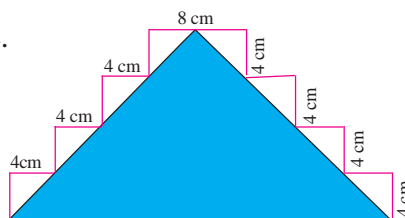
Learning outcome

- The learners will be able to measure the length, height, perimeter and area of different types of triangular shaped regions.
- They will be able to understand where Pythagoras theorem has to be applied.
- They will be able to apply the formulae of the area and height of the triangle in real life problems.
- They will be able to integrate the concepts of geometry, mensuration and algebra in various real life problems.

Evaluation: The teacher will form different groups of students and engage them in group for working out the worksheets. The worked out worksheet of one group will be assessed by the other group and will express their opinion to the teacher. In this way the teacher will understand how much knowledge has been constructed and will facilitate them likewise.

Topic: Perimeter and Area of triangle and quadrilateral (chapter - 15)

Previous knowledge
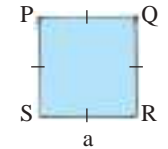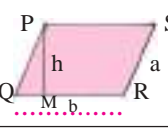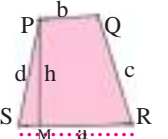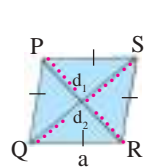
- Concept of different types of triangle and quadrilateral
- Drawing and knowing the names of different types of triangle and quadrilateral
- Making different types of triangular and quadrilateral shaped regions by cutting paper
- Identifying base and height with respect to base of different types of quadrilaterals and triangles
- Concept of Pythagoras theorem

Learning Competency (Skills to be developed by the learners)

- Ability to draw different types of triangles and quadrilaterals and find out the formula of the area and perimeter of triangle and quadrilateral.
- Ability to apply the formulae of area and perimeter in real life problems and solve them.

Task - 1: Worksheet - 1

Q. 1. Fill in the empty spaces (one is done):

Plane geometrical Figure	Name of theFigure	Base	Altitude with respect to base	Perimeter	Area
(a) P — Q S — R a					
(b) P — Q w S — R l	Rectangle	SR	QR	2(l+w)	l × w
(c) P — S h a Q M b R					
(d) b P — Q d h c S — R M a					
(e) P — S d₁ d₂ Q a R					

Q.2. The instances of applying the perimeter of a quadrilateral in real life are

(i) <u>measuring total length of the photo frame</u> (ii) _____ (iii)_____

Q. 3. The instances of applying the area of a quadrilateral shaped region in real life are

(i) <u>for painting the wall</u> (ii) _____ (iii)_____

Q. 4. The length of the base and hypotenuse of a right angle triangle is 4 cm. and 5 cm. respectively. The length of the perpendicular from the angular point of right angle to the hypotenuse will be _____ (Fill in the blank).

Q. 5. The breadth of the rectangle given in the picture here in centimeter will be _____ (Fill in the blank).

Q.6. The area of a square region is 10 sq. m. Its area in square centimeter will be _____ (Fill in the blank).

[figure: rectangle labelled 1.5 m on side and 200 cm on base]

Evaluation: The teacher will form different groups of students and engage them in group for working out the worksheets. The worked out worksheet of one group will be assessed by the other group and will express their opinion to the teacher. In this way the teacher will understand how much knowledge has been constructed and will facilitate them likewise.

Task 2

<div align="center">\boxed{\textbf{Activity}}</div>

Concept of area of square, parallelogram and triangular regions

|	
Topic	**Calculation of area of a square**
Previous knowledge	• Identifying a square
	• One unit side length of a square has the area of one sq. unit.
	• Knowing about various aspects related to square
Learning competencies	• The learners will know about the formula of calculating the area of square through hands-on activities.
	• They will know that change of the length of side will change its area
Materials required	(i) white paper (ii) geometry box
Execution of task	(i) The learners will draw a square PQRS having the side length of 6 cm on a white page.

P $\overset{P_1\ P_2\ P_3\ P_4\ P_5}{\begin{array}{|c|c|c|c|c|c|}\hline\end{array}}$ Q
Q$_1$
Q$_2$
Q$_3$
Q$_4$
Q$_5$
S R

(ii) They will divide the side PQ into six equal divisions of 1 cm each with the points P_1, P_2, P_3, P_4 and P_5 and the side QR at the points Q_1, Q_2, Q_3, Q_4 and Q_5 each of which are of 1 cm apart.

(iii) The will draw straight line segments on the side of PQ through each of those points parallel to QR and also line segments parallel to PQ on the side of QR and passing through each of those points.

(iv) They will understand that 36 square are created whereas the length of each side of the smallest squares 1 cm has an area of 1 sq.cm

(v) They will write the area of the square and will know about the formula of calculating the area of the square.
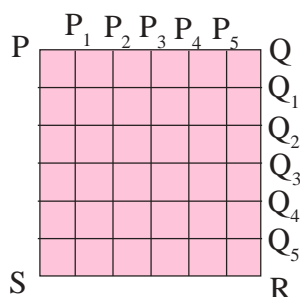
Conclusion	Area of a square= (side)^2 (A = a^2 where A= area and a = length of the side)

Task 3

Topic	**Calculating the area of a parallelogram**
Previous knowledge	• Identifying a parallelogram, a triangle and a rectangle
	• Ability to calculate the area of a rectangle
	• Identifying the height in respect to its base
Learning competency	• The learners will know the formula of calculating the area of a rectangle through hands-on activity.
	• They will be able to apply the formula of calculating the area of a rectangle in different real life problems.
Materials required	(i) white page (ii) geometry box (iii) a pair of scissors (iv)gum
Execution of task	(i) The learners will draw a parallelogram PQRS on a white page. Then they will draw a perpendicular PL on SR from the point P.
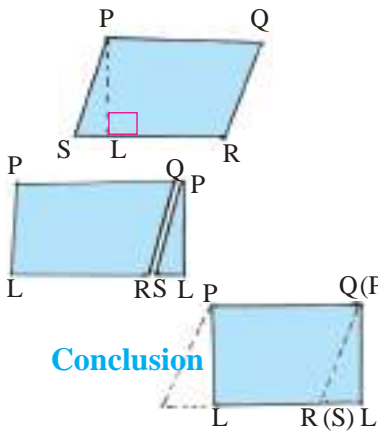
(ii) They will cut out the parallelogram PQRS from the page. Then they will cut out the triangle PLS from the parallelogram as shown in the picture here.

(iii) Now placing the triangle and the parallelogram side by side they will see a rectangle is formed (as shown in the picture).

(iv) The students could learn about a newly formed geometrical shape. So they could explain the formation of a rectangle.

(v) They will be able to construct the formula of the area of a parallelogram from the area of a rectangle and can explain it.

Conclusion

Area of a parallelogram= length of the base × height of the parallelogram with respect to base

$A = a \times h$, where, A = area, a = length of the base, h = height with respect to base.
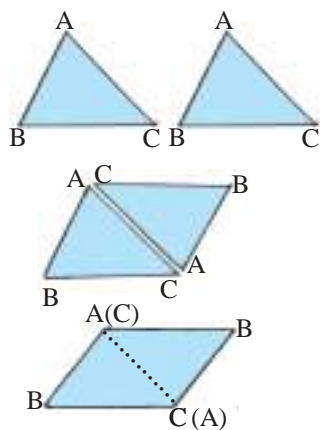
Topic — **Calculating the area of a triangular region**

Previous knowledge
- Identifying a triangle and a rectangle and knowing about various aspects related to them
- Ability to calculate the area of a parallelogram

Learning competency
- The learners will know about the formula of a triangle through hands-on activities
- They will be able to apply the formula of triangle in different real life problems

Materials required (i) white page (ii) a pair of scissors (iii) geometry box (iv) gum

Execution of task

(i) The learners will draw an acute angled triangle ABC on a white page. Then they will cut the triangle out from the page.

(ii) They will cut out another triangle of the same size, i.e. the two triangles are congruent.

(iii) The two triangle will have to be placed on another page. The vertex A of the first triangle should match the vertex C of the second triangle. Again, vertex C of the first triangle should match the vertex A of the second triangle.

(iv) The learners will name the new figure.

(v) They will explain the relation of the area of the triangle with the area of the parallelogram.

(vi) They will construct the formula of the triangle.

Area of the triangle = ½ × base × height

$A = \frac{1}{2} \times a \times h$ where A = area, a = length of the base, h = height with respect to base

In the same way they will explore the formula of the area of trapezium and rhombus shaped region.

Task 4

Calculating the perimeter and area of different types of triangle and quadrilateral.

Worksheet 2

Answer the following questions:

Q.1. In the given picture, the perimeter of the region = _____ and area _____.

Q.2. The length of a rectangular region is l unit and the breadth is w unit. Write the area of a square having the same perimeter of the rectangle.

Q.3. The base of a triangle having the length 'l' unit and the height 'h' unit in respect to its base. Write the area of the triangular region. Write the length and height of another triangle having the same area.
[Open ended question]

Q. 4. The length of the base of a right angled triangle is 12 cm and its hypotenuse is 15 cm. Write the area of the triangle. Write the length and height of another triangle having the same area.
[Open ended question]

Q. 5. If the length of the base of an equilateral triangle is 'a' unit, find the height and the area of the triangle.

Q. 6. Calculate the area of the closed region of the adjacent figure.
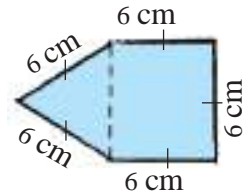
Q.7. If the length of the base of an isosceles triangle is 'b' unit and the length of the equal sides is 'a' unit each, find the height of the triangle.

Q. 8. If the length of the base of an isosceles triangle is 12 cm and the length of the equal sides is 10 cm each, find the area of the triangle.

Q. 9. The length of the base of two triangles are 10 cm each. If the ratio of the area of the two triangles is 1:2, find the height of the two triangles. [Open ended question]

Q. 10. The area of two isosceles triangles is $\sqrt{24}$ each. Find the lengths of base and each of the equal sides of the two triangles. [Open ended question]

Q. 11. If the ratio of the sides of two equilateral triangles is a : b, what is the area of the two triangles?
[Open ended question]

Worksheet 3
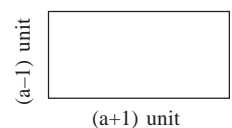
Multiple Choice Question

Each question has four options as answers of which one is correct. Tick (✓) the correct answer:

Q. 1. 1 sq. m =

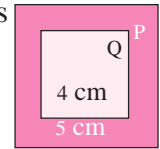(a) 100 sq. cm. (b) 1000 sq. cm. (c)10000 sq. cm. (d) 0.0001 sq. cm.

Q. 2. The perimeter of the rectangular garden given in the adjacent figure
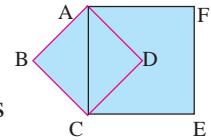(a) (a^2-1) unit (b) (a^2-1) sq. unit (c) 2a unit (d) 4a unit

Q.3. In the adjacent figure the square P has been reduced to the square Q. Thus the area is reduced to

(a) 9%   (b) 1%   (c) 36%   (d) 16%

Q.4. In the adjacent figure the ratio of the area of a square and that of the square drawn on the diagonal of the former square is
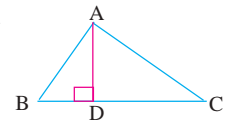
(a) 1:2 (b) 2:3 (c) 2:5 (d) 3:1

Q.5. The length of the two equal sides of an isosceles triangle is 5m. each and its height is 4m. The area of the triangle is

(a) 12 sq.m (b) 16 sq. m. (c) 10 sq. m. (d) 14 sq. m.

Q.6. In the adjacent figure BD: DC =2:3 and the area of the △ABC is 40 sq.cm. The area of △ABD is

(a) 24 sq.cm. (b) 8 sq.cm. (c) 16 sq.cm. (d) none of these

Q.7. The number of rectangles that can be drawn having the same perimeter that of a square of side length 6m. is

(a) 2 (b) 3 (c) 6 (d) infinite

Q.8. The height of a parallelogram is 3/4 of the length of the base in respect to height. If the length of the base is doubled and its height is halved, then the area of the parallelogram will be
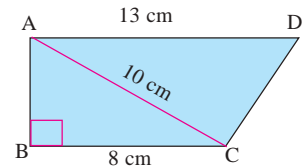
(a) half   (b) double (c) same (d) three times

Q.9. The perimeter and area of an equilateral triangle is P and S respectively. The relation of P and S is

(a) $\sqrt{3}P^2 = 18$ S (b) $P^2 = S$ (c) $\sqrt{3}P^2 = 36$ S (d) $\sqrt{3}P^2 = 4$ S

Q.10. In the adjacent figure the area of the trapezium is

(a) 105 cm.^{2} (b) 63 cm.^{2} (c) 52 cm.^{2} (d) 126 cm.^{2}

Worksheet - 4

Q. 1. Tick (✓) the correct answer:

(i)   The area of a square region is 0.25 sq. m. The area of an equivalent region is

(a) 25 sq.cm. (b) 250 sq.cm. (c) 2500 sq.cm. (d) 25000 sq.cm.

(ii). The area of the trapezium shaped region in the given picture is

(a) 600 sq.cm. (b) 100 sq.cm. (c) 50 sq.cm. (d) 300 sq.cm

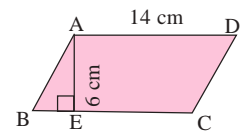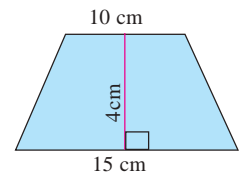(iii). The area of the parallelogram shaped region in the given picture is

(a) 42 sq.cm. (b) 84sq.cm. (c) 164 sq.cm. (d) 21 sq.cm.

(iv) If the length of the two diagonals of a rhombus are 8 cm. and 10 cm respectively, then the area of the rhombus is

(a) 80 sq.cm. (b) 40sq.cm. (c) 18 sq.cm. (d) 36 sq.cm.

(v) The length of the three sides of a triangle is a, b, c and its height is h. If the semi-perimeter of the triangle is s, then Heron's formula will be

(a) ½ ah (b) $\dfrac{\sqrt{3}}{4}$ a^2 (c) $\sqrt{s(s-a)(s-b)(s-c)}$ (d) ½.b $\sqrt{(a^2 - \dfrac{b^2}{4})}$

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Q.2. Answer the following questions:

(i) If the length of every side of an equilateral triangle is doubled, what percentage will the area of the triangle increase?

(ii) The area of the parallelogram ABCD given in the picture is 96 sq. cm. The length of the diagonal is 12 cm. If AE ⊥ BD then write the length of AE.

(iii) The length of the side of a rhombus ABCD given in the picture is 5 cm and its area is 20 sq. cm. If AE ⊥ BC, find the area of the trapezium shaped region AECD.

(iv) The length of the sides of a scalene triangle is 3m, 5m and 6m respectively. Find the area of the triangular region by applying Heron's formula.

(v) Triangular shaped tiles are to be installed on the floor of a hall. The length of the sides of each tile is 30 cm, 40 cm and 50 cm respectively. If the area of the floor is 6 sq. m, then how many tiles are required?
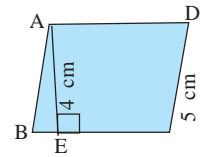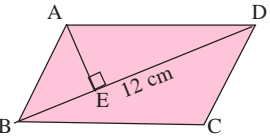
Q. 3. Open ended questions:

(i) The length of the three sides of a triangle are 20 cm, 15 cm and 30 cm respectively. If the length of one side of the triangle is changed to make the triangle a right angled triangle, then what can be the length of that changed side?

(ii) The area of a rhombus shaped region is 10 sq. cm. Find out the length of a side of the rhombus by assuming the length of a diagonal of the rhombus.

(iii) The area of a parallelogram is three times the area of another parallelogram on the same base. Write the different height of the two parallelograms.

(iv) If the sum of the square of length and breadth of a rectangle is an integer, find the area of the rectangle.

(v) If the area of a trapezium is 150 sq.cm. and its height is 10 cm., what will be the length of the two parallel sides?

Worksheet - 5

Q.1. Tick (✔) the correct answer:

(i) The length of a rectangular plot of land is 15 m and its breadth is 10 m. Within the plot there is a road 2 m wide along the boundary. The area of the plot of land excluding the road is

(a) 150 sq. m. (b) 104 sq. m. (c) 148 sq. m. (d) 66 sq.m.

(ii) The semi-perimeter of a triangle is 10 cm. The difference between the semi-perimeter and the length of each of the three sides is 8 cm, 7 cm and 5 cm respectively. The area of the triangle is

(a) $20\sqrt{7}$ sq.cm. (b) $10\sqrt{14}$ sq.cm. (c) $20\sqrt{14}$ sq.cm. (d) 140 sq.cm.

(iii) A square region and a triangle of equal area are on the same base. If the length of the base is 'a' unit, then the height of the triangle will be

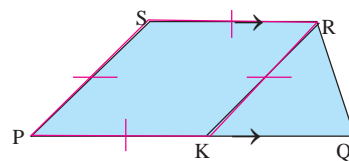(a) 4a unit (b) 2a unit (c) $\dfrac{a}{2}$ unit (d) $\dfrac{a}{4}$ unit

(iv) The height of an equilateral triangle is 4√3 cm. The area of the triangle will be

(a) 16 sq.cm. (b) 8√3 sq.cm. (c) 16√3 sq.cm. (d) 32√3 sq.cm.

(v) In the given figure PQRS is a trapezium and PKRS is a rhombus. PQ: SR = 3:1. If the area of the rhombus is 20 sq. cm., then the area of trapezium will be

(a) 10 sq.cm. (b) 30 sq.cm. (c) 40 sq.cm. (d) 80 sq.cm.

Q.2. Match the column A with the column B and the column B with the column C:

Column A	Column B	Column C (Area in sq. unit)
1. Trapezium shaped region	(a) A parallelogram shaped region which has a right angle	(i) $l \times h$
2. Parallelogram shaped region	(b) A rectangle whose adjacent sides are equal in length	(ii) $l \times w$
3. Rhombus shaped region	(c) A quadrilateral shaped region whose opposite sides are parallel	(iii) ½(a + b)h
4. Rectangle	(d) A quadrilateral shaped region whose sides are equal in length	(iv) a^2
5. Square	(e) A quadrilateral shaped region whose one pair of opposite sides are parallel	(v) ½ $d_1 \times d_2$

[l = length of the side; a, b= length of the two parallel sides; d_1, d_2= length of the two diagonals; h = height/distance between the two parallel sides; w = width]

Q. 3. Answer the following questions:

(i) Assuming the length of the diagonal of a rhombus whose length of a side 5 cm., find the length of the other diagonal. [Open ended questionn]

(ii) The ratio of the length of the two parallel sides of a trapezium is 2:3 and its area is 40 sq. cm. Assuming the height of the trapezium , write the length of the two parallel sides with respect to the height. [Open ended questionn]

(iii) The area of a parallelogram is three times the area of a triangle on the same base. Write the ratio of their respective height and find out the length of their common sides. [Open ended questionn]

(iv) The numerical value of the area of a triangle is equal to its semi-perimeter. Write your inference about the length of the sides of the triangle. [Open ended questionn]

Work Sheet - 6

Q. 1. Tick (✓) the correct answer: (any two)

(i) The length of a picture is 30 cm and its breadth is 20 cm. The cost of designing the 2 cm. wide frame 2 cm. wide all around the picture is Re1 per sq.cm. The total expenditure for designing the frame is

(a)Rs. 600 (b) Rs. 384 (c) Rs. 216 (d) Rs. 104

(ii) The lengths of the three sides of a triangle are 3 cm, 5 cm and 6 cm respectively. The area of the triangular region is ___

(a) $2\sqrt{14}$ sq.cm. (b) 56 sq.cm. (c) 28 sq.cm. (d) $\sqrt{14}$ sq.cm.

(iii) The area of a trapezium shaped region is 558 sq.cm. The distance between the two parallel sides is 12 cm. and the length of one side is double the other. The length of the smaller parallel side is

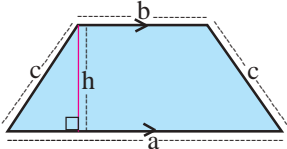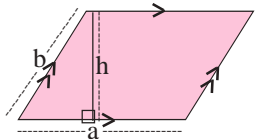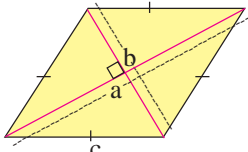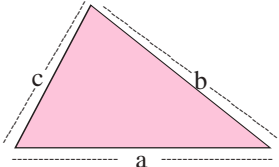(a) 21 cm. (b) 31 cm. (c) 42 cm. (d) 62 cm.

Q. 2. Write True/ False: (any two)

(i) The inside measurement of an enclosed region is called its area.

(ii) A square and a rhombus shaped region are on the base of same length. If their area is A_1 and A_2 respectively, then $A_1 < A_2$.

(iii) The length of the side of a square is 10 cm. If the length of the side increases by 1 cm., its area increases by 21%.

Q. 3. Answer the following questions:

(i) If the diagonal of a rhombus is double than the length of the other diagonal then the length of the side of the rhombus becomes a rational number. Write the length of a side of the rhombus.

[Open ended question]

(ii) The area of an isosceles trapezium shaped region is 30 sq.cm. Length of one of the parallel sides is double than the other. What will be the minimum area of the region joined with the trapezium shaped region to make the trapezium shaped region into a parallelogram shaped region? Write the lengths of the height and the smaller side of the trapezium.

[Open ended question]

Q. 4. Match the column A with the column B and the column B with the column C:

Column A (Picture)	Column B (Perimeter)	Column C (Area)
1.	a. 4c	(i) ab
2.	b. (a+b+c)	(ii) $\frac{1}{2}$ ab
3.	c. 2(a+b)	(iii) $\frac{1}{2}$ (a+b) h
4.	d. (a+b+2c)	(iv) $\sqrt{s(s-a)\ (s-b)\ (s-c)}$ $s = \dfrac{a+b+c}{2}$
5.	e. 2(a+b)	(v) ah

Evaluation: The teacher will form different groups of students and engage them in group for working out the worksheets. The worked out worksheet of one group will be assessed by the other group and will express their opinion to the teacher. In this way the teacher will understand how much knowledge has been constructed and will facilitate them likewise.
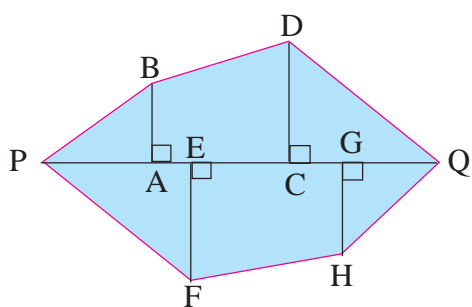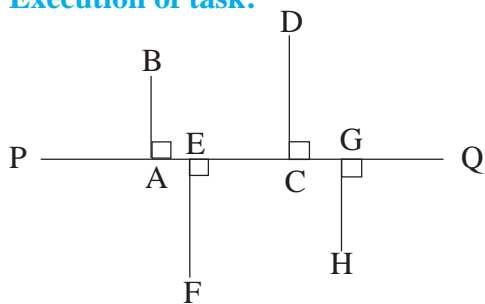
Math Lab Activity

Topic: Calculating the area of a polygonal shaped region by applying the formula of the area of triangle and trapezium shaped region through hands-on activities

Previous knowledge:
- Identifying triangle, trapezium and polygon

Learning objectives:
- To calculate the area of triangular shaped and trapezium shaped region

- To calculate the area of a polygon shaped region through hands-on activities

Meterial required:
- White page, geometry box

Execution of task:

- The learners will draw a straight line segment PQ.

- They will select four points A, E,C and G on PQ. They will draw four perpendicular line segments on each of the four points.

- The learners will write the measurement of lengths of PA, AB, AC, CD, CQ, QG, GH, EG, EF and PE

- They will find out the area of the triangular shaped regions PAB, PEF, DCQ, QGH and trapezium shaped regions ABDC and EGHF

- Finally, they will find out the area of the polygonal shaped region PBDQHFP.

Conclusion: In this way the area of a polygonal shaped region can be calculated by segregating the region into triangle and trapezium shaped regions.

Task- 6 :
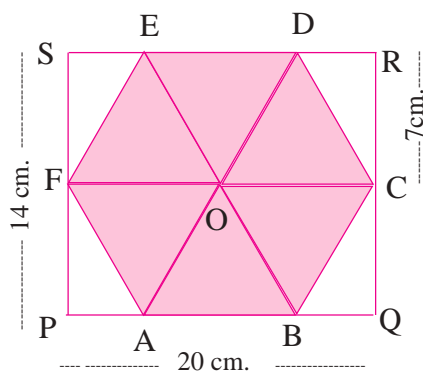
In the above picture the hexagon ABCDEF has divided into 6 triangles. Each side of the triangles is of equal length. Calculate the area of the hexagonal shaped region in the maximum ways that you can do.

- The learners will explore the different methods of calculation for solving problems in mensuration.

- The learners will discuss with logical reasoning among themselves which method of calculation is easier.

Method of calculation: Example (1)

The length of base of each triangle = 10 cm.

Height = 7cm.

Area of the triangle shaped region DOC $= \frac{1}{2} \times$ length of base $\times$ height

$$= \frac{1}{2} \times 10 \times 7 \text{ sq.cm}$$

$$= 35 \text{ sq. cm.}$$

$\therefore$ The area of the hexagonal shaped region ABCDEF$= 6 \times 35$ sq.cm.
$=210$ sq.cm.
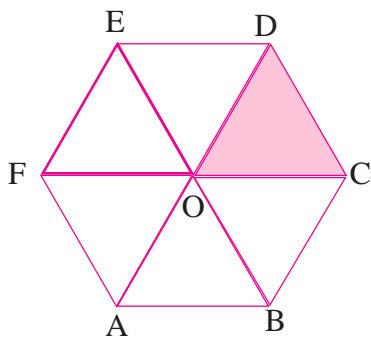
The learners will think solution of the above problen in another three ways.

Example (ii) The learners will think of the other way of solution.

Example (iii) The learners will think of the other way of solution.

Example (iv) The learners will think of the other way of solution.

The types of errors that learners often make due to their incompleteness in concept development [Student's responses and teacher's reflections]

Task - 7 : The length of the side of the rhombus shaped region ABCD is 5 cm. and its area is 20sq.cm. If AE ⊥ BC, find the area of the trapezium shaped region AECD.

Length of side of the rhombus = 5 cm,

area of the rhombus shaped region = 20 sq.cm.

Height of the rhombus =AE cm.   ∴ $5 \times AE = 20$

$$\Rightarrow AE = 4$$

∵ ABE is right angled triangle

∴ $BE^2 = AB^2 - AE^2$

$$= 25 - 16 = 9 \quad \therefore BE = 3$$
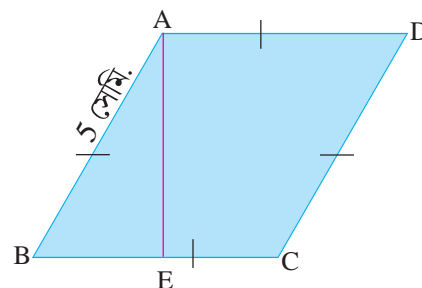
$$\therefore EC = 5 - 3 = 2$$

∴ Area of the trapezium shaped region AECD

$$= \frac{1}{2} \times AE \times (EC + AD) \text{ sq. cm}$$

$$= \frac{1}{2} \times 4 \times (2 + 5) \text{ sq. cm}$$

$$= 14 \text{ sq. cm}$$

Other method:

Area of ΔABE $= \frac{1}{2} \times BE \times AE$ sq.cm.

$$= \frac{1}{2} \times 3 \times 4 \text{ sq.cm.}$$

$$= 6 \text{ sq.cm.}$$

Area of the trapezium shaped region

$= (20-6)$ sq. cm. $=14$ sq.cm.

Specially Noticed

Possible errors of the learners:

1. [Ignorance of rule restriction] unable to calculate the area of different types of quadrilateral in various methods; for example,

   Area of rhombus = ½ × product of the length of the two diagonals. Most learners know this formula but in this case, sometime they do not recall the formula

   Length of base × height with respect to base = area of the rhombus. (This formula can be derived from the formula of a parallelogram because rhombus is also a parallelogram)

2. [Wrong application of rules] unable to apply the theorem of Pythagoras properly to calculate the area of ΔABE; for example,

   $BE^2 = AB^2 + AE^2 = 25 + 16 = 41$

   $BE = \sqrt{41}$

3. [Over generalization] again $BE^2 = 9$, or $BE = \pm\sqrt{9} = \pm 3$, here they are unable to explain why the length of BE will not be in negative.

4. [False concepts hypothesized] (i) $5 \times AE = 20 \Rightarrow AE = 100$

   (ii) Area of the trapezium shaped region AECD $= AE \times (EC + AD)$ sq.cm. (Wrong formula applied)

   (iii) Area of the triangle shaped region $= BE \times AE$ sq.cm. (Wrong formula applied)

(iv) Area of the trapezium shaped region AECD = EC × AE sq.cm. (Wrong formula applied)

(v) Area of the trapezium shaped region AECD = ½ × 4 × (2 + 5)cm. (Using wrong unit)

Teacher's reflections on these errors:

1. The formula that should be used for calculating the area of a rhombus shaped region is

   Area of a rhombus shaped region = length of the base × height with respect to base

2. Apply Pythagoras theorem perfectly, $BE^2 = AB^2 - AE^2$

3. BE = +3 because the length of a side is always positive.

4. (i) Committing errors while transposing: $5 \times AE = 20 \Rightarrow AE = 20/5 = 4$

   (ii) Area of the trapezium shaped region AECD = ½ × AE × (EC + AD) sq. cm.

   (iii) Area of the triangle shaped region = ½ × BE × AE sq. cm.

   (iv) Area of the trapezium shaped region AECD = ½ × AE × (EC + AD) sq. cm.

   [not length of base × height]

   (v) Area of the trapezium shaped region AECD = ½ × 4 × (2 + 5) sq. cm.

After assessing the worksheets the teacher will help the learners in error correction and providing correct concept. More worksheets have to be done to ensure quality education of the learners.

Some instances of the misconceptions of the students:

1. **Conversion in same unit** : For example, the length of a rectangle is given in centimetre and its width is in metre. To calculate the problem either the unit has to be converted into metre or in centimeter, otherwise there will be a mistake.

2. **Conversion of units** : For example, 1 m. =100 cm but 1 sq. m. is not equal to 100 sq. m.

   1 sq. m. = 100 × 100 sq.cm. = 10000 sq.cm.

3. **Wrong conception** : In ΔABC, the height AD with respect to base BC [here height AD with respect to base BC, not BD]; again CE height with respect to AB base.
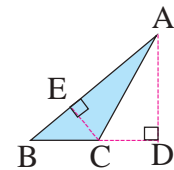
4. In a square region if the length of the side is doubled, its area will be doubled is a wrong concept. The area will be four times. But why should it be, the concept has to be logically formed.

5. If the length and breadth of a rectangle are doubled, its perimeter becomes doubled. But the area of the rectangle will not be doubled, it will be four times. The difference in area and perimeter is noticeable.

6. Missing out the right unit in the answer. The right unit has to be mentioned.

[Student's responses and teacher's reflections]

- Ability to understand the method of calculating the area of different plenary geometrical figures and thereby enhance their skill

- Mathematical logic will be created for different topics related to calculation of area

- They will be able to apply the formula of area in different types of real life problems.

- They will be able to assess and explain the formula of area.

- They will be able to solve the problems on area in different methods all of their own.

Learning methodolegy   5E model

Topic	**Calculating the perimeter and area of a triangle**

| Engage :
[Generate interest] | For example, let's make a rose garden in a triangle shaped region:

1. What will be the length of the fence to enclose the triangular shaped garden?

2. In every square metre 1 sapling of rose has to be planted. How many saplings of rose is required?

To understand these questions one has to know the calculation of perimeter and area. So the learner will be interested to know about perimeter and area. |

Explore [Establish relationship and understanding] (Concept of the formulae for finding perimeter and area)	For example, by measuring the outline of the triangular shaped region, the perimeter and area of the region can be calculated. $2s = a + b + c$ and $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$
Explain : [Communicate new understanding] (Concept of another formula of area and conpept of the formulae of area of equilateral triangle and isosceles triangle etc.)	For example $\Delta = \dfrac{1}{2} \times$ length of the base $\times$ height with respect to the base $\Delta = \dfrac{\sqrt{3}}{4} \times$ (length of the side)^2 $\Delta = \dfrac{1}{2} \times b \sqrt{a^2 - \dfrac{b^2}{4}}$
Extend/Elaborate : [Apply new learning to a new or similar situation] (Apply the concept of the formula of area of triangle to find the area of different plane geometrical shaped region)	For example, they will calculate the area of a parallelogram shaped region by applying the concept that the diagonals of a parallelogram bisect it into two congruent triangles.
Evaluate: [Apply within problem situation] (Apply new learning about perimeter and area in real-life problems)	For example, there is a road within a triangle shaped park. The lengths of the inside part of the road are 20 m, 25 m and 30 m respectively and the lengths of the outside part of the road are 22 m, 27 m and 32 m respectively. Calculate the area of the road.

Note: This is only a sample. In this way the teachers will design Lesson plans on different topics included in the textbook *Ganit Prakash* and help the learners in providing quality education (as recommended by RMSA).

Unit : Theorems on Concurrence

Sub-unit : Perpendicular bisectors of the three sides of a triangle are concurrent

Learning Competency : (what the learners will learn)

The concept of concurrency of the perpendicular bisectors of the three sides of a triangle will be developed among the learners. This will help them to understand the concept of diagrams/ geometrical figures in real life so that they will be able to apply the concept to prove various geometrical principles.

   (a) "Perpendicular bisectors of the three sides of a triangle are concurrent"— the concept of proving this geometrical principle through reason.

   (b) "Perpendicular bisectors of the three sides of a triangle are concurrent"— solving various problems by applying this concept

   (c) Concept of different positions of the circumcentre of the various triangles developed through hands-on activities.

Learning Tools : Rectangular/triangular paper, stick, chart, pictures, commonplace things, a pair of scissors, gum etc.

Learning Indicators :

1.   Concept of triangle, concept of perpendicular bisector of a line segment and the concept of concurrency.

Learning task : (different tasks for the learners while learning)

An illustration is given below about how a lesson can be presented in the classroom following the Interpretation Construction model or ICON model.

Observatios :

The teacher will show various things of the surroundings and involve the students in different activities and thereby will measure the level of their previous knowledge. For example every learner will be asked to fold a rectangular shaped page, each of same size, and then unfold the page. From the folds of that page the concept of straight line segment, point, parallel straight line segments, intersecting straight line segments, concurrent line segments, perpendicular, bisector, perpendicular bisector etc. will be assessed by the teacher.

Activity: For instance, the following questions can be asked by showing the three 'unfold' papers given below:
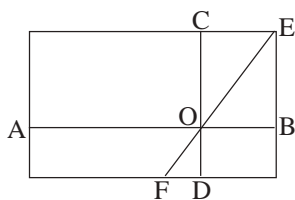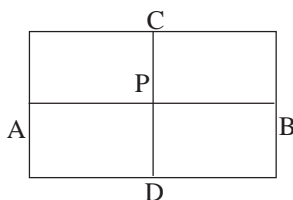
Page No. (i)   Page No. (ii)   Page No. (iii)
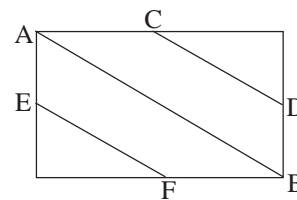
Choose the correct Answer :

(a) In page no. (i) AB, CD and EF are ⬚ (straight lines/straight line segments).

(b) In page no. (ii) AB and CD intersect each other at the point P. So, the straight line segments AB and CD are ⬚ (parallel/intersecting)

(c) In page no. (i) the straight line segments AB, CD and EF meet at point O. … The straight line segments ∵ AB, CD and EF are ⬚ (concurrent/parallel).

(d) In page no. (ii) the straight line segments AB and CD are ⬚ (perpendicular/parallel).

(e) **Write True/False:**

In page no. (ii) CD is the perpendicular bisector of AB. [True/False]

In page no. (ii) AB and CD are perpendicular to each other. [True/False]

Contextualization : Previous knowledge is necessary for contextualization.

Activity: Give every learner different types of triangular shaped papers and tell them to find out the perpendicular bisectors of the sides. Then tell them to answer the following types of questions on the basis of their hands on activity.

Worksheet on hands on Activity II
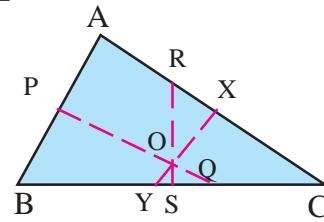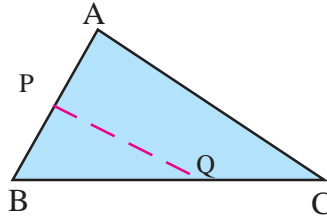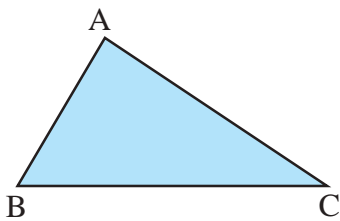
Choose the correct Answer :

(a) The triangle ABC in the above picture is

　(i) a right angled triangle　　(ii) an acute angled triangle　　(iii) an obtuse angled triangle
　(iv) an equilateral triangle

(b) In the triangular figure ABC the midpoint of the side AB is

　(i) S　　　　　(ii) R　　　　　(iii) P　　　　　(iv) O

(c) In the triangular figure ABC of the above picture the perpendicular on the side AB is

　(i) PQ　　　　(ii) SR　　　　(iii) XY　　　　(iv) AC

(d) In the triangular figure ABC of the above picture the perpendicular bisector of AB is

　(i) SR　　　　(ii) PQ　　　　(iii) RS　　　　(iv) BC

(e) In the triangular figure ABC of the above picture XY is the perpendicular of the side

　(i) AB　　　　(ii) BC　　　　(iii) CA　　　　(iv) AB and AC both

(f) The number of perpendicular bisectors of the above ΔABC is/are

　(i) 1　　　　　(ii) 2　　　　　(iii) 3　　　　　(iv) 4

(g) The perpendicular bisectors of the sides of ΔABC meet at the point

    (i)   P   (ii) X   (iii) R   (iv) O

(h) The perpendicular bisectors of the sides of ΔABC are ☐ [concurrent/parallel].

> (i) The previous knowledge of the learners can be assessed through the discussion of the answers of Activity II.
>
> (ii) It can also be assessed through question-answers and discussions which learners do not have complete idea in their previous knowledge or lack in concept.
>
> (iii) If it is necessary certain sections of previous knowledge may be introduced for discussion.

Cognitive Apprenticeship

Now ask them to draw different figures and give them many questions on the figures drawn by them so that they form the idea of perpendicular bisectors of the triangle.

Worksheet III

Answer tthe following Questions :

(a) What do mean by acute angle? Draw an acute angled triangle ABC.

(b) In the acute angled triangle ABC draw the perpendicular bisector PQ of the side BC so that it intersects BC at the point P.

(c) Now in that triangle ABC measure BP and CP with a scale and compare them.

(d) In the acute angled triangle ABC draw two perpendicular bisectors of the sides AB and AC and say what types of line segments are the three perpendicular bisectors.

(e) Draw an isosceles triangle ABC whoes AB=AC. Draw three perpendicular bisectors of the triangle ABC and say which of these perpendicular bisectors passes through a vertex.

(f) In the triangle XYZ given here the two perpendicular bisectors PO and QO of the sides YZ and ZX intersect each other at the point O. Now let us write the correct answer in the box given below:
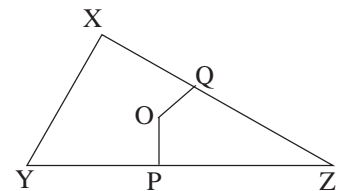
    (i)   YO ☐ OZ [= / ≠]

    (ii) XO ☐ OZ [= / ≠]

    (iii) What is the length of OX called?

    (iv) What do you call the point O?

(g) In the picture given here the perpendicular bisectors of the sides PQ and QR of ΔPQR are XO and YO respectively and they intersect each other at the point O. If Z is the midpoint of the side PR then let us prove that
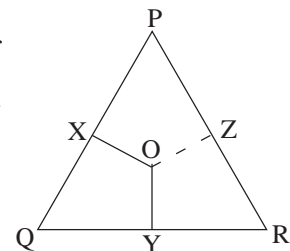
    (i) ΔPOZ ≅ ΔROZ   (ii) OZ ⊥ PR

(h) Draw a right angled triangle ABC where $\angle ABC = 90^0$. Draw two perpendicular bisectors of the sides AB and BC of this right angled triangle and say where do they intersect?

(i) If the length of the hypotenuse of a right angled triangle is 8 cm., then which of the following is the length of the circumradius?

(i) 8 cm   (ii) 4 cm   (iii) $2\sqrt{2}$ cm   (iv) $4\sqrt{2}$ cm

Collaboration : The learners will be divided into groups and will discuss among themselves about their experience of working out in the worksheet and the hands on activity. They will now do hands on activities in groups. The teacher will direct their discussions in right path by asking them questions and engaging them in discussions.

Interpretation Construction : The learners will present their own concept developed through observation, contextualization and activities through cooperation about the proof of the principle that 'the perpendicular bisectors of the sides of the triangle are concurrent'. This method will enhance their thinking ability and the skill to explain.

Multiple Interpretation : The learner will form their concept by proving the principle with respect to various types of triangles and also applying the concept. They will try to prove it in alternative method and will discuss in group about their own explanation. If necessary they will alter and modify their explanation and will know about the different methods of proof.
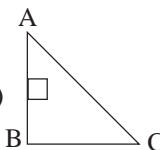
Multiple Manifestation : The learners will work in groups and apply different concepts of geometry by making charts. For example, they will apply the concept that the three perpendicular bisectors of the sides of a triangle are concurrent in drawing a circle through three points.

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Worksheet IV

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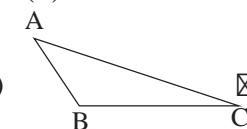
Choose the correct Answer :

(1) Where is the circumcenter of the triangle ABC located? Which of the following is true?

(a) on the side AB   (b) on the side BC   (c) on the side CA   (d) within the $\triangle$ABC

(2) Where is the circumcenter of the triangle ABC located? Which of the following is true?

(a) on the side AB (b) on the side BC (c) on the side CA (d) in the $\triangle$ABC

(3) The circumcenter of the triangle ABC lies

(a) on the side AB (b) on the side BC (c) on the side CA (d) with the $\triangle$ABC

(4) The circumcenter of $\triangle$ABC is O; if $\angle BOC = 90^o$, then the $\angle BAC$ will be

(a) 40º   (b) 180º   (c) 45º   (d) 100º

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(5) The length of the circumradius of the right angled triangle PQR is 8 cm, then the length of the hypotenuse is

    (a) 4 cm   (b) 8 cm   (c) 2 cm   (d) 16 cm

(6) The length of the circumradius of a triangle of side length 6 cm, 8 cm and 10 cm is

    (a) 5 cm   (b) 6 cm   (c) 8 cm   (d) 10 cm

(7) The circumcenter of $\triangle ABC$ is O; if $\angle BAC = 42^0$ then the $\angle BOC$ will be

    (a) 21º   (b) 42º   (c) 84º   (d) 90º

(8) The circumcenter of $\triangle XYZ$ is O; prove that $\angle YOZ = 2\angle YXZ$

(9) Draw an obtuse angled triangle ABC. Draw the circumcircle of the triangle and find out the length of the circumradius [with scale and compass]

Learning Outcomes : (areas of knowledge construction of the learners)

1.   (a) Concept of the three perpendicular bisectors of the sides a triangle.

    (b) Concept of concurrence.

    (c) Concept of congruence of S-A-S, R-H-S

    (d) Concept of concurrency of the three perpendicular bisectors of the sides a triangle

    (e) Concept of perpendicular bisectors of which triangles on the basis of their sides passing through which vertices

    (f) Concept of the position of circumcenter of different triangles

Mathematics: Class IX
Sample for Internal Formative Evaluation
Textbook: Ganit Prabha

1. **Survey**

    Selected text: Factorization (Lesson-8)

Step I:

The teacher will instruct the students to read the lesson (Lesson-8) carefully. Every student will have to set a question paper individually on the said lesson. Each paper should comprise of 10 questions along with the student's name and roll number. A sample of the question paper is given below:

1. Factorise the number 12 into two factors.

2. Factorise the algebraic expression $x^2 + 3x$ into two factors.

3. What are the things that we have learnt to factorise?

4. Can the number 48 be factorised into prime factors? If so, factorise it.

5. Can all the natural numbers (excluding 1 and prime numbers) be factorised into prime factors?

6. Can the number 6 be factorised into two factors so that none of the factors is a natural number? If so, factorise it.

7. Factorise a number into two factors of which one is the number itself. Give examples.

8. Factorise the polynomial expression $x^2 - 1$.

9. Factorise the polynomial expression $x^2 - 8$.

10. Factorise the polynomial expression $x^2 + 12x + 35$.

Step II:

Following the instruction of the teacher, the students will exchange the question papers among themselves and solve the peer's question paper. Observing the answers of the respective question papers, each paper setter will try to understand whether the concept of Factorization and the skill of factorising a number have been developed in the peer.

Step III:

Each paper setter will have to write a report expressing his/her opinion in reference to his/her observation of the answered script. He/she will have to submit the report to the teacher along with his/her question paper and the answered script. On the basis of his/her report, marks will be awarded to the student (paper setter) by the teacher.

Allotment of marks:

Paper setting- 4 marks; evaluating the answers correctly- 4 marks; written report- 2 marks Time allotted: 2 periods

[This distribution and allotment of marks is applicable only for mathematics. Teacher of other subjects will take decesions accordingly]

2. Nature Study:

Selected text: Calculating the area and perimeter of a triangle and a quadrilateral (Lesson-15)

Step I:

The teacher will tell the students that each of them will draw a picture of their environment using pen and paper. They will have to use triangles and quadrilaterals in their respective images. The teacher will also tell them to measure the approximate value of the area and perimeter of the various geometrical figures (included in the syllabus) of their respective images.

Example

Step II:

The teacher will collect their drawings that include their respective names and roll numbers.

Allotment of marks:

Geometrical figures- 2marks; beautiful organisation of geometrical figures- 2marks; concept of area and perimeter of the geometrical figures- 3 marks; ability to understand nature using geometrical figures-3 marks

Time allotted: 2 periods

3. Case Study

Selected text: Polynomial expression (Lesson-7)

Step I:

The teacher will write down some questions on the blackboard. A sample of the set of questions is given below:

1. Find out the term, degree and the coefficient numbers in each of the polynomial expression given below:

    i) $3x^2 + 2x + 7$

    ii) $\frac{1}{3}x^4 + \frac{2}{3}x^3 + \frac{7}{5}x^2 + \frac{9}{5}x + \frac{3}{8}$

    iii) $-3x^3 - 5x^2 - 9x - 1$

    iv) $\cdot 2x^5 + \cdot 11x^4 + \cdot 7x + \cdot 3$

    v) $15x + 4$

    vi) $\cdot 15$

    vii) 0

    viii) $2x + 3y$

2. Give examples of algebraic expressions which are not polynomial expressions.

   $x + \frac{1}{x}$, $2x^{-3} + 7$, $2\cdot x + x$ etc

3. I had Rs. 225. I bought 4 books of same price and yet I have Rs.5 with me. Form an equation of polynomial expression to find out the price of one book.

4. Let us create a problem like the one given above. Then form an equation of polynomial expression of the problem and solve it.

Step II:

Every student will have to prepare his/her answer script and submit it after witting his/her name and roll number.

Allotment of marks:

Concept regarding term, degree and the type of coefficient numbers of polynomial expressions- 4 marks; example of algebraic expression which are not polynomial expressions- 2 marks; able to answer Question no. 3- 2marks; able to answer Question no. 4— 2 marks

Time allotted: 2 periods

4. Creative Writing

Selected text: factorization (Lesson 8)

Step I:

The teacher will write down on the blackboard some examples of factorisation as given below:

Example: Factoring 6 we get 2×3. Here 2 and 3 are natural numbers.

Again, factoring 6 we get $(-2) \times (-3)$. Here (-2) and (-3) are integers.

Again, factoring 6 we get $\frac{36}{5} \times \frac{5}{6}$. Here $\frac{36}{5}$ and $\frac{5}{6}$ are rational numbers.

Again, factoring 6 we get $\sqrt{2} \times \sqrt{18}$. Here $\sqrt{2}$ and $\sqrt{18}$ are irrational numbers.

Step II:

On the basis of the examples stated above, the teacher will invite the students to write creative essays on factorization of two polynomial expressions. Every student will make a comparative study of factorization in respect of the examples stated above and write an essay on it.

Step III:

The teacher will evaluate the essays and award marks individually.

Allotment of marks:

Factorizing two polynomial expressions into two algebraic expressions-2 marks; factorizing a polynomial expression which is not an algebraic expression-2; factorizing a polynomial expression into various types of algebraic expression-2 marks; ability to make a comparative report on factorization of polynomial expressions and algebraic expressions-4 marks

Time allotted: 2 periods

5. Model making

Selected text: Factorization (lesson- 8)

Step I:

The teacher will write down the following text on the blackboard; a and b are positive whole numbers and a>b.

In an event (a +b) persons donated Rs. (a-b) each and the total subscription was Rs. x.

In another event 'a' persons donated Rs. 'a' each as subscription and from the total amount 'b' persons were given Rs. 'b' and thereby the remaining amount became Rs. 'y'. Is 'x' and 'y' are equal? Which identity is to be adopted to understand whether x=y? Make geometric models of those identities.

Example of the model
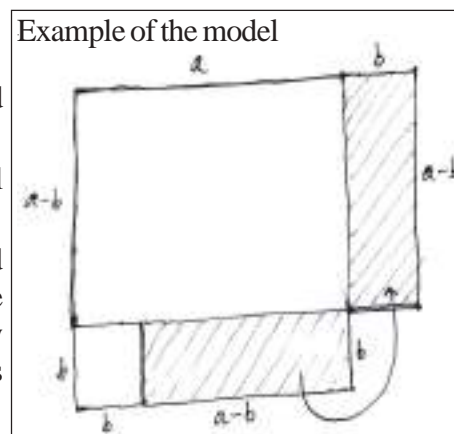
Step II:

Every student will make an algebraic model and a geometric model of the algebraic expression of the statement given above in his/her answer script and submit it to the teacher.

Step III:

The teacher will assess the models made by each student and award marks.

Allotment of marks:

For making an algebraic model of the statement i.e. $x = (a+b)(a-b)$ and $y = a^2-b^2$ - 3 marks;

For concept of geometric model of a^2 and b^2 - 3marks;

For making geometric model of the identity $(a+b)(a-b) = a^2 - b^2$ - 4marks

Time allotted: 2 periods

6. Open Textbook Evaluation (OTBE)

Selected text: Factorization (lesson- 8)

Step I:

The teacher will write down the following on the blackboard and ask them to prove them:

We know that-

$1-c^2 = (1-c)(1+c)$

$1-c^3 = (1-c)(1+c+c^2)$

$1-c^4 = (1-c)(1+c+c^2+c^3)$ and

$1-c^5 = (1-c)(1+c+c^2+c^3+c^4)$

(Let us prove the above identities)

Step II:

The teacher will write down the following question on the blackboard:

Let us try to factorise $1-c^{11}$ and $1-c^{13}$ like those given above. Let us prove that our factorization is correct.

Step III:

The teacher will award marks to each student assessing his/her answer or the process of his/her answer

Allotment of marks:

For proving the first two identities- 2 marks;

For proving the third and fourth identities- 2 marks;

Understanding the nature of factorization of $1-c^{11}$ and $1-c^{13}$ -2 marks

For factorising $1-c^{11}$ and $1-c^{13}$ – 4 marks

(The students can take the help of their textbook while answering this question in the classroom)

Time allotted : 2 periods

Note: Some examples of Internal Formative Assessment on six different areas are given here with reference to certain lessons of the Mathematics textbook for class IX. In this way the teachers will assess the learners in reference to *Ganit Prakash* in a much better way.

Question Pattern & Allotment of Marks for 1st Summative Evaluation

[Summative-I (Chapters 1 to 8)]

Subjects	Very short answer type questions	Short answer type questions	Long answer type questions	Total Marks	Chapters
Arithmatic	1 (1×1)	2 (2×1)	3 (3×1)	6	1
Ajgebra	3 (1×3)	8 (2×4)	9 (3×3)	20	2,3,5,7,8
Geometry	1 (1×1)	2 (2×1)	7 (4×1 + 3×1)	10	6
Coordinate geometry	1 (1×1)	-	3 (3×1)	4	4
Total Marks	**6**	**12**	**22**	**40**	
	**6 + 12 = 18**				

Internal formative Evaluation : 10 Marks

Very short answer type questions 1. Multiple choice questions 2. True/False 3. Fill in the blanks

Arithmetic :	Real Number	One question = 1 Mark
Algebra :	(i) Laws of indices	One question = 1 Mark
	(ii) Polynomial	One question = 1 Mark
	(iii) Graph	One question = 1 Mark
Geometry :	Properties of Parallelogram	One question = 1 Mark
Coordinate Geometry :	Distance Formula	One question = 1 Mark

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short answer type questions

Arithmetic :	Real Number	One question = 2 Marks
Algebra :	(i) Laws of indices/Polynomial	One question = 2 Marks
	(ii) Graph	One question = 2 Marks
	(iii) Linear Simultaneous equations	One question = 2 Marks
	(iv) Factorisation	One question = 2 Marks
Geometry :	Properties of Parallelogram	One question = 2 Marks

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Long answer type questions

Arithmatic :	Real Number	One question = 3 Marks
Algebra :	(i) Graph	One question = 3 Marks
	(ii) Linear Simultaneous equations	One question = 3 Marks
	(iii) Factorisation	One question = 3 Marks
Geometry :	Properties of Parallelogram	One out of two Theorems = 4 Marks
	Application of theorems in solving geometrical problems = 3 Marks	
Coordinate Geometry :	Distance Formula	One question = 3 Marks

SAMPLE QUESTION PAPER OF FIRST SUMMATIVE EVALUATION

CLASS IX

SUBJECT—MATHEMATICS

1. **Choose the correct answer:**   **1×6=6**

   (i)   x, y. z are three real numbers. $x < y$, $y < z \Rightarrow$

   (a) $x > z$ (b) $x < z$ (c) $x \geq z$ (d) relation between x and y can't be determined

   (ii) $(64)^{1/6} =$

   (a) 6   (b) 4   (c) 2   (d) none of these

   (iii) Which of the following equation has the solution $(1, 0)$

   (a) $x + y = 2$ (b) $x - y = 1$ (c) $2x + y = 1$ (d) $x - y = 2$

   (iv) The degree of the polynomial $2x + 3$ is

   (a) 2   (b) 3   (c) 1   (d) 0

   (v)   In the rhombus ABCD, $\angle ABC = 15°$ then, $\angle BCD =$

   (a) 30°   (b) 15°   (c) 75°   (d) 165°

   (vi) The triangle which is formed by joining the three points $(2,0)$, $(-2,0)$ and $(0, -2)$ is called

   (a) an equilateral triangle   (b) a scalene triangle

   (c) a right angled isosceles triangle   (d) isoscales but not right angled

2. Answer the following questions: **2×6=12**

   (i)   Match the two columns by joining with a line:

$\frac{22}{7}$, 3.14	Irrational number and real number
π	Rational number and real number

   (ii) Match the left columns with the right (any two):

$2^3 \div 2^{-2}$	1
$3^{-3} \div 3^{-1}$	32
$4^3 \times 4^{-3}$	$\frac{1}{9}$

(iii) Write the co-ordinates of the point where the graph of the equation $x + \frac{y}{2} = 1$ intersects the x-axis.

(iv) Write two equations in the form of $ax + by = c$ where a, b, c are whole numbers and the two equations have only one solution.

(v) Write two algebraic expressions which are not polynomials.

(vi) Write a quadratic polynomial expression of your own and factorize it.

3. Express the two numbers $\frac{5}{8}$ and $\frac{3}{11}$ in decimals.   3

4. **Express the following expression in a linear equation with two variables and draw its graph.** 3

The sum of two numbers is 15.

5. **Solve :**   3

$\frac{x}{2} + \frac{y}{3} = 1$; $\frac{x}{3} + \frac{y}{2} = 1$

6. **Factorize the following :** $x^3 - 7x - 6$.   3

7. **Answer any one question :**   1×4=4

(a) If the opposite sides of a quadrilateral are equal, prove that the quadrilateral is a parallelogram.

(b) If the opposite angles of a quadrilateral are equal, prove that the quadrilateral is a parallelogram.

8. In the rectangle ABCD the points E,F,G,H are on the sides AB,BC, CD, DA in such way that AE=CG and BF=DG. Prove logically that ABCD is a rectangle.   3

9. Show that if the points (2,5), (5,9), (9,12), and (6,8) are joined then a rhombus is formed.   3

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Question Pattern & Allotment of Marks for 2nd Summative Evaluation
[Summative-II (Chapters 4, 5, 6, 9 to 16)]

Subjects	Very short answer type questions	Short answer type questions	Long answer type questions	Total Marks	Chapters
Arithmatic	1 (1×1)	2 (2×1)	3 (3×1)	6	10
Algebra	-	-	3 (3×1)	3	5
Geometry	1 (1×1)	2 (2×1)	11 (4×1 + 3×1 + 4×1)	14	6,9,12,13,14
Coordinate Geometry	1 (1×1)	2 (2×1)	-	3	4
Mensuration	1 (1×1)	2 (2×1)	6 (3×2)	9	15, 16
Statistics	-	2 (2×1)	3 (3×1)	5	11
Total Marks	**4**	**10**	**26**	**40**	
		4 + 10 = 14			

Internal formative Evaluation : 10 Marks

Very short answer type questions 1. Multiple choice questions 2. True/False 3. Fill in the blanks		
Arithmetic :	Profit and loss	One question = 1 Mark
Geometry :	Properties of Parallelogram	One question = 1 Mark
Coordinate Geometry :	Distance Formula	One question = 1 Mark
Mensuration :	Perimeter and Area of Triangle and Quadrilateral	One question = 1 Mark

short answer type questions		
Arithmetic :	Profit and loss	One question = 2 Marks
Geometry :	Transversal and mid point theorems /theorems of Area	One question = 2 Marks
Coordinate Geometry :	Distance Formula	One question = 2 Marks
Mensuration :	Circumference of Circle	One question = 2 Marks
Statistics :		One question = 2 Marks

Long answer type questions		
Arithmatic :	Profit and loss	One question = 3 Marks
Algebra :	Linear Simultaneous equations (Method of elemination/substitution)	One question = 3 Marks
Geometry :		One out of two Theorems = 4 Marks
	Application of theorems in solving geometrical problems = 3 Marks	
	Construction	One Question = 4 Marks
Mensuration :	(i) Perimeter and Area of Triangle and Quadrilateral	One question = 3 Marks
	(ii) Circumference of Circle	One question = 3 Marks
Statistics :		One question = 3 Marks

SAMPLE QUESTION PAPER OF SECOND SUMMATIVE EVALUATION

CLASS IX

SUBJECT—MATHEMATICS

TIME—1 HOUR 30 MINUTES   **FULL MARKS: 40**

1. **Choose the correct answer:**   **1×4=4**

   (i) If the ratio of cost price and selling price is 10:11 the percentage of profit is

   (a) 9   (b) 11   (c) $10\frac{1}{9}$ (d) 10

   (ii) In the $\triangle ABC$ if D is the midpoint of the side BC, E is the midpoint of BD and O is midpoint of AE, then the area of $\triangle BOE$ is

   (a) $\frac{1}{3} \times \triangle ABC$ (b) $\frac{1}{4} \times \triangle ABC$ (c) $\frac{1}{6} \times \triangle ABC$ (d) $\frac{1}{8} \times \triangle ABC$

   (iii) If the coordinates of the centre of a circle is (0,0) and the coordinates of a point on the circle is (4,3), then the length of the radius is

   (a) 5 unit   (b) 4 unit   (c) 3 unit   (d) 2 unit

   (iv) If the area of a square and a rectangular region of equal perimeter are S and R respectively, then

   (a) S = R   (b) S>R   (c) S<R   (d) R = 2S

2. **Answer the following questions :**   **2×5=10**

   (i) A salesman makes a profit of 20% on the selling price by selling a book. What is his percentage of profit on the cost price?

   (ii) The area of a parallelogram ABCD id 100 sq. unit; P is the midpoint of the side BC; calculate the area of $\triangle ABC$.

   (iii) If the distance of the point (-4,y) from the origin is 5 unit, then write the value of y.

   (iv) If the perimeter of a semicircular region is 36 cm then what is the length of the diameter of the semicircle?

   (v) The midpoint of a series in a continuous frequency distribution table is m and if the upper limit is u, what is the lower limit?

3. Let us find out what will be the equivalent rate of discount of the subsequent discounts of 20%,10% and 5%? 3

4. **Solve the following by the method of elimination or substitution:** 3

$5x+3y = 11, \ 2x–7y = –12$

5. **Answer any one question :** 1×4=4

a) Prove that the parallelograms which stand on the same base and are between the same pair of parallels are equal.

b) Prove that the straight line segment joining the midpoints of any two sides of a triangle is half and parallel to the third side.

6. P is a point on the median AD of $\triangle$ ABC. Prove that $\triangle$ ABP = $\triangle$ ACP. 3

7. Draw an equilateral triangle whose the length of a side 6.5 cm and draw a parallelogram of equal area having one angle of 45^0. (only traces of construction are to be required) 4

8. The length of the diagonal of a rectangular land is 15 m. and the difference between the length and breadth of the rectangle is 3m. Find the area and perimeter of the rectangular land. 3

9. If the difference between the radius and circumference of a wheel is 75 cm. find out the length of its radius. 3

10. **Draw the histogram of the following distribution table:** 3

Class	1—10	11—20	21—30	31—40	41—50	51—60
Frequency	8	3	6	12	2	7

_____

Question Pattern & Allotment of Marks for 3rd Summative Evaluation

Subjects	Multiple Choice questions	Short answer type questions	Long answer type questions**	Total
Arithmetic	2 (1×2)	4 (2×2)	4	10
Algebra	5 (1×5)	8 (2×4)	22	35
Geometry	2 (1×2)	4 (2×2)	11	17
Co-ordinate Geometry	1 (1×1)	2 (2×1)	3	6
Mensuration	2 (1×2)	4 (2×2)	6	12
Statistics	2 (1×2)	4 (2×2)	4	10
Total Marks	**14**	**26**	**50**	**90**
	14 + 26 = 40			

Internal Formative Evaluation : 10 marks

** **Long answer type questions.**

Arithmetic	
(i) Real numbers (ii) Profit and loss }	Answer one question out of two questions = 4 Marks
Algebra	
(i) Polynomials	Answer one question out of two questions = 3 Marks
(ii) Factorisation	Answer one question out of two questions = 3 Marks
(iii) Graph	Answer one question out of two questions = 4 Marks
(iv) Solve (linear simultaneous equations)	Answer one question out of two questions = 3 Marks
(v) Application of Linear simultaneous equations in real life problems	Answer one question out of two questions = 3 Marks
(vi) Laws of Indices	Answer one question out of two questions = 3 Marks
(vii) Logarithm	Answer one question out of two questions = 3 Marks
Geometry	Proof one theorem out of two theorems = 4 Marks
	Application of theorems in solving geometrical problems = 3 Marks (Answer one question out of two questions)
	Construction (Answer one question out of two questions) = 4 Marks
Co-ordinate Geometry	Answer one question out of two questions = 3 Marks
Mensuration	Answer two questions out of three questions= 3×2 Marks = 6 Marks
Statistics	Answer one question out of two questions = 4 Marks

SAMPLE QUESTION PAPER OF THIRD SUMMATIVE EVALUATION

CLASS IX

SUBJECT—MATHEMATICS

TIME—3 HOUR 15 MINUTES   **FULL MARKS: 90**

1. **Choose the correct answer:**   **1 × 14 = 14**

    i)   Number 1 is

         a)   a natural number but not a rational number

         b)   a rational number but not a real number

         c)   an irrational number and a real number

         d)   a natural number, an integer, a rational number and a real number

    ii) Number 0 is

         a)   an integer but not a rational number

         b)   a rational number but not a real number

         c)   an integer, a rational number and a real number

         d)   an irrational number and a real number

    iii) $x^{-3} \times x^5 =$

         (a) x^{-15} (b) x^{-8} (c) x^2 (d) x^8

    iv) $\left(2^2\right)^2 =$

         (a) 2^5 (b) 2^6 (c) 2^4 (d) 2^8

    v)   If $2^x = 8^2$, then the value of x will be

         (a) 6   (b) 4   (c) 2   (d) 8

    vi) The two equations $x + y = 1$ and $x - y = 1$ have

         a)   a unique common solution

         b)   infinite number common solutions

         c)   no solution

         d)   two unique common solutions

    vii) A factor of $x^3 + 3x + 4$ is

         (a) $x + 2$ (b) $x - 2$ (c) $x - 1$ (d) $x + 1$

    viii) In the parallelogram ABCD, if $\angle ABC = 5°$ then, $\angle BAD =$

         (a) 150°   (b) 10°   (c) 90°   (d) 175°

ix) In the trapezium ABCD, AB || DC and AB = 4.25 cm and DC = 3.75. If the midpoints of AD and BC are P and Q respectively, then the length of PQ is

(a) $\frac{4.25}{2}$ cm   (b) $\frac{3.75}{2}$ cm   (c) $\frac{4.25 - 3.75}{2}$ cm   (d) $\frac{4.25 + 3.75}{2}$ cm

x) The co-ordinates of the two end points of a diameter of a circle are (-3,4) and (5,-2). The co-ordinates of the centre of the circle will be

(a) (4, –3)   (b) (1, 1)   (c) (2, 2)   (d) (–3, 4)

xi) The perimeter of a semi circle having the length of radius 7 cm is

(a) 22 cm   (b) 36 cm   (c) 44 cm   (d) 66 cm

xii) The area of a circular region is A sq. unit. If the circumference of the circle is P unit and the length of the diameter D unit, then the value of PD/A is

(a) 2   (b) 4   (c) 6   (d) 1

xiii) The midpoints of the classes in a frequency distribution table are 15,20,25,30..........respectively. 25 is the midpoint of the class

(a) 20 — 25   (b) 17.5 — 22.5   (c) 22.5 — 26.5   (d) 22.5 — 27.5

xiv) When the length of every class is same then the area of the rectangular region of a histogram is proportional to

(a) the midpoint of the corresponding class

(b) the length of the class of the corresponding class

(c) the frequency of the corresponding class

(d) the cumulative frequency of the corresponding class

2. **Answer the following questions:** $2 \times 13 = 26$

i) Fill in the blanks:

Cost price	Selling price	Profit/Loss	Percentage of profit/loss
Rs. 200	Rs. 250		
Rs. 400		Loss Rs. 60	

ii) (a) Write two rational numbers which are not integers.

(b) Write an irrational number which is greater than 0 and smaller than 1

(Open ended Problem)

iii) Write $(27)^{-4/3}$ in the form of $\frac{p}{q}$ when p and q are two integers.

iv) Write a trinomial with of one variable where the two co-efficients are rational and one co-efficient is irrational numbers.   (Open ended Problem)

v) Factorise the following :

$x^2 + (a+b)x + ab$

vi) Calculate the value of $\log_{\sqrt{3}} 81$ and write whether the number is rational or irrational.

vii) Draw a convex and a concave quadrilateral. Draw the diagonals of the quadrilateral by dotted lines. (Open ended Problem)

viii) Draw a quadrilateral so that the diagonals are perpendiculars to each other but the quadrilateral should not be a rhombus. (Open ended Problem)

ix) Take a point P on the x-axis and another point Q on the y- axis. Take the co-ordinate of the point P and the co-ordinate of the point Q in such way that the distance of the line segment PQ is 5 unit. Write what co- ordinates of P and Q will you take? (Open ended Problem)

x) Draw an equilateral triangle with a scale and compass. Calculate the area of the triangle in sq. cm. (Open ended Problem)

xi) Draw a circle with scale and compass and find out the circumference of the circle.

(Open ended Problem)

xii) Give an example of a discrete variable and an Contionuous variable. (Open ended Problem)

xiii) If the classes 60 — 69, 70 — 79, 80 — 89, 90 — 99 are expressed in class-boundary, then how will the classes be?

3. **Answer one question :** **4 × 1 = 4**

   a) My friend bought a story book with a rebate of 25% on the marked price. If he sells the book at the marked price then what with be this percentage of profit?

   b) Write two numbers which one greater than 1 but smaller than 2 and their decimal range is infinite and non-repeating. Write two numbers whose decimal range is infinite and recurring.

   (Open ended Problem)

4. **Factorise the following polynomial expressions : (any one)** **3 × 1 = 3**

   a) $x^3 - 7x - 6$

   b) $4x^2 - 12xy + 9y^2 + 2x - 3y$

5. **Answer any one question :** **3 × 1 = 3**

   a) By dividing the polynomials (ax^3+3x^2-3) and $(2x^3-5x+a)$ by $(x-4)$ if the remainder is the same, then what is the value of a ?

   b) If $f(x) = ax + b$, $f(o) = 3$ and $f(2) = 5$, then let us find out the values of a and b.

6. **Draw the graph of the following simultaneous equations and write the co-ordinates of the intersecting points : (any one).** $\qquad$ **4 × 1 = 4**

   a) $x + y = 12$ and $x - y = 2$

   b) $y = 5$ and $2x + 3y = 11$

7. **Solve the following equation: (any one)** $\qquad$ **3 × 1 = 3**

   a) $\dfrac{2}{x} + \dfrac{5}{y} = 1$; $\dfrac{3}{x} + \dfrac{2}{y} = \dfrac{19}{20}$ $\qquad$ b) $\dfrac{x+1}{y+1} = \dfrac{4}{5}$; $\dfrac{x-5}{y-5} = \dfrac{1}{2}$

8. **Answer any one question :** $\qquad$ **3 × 1 = 3**

   a) The denominator of a proper fraction is greater than its numerator by 5 and if 3 is added to the numerator and the denominator the fraction becomes $\dfrac{3}{4}$. Construct a linear simultaneous equation with two variables. Solve it and find out the fraction.

   b) The total weight of Ayesha and Rafiq is 51 kg. If half of the weight of Ayesha is $\dfrac{4}{9}$ of the weight of Rafiq then construct a linear simultaneous equation with two variables and solve it to find out the individual weight of Ayesha and Rafiq.

9. **Answer any one question :** $\qquad$ **3 × 1 = 3**

   a) **Simplify :**

   $$9^{-3} \times \frac{16^{\frac{1}{4}}}{6^{-2}} \times \left(\frac{1}{27}\right)^{-\frac{4}{3}}$$

   b) **Solve :**

   $$9 \times 81^{x} = 27^{2-x}$$

10. **Answer any one question :** $\qquad$ **3 × 1 = 3**

   a) If $\dfrac{\log x}{y - z} = \dfrac{\log y}{z - x} = \dfrac{\log z}{x - y}$ then show that $xyz = 1$

   b) If $a^2 + b^2 = 7ab$ then show that $\log \left(\dfrac{a+b}{3}\right) = \dfrac{1}{2}(\log a + \log b)$

11. **Answer any one of the following questions:** $\qquad$ **4 × 1 = 4**

   a) **The height of 75 persons are given in the table below:**

Height (cm)	136 — 142	142 — 148	148 — 154	154 — 160	160 — 166
Population	12	18	26	14	05

   Draw the histogram of the above data.

b) **Draw a frequency polygon on the basis of the frequency distribution table given below:**

Height (cm)	75 — 80	80 — 85	85 — 90	90 — 100	100 — 110
Population	12	18	22	10	8

12. **Answer any one question:** $1 \times 4 = 4$
   a)   Prove that the diagonals of a parallelogram bisect each other.
   b)   Prove that the three medians of a triangle are concurrent.

13. **Answer any one question:** $1 \times 3 = 3$
   a)   O is a point in the parallelogram ABCD. Prove that $\triangle AOD + \triangle BOC = \frac{1}{2}$ parallelogram ABCD.
   b)   Prove that by joining the midpoints of the sides of any quadrilateral, the quadrilateral that is formed is a parallelogram.

14. **Answer any one of the following question:** $1 \times 4 = 4$
   a)   In the $\triangle PQR$, $\angle PQR = 30°$, $\angle PRQ = 60°$ and $QR = 8$cm. Draw a rectangle equal to the area of $\triangle PQR$ (only traces of construction are required)
   b)   Draw a square having the length of side 6cm. Draw a triangle equal to the area of the square.

15. **Answer any one question:** $1 \times 3 = 3$
   a)   Find out in what proportion the joining line segment of the two points (4,3) and (5,4) is divided by the x-axis.
   b)   The co-ordinates of the point A,B and C of $\triangle ABC$ are (5, 3), (–2, 1) and (2, 4) respectively. Find out the area of the $\triangle ABC$ by co-ordinate geometry.

16. **Answer any two questions:** $2 \times 3 = 6$
   a)   You decide the length of the three sides of a triangle which is not right angled and find out the area of the triangle.   (Open ended Problem)
   b)   You decide the length of the diagonal and the perimeter of a rhombus which is not a square and find out the length of the other diagonal.   (Open ended Problem)
   c)   A circle and a squar cricumscribe it are drawn. If the area of the circle is 154 sq cm, then find out the area of the square.

Development of certain life skills through the curriculum of Mathematics for class IX: A discussion

The aim of education is holistic development of the learner. Hence,learning is continuous and lifelong. The learner experiences varied challenges in daily life. When these experiences are properly integrated with the learning developed through school curriculum we infer that his/her learning is progressing with the right approach. But can the school curriculum facilitate him so that at the end of school education he/she is equipped enough to meet the challenges of social life? Is the curriculum adequate enough to utilize the minimum hidden opportunities even in adverse conditions? In such situations various types of life skills are required.

Surpassing the limitations of school curriculum, the learner needs to develop the skills in order to face the different challenges and uncertainities, both within and also beyond him/her. Hence the learner needs to develop his/her innate qualities to become adequate enough to meet the demands of the fast changing society. In other words, this special kind of learning imparts in him/her the skills to become sensitive and socially responsible. This skill of education is commonly known as Life skill education. Life skill education devlops the skill of the learners. Life skills help in the cognitive development of the learners. The communicative skill is enhanced and they learn the skill of anxiety management.

In the Mathematics curriculum, the prospects of different life skills can be found. Some instances of the life skills are stated below.

Some contextual examples to adopt life skills

Topic: Area of a circle

Task: There is a rectangular aluminium sheet of length 1m and breadth ¾ m. The cost of the sheet is Rs.472. Plates of ½ m diameter or pots of ¼ m diameter are to be made from this aluminum sheet. A profit of Rs. 50 for selling each plate and Rs 12 for each pot is being made. By selling the remaining unused pieces Rs. 18 is gained. How many pots and plates can be made from the aluminum sheet with minimum wastage? What will be the maximum profit and what will be the percentage of profit? What will be the selling price of unused materials per sq. m.?

(i) 12 pots   (ii) 8 pots and 1 plate   (iii) 4 pots and 2 plate
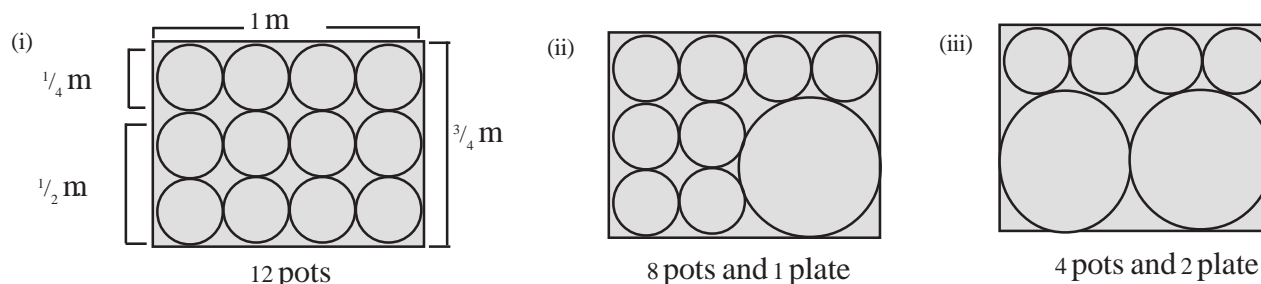
.From fig. (i),total profit from12 pots= Rs.12×12=Rs. 144

From fig. (ii),profit from 8 pots= Rs.12×8=Rs. 96 and profit from 1 plate= Rs.50

Total profit=Rs. (96+50)=Rs. 146

From fig (iii), profit from 2 plates= 2 × Rs.50= Rs.100

and profit from 4 pots= 4 × Rs.12= Rs.48

Total profit=Rs. (100+48) =Rs.148

∴ To get the maximum profit with minimum wastage, maximum 2 plates and 4 pots can be made in the shape of the diagram (iii) given above.

∴   The maximum profit = Rs. 148

Now, in Rs.(472-18) or in Rs 454, the profit is Rs.148.

∴   In Rs. 100 the profit is Rs. $\frac{148}{454}$× 100 =Rs. 32.60 (approx.)

∴   The rate of profit is 32.60%

The area of the remaining portion

$$= [1 \times \frac{3}{4} - \{\frac{22}{7} \times (\frac{1}{8})^2 \times 4 + \frac{22}{7}(\frac{1}{4})^2 \times 2\}] \text{ sq.m}$$

$$= [\frac{3}{4} - \frac{22}{7}(\frac{1}{16} + \frac{1}{8})] \text{ sq.m}$$

$$= (\frac{3}{4} - \frac{22}{7} \times \frac{3}{16}) \text{sq.m} = \frac{9}{56} \text{ sq.m}$$

∴   Selling price of unused materials per sq. m.= Rs.$(18 \div \frac{9}{56})$ = Rs. 112

In this problem the life skills that are developed are—

1.   Wise use of Resources

2.   Critical Thinking

3.   Problem Solving

4.   Decision Making

Topic: Profit and loss

Task: The cost of making a bed is Rs. 15,000. The trader had fixed the selling price at Rs. 20,000. He sold one bed to a customer at a rebate of 15%. The customer's friend appreciated the bed and wanted to buy a similar bed from the same trader. The trader made a bill at a rebate of 10% on the selling price. The second customer told the trader of the rebate of 15% got by his friend on the previous day. Then the trader gave him a further 5% rebate on the bill amount. Now apparently both got the same amount of rebate. But did the two customers get the same amount of rebate? Who gained more, the first customer or the second? How much did he gain?

Selling price to the first customer =Rs. $(20000 - 20000 \times \frac{15}{100})$=Rs.17000

∴   He earns profit from the first customer =Rs.(17000 – 15000) =Rs.2000

Selling price of the first part of the bill to his friend =Rs.$(20000 – 20000 \times \frac{10}{100})$ =Rs.18000

Selling price of the second part of the bill =Rs.$(18000 – 18000 \times \frac{5}{100})$ =Rs.17100

Therefore they did not get the same rebate. Thus the first customer gained more than the second one.

The trader gained Rs 2000 from the first customer and gained Rs. (17100-15000)=Rs. 2100 from the second customer.

In this problem the life skills that are developed are—

1.   Marketable Skill

2.   Critical Thinking

3.   Problem Solving

Topic: Statistics

Task : The marks obtained in Mathematics by different students of class IX in the 3rd Summative Evaluation of last year are given below:

72,   85,   73,   95,   44,   48,   62,   53,   31,   92,
28,   32,   09,   14,   56,   85,   92,   58,   93,   67,
08,   17,   26,   39,   49,   52,   93,   87,   77,   99.

Make a frequency distribution list of the raw data using the Tally mark where the length of the class is 10. Draw a Histogram and a Frequency Polygon using the list to understand the performance of the students.

Highest mark= 99,   Lowest mark= 08

class	Tally mark	class marks	frequency(f)
0 – 10	||	5	2
10 – 20	||	15	2
20 – 30	||	25	2
30 – 40	|||	35	3
40 – 50	|||	45	3
50 – 60	||||	55	4
60 – 70	||	65	2
70 – 80	|||	75	3
80 – 90	|||	85	3
90 – 100	⅂⅃⅂|	95	6

Frequency distribution table of class length 10
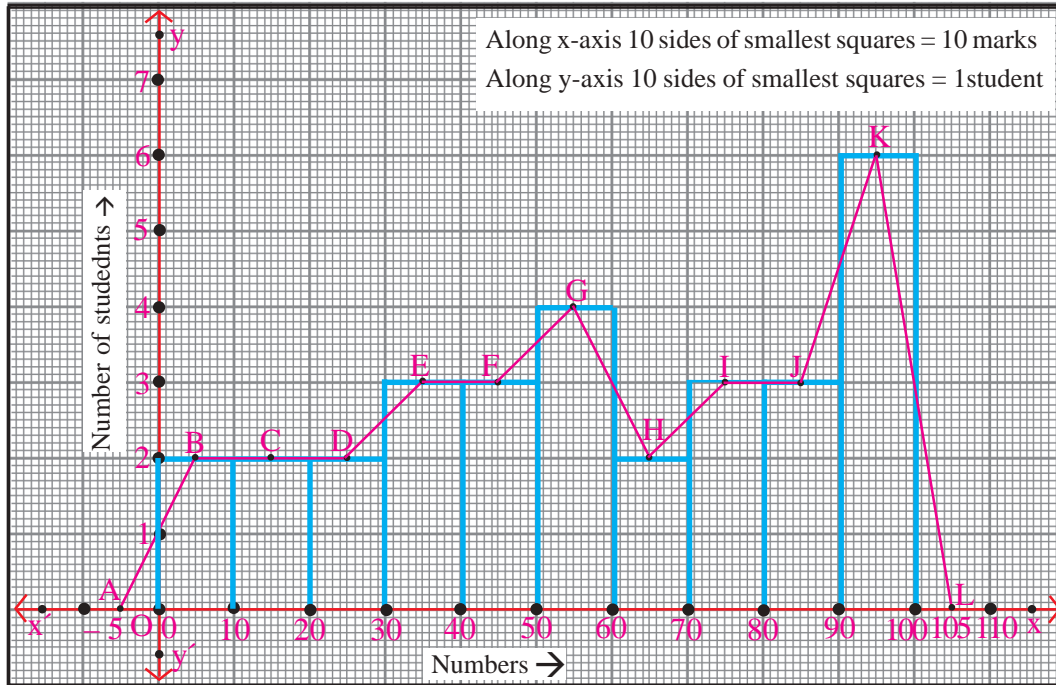
Here the Frequency Polygonis A B C D E F G H I J K L

Two axis XOX´ and YOY´ are drawn on the graph paper perpendicular to each other. The histogram is drawn by taking the length of the sides of 10 smallest squares along the x-axis=10 marks and the lengthof the sides of 10 smallest squares along the y-axis=1 student.

Then the points (-5,0),(5,2),(15,2),(25,2),(35,3),(45,3),(55,4),(65,2),(75,3),(85,3)(95,6) and (105,0) are joined by line segments sequentially and the Frequency Polygon A B C D E F G H I J K L is drawn.

Life skills are also developed by working out the problems of statistics. In this case the life skills developed are:

1. Keeping Records

2. Planning/Organizing

It is anticipated that the teachers will engage the learners into similar other instances to develop various other life skills of the learners.

Characteristics of Some life skills

Problem Solving

- Ability to identify the problem, i.e. he/she is able to identify those mathematical matters related to the problem

- Ability to write the problem in mathematical language

- Ability to think about the possible ways and also to apply the most appropriate way of solving the problem

- Ability to analyze logically the way of solving the problem and to practice it

Decision Making

- Ability to know why a decision is being made on a given topic

- Ability to select with utmost confidence the most important and effective method

- Ability to think about the possible advantages to be gained for selecting the method along with the probable disadvantages to be faced

- Ability to verify the decision

Critical Thinking

- Remembering

- Comprehending

- Applying

- Analysing

- Evaluating

- Creating

Wise use of Resources

- Understanding the value of resources and using them appropriately

- After using the resources with proper objective, utilizing the other resources in varied ways appropriately

- Transforming the resources by maintaining their importance

- Adopting appropriate planning for successful implementation of the objectives

- Feeling motivated from the experience gathered in the desired field of activity and achieving success in any other field

Marketable Skill

- Reaction based on diverse circumstances

- Marketing strategies

- Decision making based on circumstances

- Preparation for adopting new approach based on experience

Keeping Records and Planning/Organizing

- Decision can be taken regarding the planning or organizing an activity on the basis of the data recorded and the objectives undertaken

- Apprehending the future perspective of an event based on analysis and comparison

- Knowing about the essence of the matter

- Realizing the errors and mistakes committed and rectifying them

- Knowing about a topic in detail and being aware of its responsibility