Grade 7

Mathematics

Teacher's Instructional Manual

Department of Mathematics
Faculty of Science and Technology
National Institute of Education
Maharagama
2008

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Message of the Director General

The first curriculum revision for the new millennium aims to eliminate several problems that exist in the present education system. Having identified the problems that youth face due to the weakening of thinking, social and personal skills, and investigating step by step the factors that have resulted in this situation, this curriculum reform has been planned in order to create the environment that is necessary to overcome this.

Our country took the lead in education in the Asian region in the past. However many other countries in this region have now advanced ahead of us. Some of the factors that have caused this decline are the actions that have been taken continuously by the educational institutions over a period of time, to retain what is known, to learn the pre-determined and construct what is in the same manner as before.

By taking all these factors into consideration, the officers of the National Institute of Education have endeavored to compile the new curriculum with a clearer vision. The primary objective of this curriculum is to produce a generation of students who will display their readiness for a successful future, by changing what is known, exploring what is new and building up what is required for the future. It is unnecessary to reiterate that to fulfill this goal, there should be a distinct change in the teacher's role. Instead of the transmission and transactional teacher role that has been prominent in our classrooms to date, teachers in the Sri Lankan schools will have to understand and familiarize themselves with a student centered, competency based and activity focused transformational role under this new curriculum.

It is our firm belief that this Teacher's Instructional Manual will aid you to adapt yourself to the new situation and to become an effective teacher in the new millennium. By following these instructions you will be helped in your daily teaching and evaluation duties. There is no doubt that the instructions for student exploration and other quality inputs will also facilitate the teacher's task. This Teacher's Instructional Manual also provides valuable information to school principals regarding the preparation of timetables, sharing of limited resources and internal supervision.

My sincere thanks go to Dr. Mrs. I. L. Ginige, Assistant Director General (Curriculum Development), Faculty of Science & Technology of the National Institute of Education for her direct involvement in the preparation of this Teacher's Instructional Manual. My thanks are also due to the other officers and all other personnel who aided in the preparation of this manual that will serve not only the above mentioned persons involved at the school level but also the teacher educationists involved in beginning or in continuous teacher education duties, in-service advisors as well as officers at various levels who are involved in external supervision and monitoring programmes.

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Director General
National Institute of Education

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Preface

The first curriculum reforms of the new millennium which are being implemented with the objective of laying a strong foundation for a new Sri Lanka, anticipates a visible transformation in the role of the teacher. The Teacher's Instructional Manual which has been compiled to provide the support necessary to achieve this, contains the following main sections.

- Descriptive syllabus
- Activity continuum to aid in the implementation of the syllabus
- Instruments for the extension of the learning-teaching process

The descriptive syllabus which extends further than the subject topics and sub-topics, provides teachers with an understanding of some of the main issues that were considered in designing the curriculum. This section, which begins with an introduction of the basis for the new syllabus and the subject aims, includes competency levels that have been prepared in line with the subject competencies. The subject knowledge that students should gain under each competency level is introduced as subject content. A special feature of this section is that by considering the many learning-teaching methods that are used to provide students with the required knowledge, the time frame required for each competency level has been determined. It is essential that every instructional leader carefully reads and understands the final section of this descriptive syllabus which is presented under the topic "School Policies and Programmes". This section provides school managers with a range of valuable instructions to assist them in allocating time for teaching, assigning teaching duties, implementing co-curricular activities and supervising teachers' tasks.

The second section of the teacher's instructional manual has been prepared with the aim of providing teachers with a clear understanding of the proposed learning-teaching methodologies. This section commences with the desired change in the teacher's role and an introduction to the procedures that should be followed to prepare activities under a competency based education. The activity continuum of the curriculum is presented next. The teacher is not expected to carry out the activities exactly as presented. He/she should use his/her creative ability and reasoning to adapt the activities to suit the class. Although instructions have been provided based on each problem that is to be explored, on the number of groups that the class should be separated into, it is expected that the teacher will use his/her discretion to group the class wisely taking into consideration on the number of students in the class.

Time has been allocated for the activities to enable the relevant competency levels to be achieved. Thus teachers will have to go beyond the usual 40 minutes period. While each activity has been provided with adequate time for the competency level to be achieved, the teacher is expected to make use of single or double periods in the time-table to breakdown the activities in a suitable manner. Whenever an activity which has commenced on a previous day is continued on the following day, it is essential that a brief summary of what has been carried out previously is presented to the class for the success of this process. This decision will also provide the school community with the opportunity to engage students in effective learning whenever a teacher is absent. The final item in this section is the list of quality inputs that are necessary to maintain the quality of the learning-teaching process taken as a whole. Provision of this list enables the teacher to order the necessary quality inputs in time and have them in hand when required.

A number of important hints to ensure that the results expected from this syllabus are achieved are included in the third section of the teacher's instructional manual under the title "Assessment and Evaluation". This section has been planned to introduce the assessment and evaluation that should take place under each activity, instruments for the extension of the learning teaching process and the nature of the questions that could be expected at general examinations. The main responsibility of the teacher is to identify when assessment and evaluation can take place in the course of each activity, and to carry it out successfully through a common set of criteria. The set of instruments for the extension of the learning teaching process provide students with the opportunity to be involved in continuous learning outside the recommended classroom sessions. It is the responsibility of the teacher to encourage the students and regularly assess the competencies developed by them through these instruments. It is also expected that the teacher will make correct judgments regarding the final outcomes of the activities and communicate them to the relevant parties.

There should be a distinct change in the questions in the general examinations for the success of this learning teaching process. The National Institute of Education with the assistance of the Department of Examinations has worked towards introducing several prototype questions to the educational levels that terminate with a general examination. Since this change in the examination questions has been suggested in order to direct students to learn through activities and experiences instead of through mechanical approaches such as memorizing and answering model papers, students and parents should be informed of this change at the initial stage itself.

All teachers should understand that various activities can be developed to achieve the required competency levels. They should be prepared therefore for more innovative teaching through better approaches, exploration and instruments for the extension of the learning-teaching process, instead of implementing the proposed activities exactly as instructed. This teacher's instructional manual will give teachers throughout the country the courage to effect a visible change in the teacher's role and to prevent them from becoming inactive in the face of new approaches. We expect to award certificates and provide numerous development opportunities to encourage teachers who go beyond the given activities and involve themselves in novel creations. To be eligible for these awards, the teachers should use their creative abilities to further improve the proposed activities. These should be forwarded to the Assistant Director General (Curriculum Development), Faculty of Science and Technology, National Institute of Education, Maharagama. The activities will be examined by the relevant subject committees before a final decision is made regarding the awards.

We have endeavored through this effort to bring learning, teaching, assessment and evaluation onto the same platform through new methodologies. By this, the teacher is provided with latitude to carry out the learning – teaching process, school based evaluation and homework assignments in a meaningful manner. It is our firm conviction that the Sri Lankan school system will make maximum use of this aid and depart from orthodox learning teaching approaches to enhance the thinking, social and personal skills of our children.

Dr. Mrs. Indira Lilamani Ginige
Assistant Director General
(Curriculum Development)
Faculty of Science and Technology
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Contents

Descriptive Syllabus

Introduction

The abilities, skills, virtues and customs that should be developed in students, and which are based on the capabilities that those learning mathematics from grade 6 to grade 11 should aim at achieving, have been identified as a set of competencies and organized to suit the different grades. It is expected that students who study mathematics would approach all these competencies by the end of grade 11. To aid the students in approaching these competencies, competency levels and appropriate learning outcomes have been prepared for each competency. The competencies that students learning mathematics in grade 7 should approach, the appropriate competency levels, and the learning outcomes that are required to achieve the competency levels have been included in this manual. All these have been included in the manual such that they can be identified as the mathematics syllabus for grade 7. The subject content prepared to aid the students in achieving these learning outcomes, and the number of periods required to operate this subject content based learning teaching and assessment process have also been included in this syllabus. The new competency based syllabi related to mathematics have been in operation from 2007 in grade 6 and in 10, and a policy decision has been made to implement this syllabus in grade 7 from 2008.

The subject content of this syllabus has been organized so that the following aims of learning mathematics are achieved.

- Knowledge and Skills
- Communication
- Identifying Relationships
- Reasoning
- Problem Solving

It is expected that through this syllabus, mathematics will not just be limited to knowledge but that the skills required in practical life as well as virtues will be developed. In implementing the learning, teaching and exploring process of this competency based syllabus,

- the instances of meaningful discovery learning are increased and thus learning becomes more student centered
- guidance is provided for students to achieve the various competencies appropriate for their mental level and to develop these throughout their lives.
- the aims of learning, teaching and exploring become clearer.
- the goals of the teacher become more specific.
- since it is possible to identify how far each student has progressed towards achieving each competency level, it is easy for the teacher to provide the required feedback and feed-forward.
- the opportunity is given for students to develop the necessary mathematical concepts as well as the principles related to them.
- the teacher is able to step away from traditional teaching methods and enter into a transformation role.

When operating this mathematics syllabus in the classroom, under the sections that are considered topical, day to day phenomena should be used to create new teaching strategies.

It is more productive to implement this grade 7 mathematics syllabus by first resolving the problems that have been identified while operating the grade 6 and grade 10 syllabi in year 2007. Some of the problems that have been identified and remedial actions that could be taken have been included in this syllabus under the chapter 'school policies and programmes'.

The quality inputs that are required for the activities that have been proposed to provide students with experience within the learning, teaching and exploring process, have been included under each activity in the chapter named learning- teaching methodology.

In the learning, teaching and exploring process, since the opportunity to develop activities for each competency level is provided, assessment of the competency level that the student is approaching and evaluation of the student is facilitated. In addition, the following aspects

- the aims of learning mathematics
- the learning-teaching strategies
- the school policies and programmes
- proposed teaching sequence and number of periods
- the competency based syllabus

that aid in carrying out the various duties related to teaching mathematics in schools are also presented in this syllabus..

Aims of learning mathematics

The following objectives should be aimed at and achieved to further develop the mathematical concepts, creativity and sense of appreciation in students entering the senior secondary stage, so that their mathematical thinking, understanding and abilities are enhanced.

(1) The development of computational skills through the provision of mathematical concepts and principles as well as the knowledge of mathematical operations, and the development of the basic skills of solving mathematical problems with better understanding.

(2) The development of correct communication skills by enhancing the competencies of the proper use of oral, written, pictorial, graphical, concrete and algebraic methods.

(3) The development of relationships between important mathematical ideas and concepts, and the use of these in the study and improvement of other subjects. The use of mathematics as a discipline that is relevant to lead an uncomplicated and satisfying life.

(4) The enhancement of the skills of inductive and deductive reasoning to develop and evaluate mathematical conjectures and arguments.

(5) The development of the ability to use mathematical knowledge and techniques to formulate and solve problems both familiar and unfamiliar that arise in day to day life.

1. Knowledge and Skills

It is expected that students will acquire basic skills and gain understanding of concepts, principles and methods by learning mathematics. These can be used as tools to apply mathematical thinking in other fields, and also as a base for further mathematical activities. It is necessary to keep in mind the recent developments in technology when deciding on the skills and knowledge that the students should gain by memorizing or learning, as scientific calculators and symbolic processes which are affordable, more powerful and mechanical have an influence on senior secondary schools.

2. Communication

Due to the fact that mathematics has the power to communicate and represent ideas concisely and with clarity, the use of it in other disciplines has increased tremendously. Guaranteeing that students come to a common agreement regarding concepts and definitions should be an important component of the school curriculum.

This can be accomplished by providing students with the latitude to explain their ideas both orally and in writing, to think intuitively, and to defend their ideas. Through such activities, the skills of exchanging knowledge and working with amity in co-operation with others are guaranteed. These are considered as higher skills in the modern world of work.

3. Relationships

Students are often inclined to think of mathematics as a series of isolated and unrelated truths and processes. It is therefore important to educate them about the many relationships that exist even in the learning of mathematics through graphical, numerical, physical and algebraic representations or models. Students should recognize that mathematical thinking and modeling are used to solve problems in other fields such as the Biological, Physical and Social Sciences, Arts, Music and Commerce, as well as in day to day life. They should also understand the manner in which mathematics has been related to our culture both local and foreign, in the past as well as in the present.

4. Reasoning

The argument that has existed for years to pay greater attention to mathematics in the school curriculum is due to the belief that by learning mathematics, students will be able to develop clear and logical thought.

Although the principles of logic form the base for deductive reasoning in mathematics, there are many developments in mathematics based on induction, i.e., on conjectures that are proved by deductive reasoning, by first identifying patterns. The development of mathematics has occurred through the interactions that take place between various observations, identification of patterns, making assumptions and proving theorems. Students should be educated regarding these various aspects of mathematical thought and should also develop the skills related to each of them.

5. Problem Solving

For a student to become a productive citizen it is essential that he/she develops problem solving skills. Problem solving is a common investigative path through which students develop an awareness of the usefulness and power of mathematics. Students will face various issues when they attempt to use logical and creative thought to analyze a mathematical method by which a wrong conclusion has been arrived at. But in every situation, the students have the ability to solve problems that are within the scope of the knowledge they have gained. Suitable methods should be developed to evaluate and appreciate the success of these efforts by students and these evaluation methods should be incorporated into the regular evaluation scheme.

Grade 7 – Mathematics

Competencies, Competency Levels, Subject Content and Number of Periods

Competencies and Competency Levels	Subject Content	Periods
Competency – 1 **Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.**		

1.1 Investigates the relationships between numbers.	• Directed Numbers
	  • Concept
	  • Addition
		06

1.2 Applies the rules of divisibility to find the factors of a number.	• Rules of Divisibility (Numbers that are divisible by 3, 4, 6 and 9)	02
1.3 Investigates the methods of determining the factors and multiples of numbers.	• Factors and Multiples (Up to 1000) • Prime Factors (Up to 100) • Greatest Common Factor (Up to three numbers) • Least Common Multiple (Up to three numbers)	04
Competency – 3 **Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.**		

3.1 Compares quantities related to fractions and decimals.	• Comparison of Fractions
	  • Without Mixed Numbers
	  • With Unrelated Denominators (Denominator ≤ 12)
	• Introducing Mixed Numbers
	  • Conversion
	(Improper Fractions ⇔ Mixed Numbers)
	• Decimals
	(Terminating Decimals ⇔ Fractions)
		05

Competencies and Competency Levels	Subject Content	Periods
3.2 Manipulates fractions under the mathematical operations.	• Addition and Subtraction of Fractions (Including Mixed Numbers)	03

3.3 Manipulates decimals under the mathematical operations.	• Multiplication and Division of Decimals
	  • By Powers of Ten
	  • By a Whole Number
		06

Competency - 4 **Uses ratios to facilitate day to day activities.**		
4.1 Uses ratios to divide things.	• Dividing according to a Ratio (Up to three portions)	05
Competency - 5 **Makes successful transactions in the modern world of commerce by using percentages.**		
5.1 Represents decimal numbers as percentages.	• Concept of Percentages • Decimal Numbers as Percentages	06
Competency – 6 **Easily solves problems in day to day life by using logarithms and calculators**.		
6.1 Finds the numerical value of a power with an algebraic base.	• Introducing Powers with Algebraic Bases (With two symbols and index less than 4) • Expansion of Powers with Algebraic Bases • Substitution of Numerical Values for Algebraic Symbols in Powers with Algebraic Bases	06

Competencies and Competency Levels	Subject Content	Periods
Competency – 7 **Carries out daily tasks effectively by investigating the various methods of finding the perimeter.**		

7.1 Manipulates measurements related to lengths under the basic mathematical operations for various needs.	• Measurements Related to Lengths
	  • Addition; Subtraction
	  • Multiplication; Division (By a whole number only)
		03

7.2 Uses formulae to determine the perimeters of rectilinear plane figures.	• Formulae for Perimeters
	  • Triangle
	  • Square
	  • Rectangle
		03

Competency – 8 **Makes use of a limited space in an optimal manner by investigating the area.**		

8.1 Investigates the areas of rectilinear plane figures.	• Formulae for Areas
	  • Square
	  • Rectangle
	• Standard Units (m^2, cm^2)
	• Estimation of Areas
	• Areas of Compound Plane Figures (Squares and Rectangles)
		06

Competency – 9 **Fulfills daily requirements by working with an awareness of mass.**		
9.1 Manipulates measurements related to mass under the basic mathematical operations.	• Relationship between Milligrams and Grams • Estimation of Mass • Mass (*mg*, *g*, *kg*) • Addition and Subtraction • Multiplication; Division (By a whole number only)	06

Competencies and Competency Levels	Subject Content	Periods
Competency – 10 **Gets the maximum out of space by working critically with respect to volume**.		

10.1 Has an awareness of the amount of space occupied by solids.	• Volume (Cube, Cuboid)
	  • Concept
	  • Volume in terms of Arbitrary Units
	  • Volume in terms of Standard Units (cm^3, m^3)
	  • Estimation of Volume
		06

Competency – 11 **Fulfills daily needs by working critically with the knowledge of liquid measures.**		

11.1 Manipulates measurements related to liquids under the basic mathematical operations.	• Units of Liquid Measurements (*ml*, *l*)
	  • Multiplication (By a whole number)
	  • Division (By a whole number)
		06

Competency – 12 **Fulfills the needs of the world of work by time management.**		

12.1 Manipulates measurements related to time under the basic mathematical operations.	• Leap Year, Century
	• Measurements Related to Time
	  • Addition
	  • Subtraction
		05

Competency – 13 **Uses scale drawings in practical situations by exploring various methods**.		
13.1 Represents by geometrical plane figures measurements related to lengths that are obtained from the environment.	• Selecting appropriate Scales • Simple Plane Figures • Rectangle	06

Competencies and Competency Levels	Subject Content	Periods
Competency – 14 **Simplifies algebraic expressions by systematically exploring various methods.**		

14.1 Constructs algebraic expressions using all four mathematical operations.	• Algebraic Expressions
	  • Including Fractional Coefficients
	  • With all Four Mathematical Operations
		03

14.2 Simplifies algebraic expressions that include like terms and unlike terms.	• Algebraic Expressions
	  • Addition, Subtraction (Including like terms and unlike terms)
	  • Substitution (Whole numbers, excluding powers and roots)
		03

Competency – 17 **Manipulates the methods of solving equations to fulfill the needs of day to day life.**		

17.1 Uses simple equations to solve problems that are encountered in day to day life.	• Constructing Equations
	  • Of the type $ax \pm b = c$ (When a is a whole number or a fraction, $c > 0$)
	• Solving Equations
	  • Using Flow Charts
	  • By Algebraic Methods
		05

Competency – 18 **Analyzes the relationships between various quantities related to real-life problems.**		

Competencies and Competency Levels	Subject Content	Periods

18.1 Displays pictorially the limits of the values that variables can take under given restrictions.	• Solving Inequalities
	  • Of the form $ax \underset{<}{>} b$
	  • Of the form $x \pm a \underset{<}{>} b$
	• Representation on the Number Line
	  • Integer Solutions of Inequalities of the form $ax \underset{<}{>} b$, $x \pm a \underset{<}{>} b$
		06

Competency – 19 **Solves problems encountered in day to day life by exploring the methods by which formulae can be applied.**		
19.1 Constructs simple formulae.	• Construction of Simple Formulae (Up to three variables)	03
Competency – 20 **Easily communicates the mutual relationships that exist between two variables by exploring various methods.**		

20.1 Analyses the location of a place relative to two mutually perpendicular axes.	• Cartesian Plane
	  • Plotting Points
	  • Ordered Pairs (In the first quadrant only)
		06

Competency – 21 **Investigates the relationships between various angles.**		

21.1 Analyses angles using static and dynamic concepts.	• Concept of Angles
	  • Static
	  • Dynamic
		04

21.2 Investigates the sizes of angles.	• Angles
	  • Drawing
	  • Naming
	  • Measuring
	• Size of an Angle (In Degrees)
	  • Right Angle
	  • Straight Angle
		03

Competencies and Competency Levels	Subject Content	Periods

21.3 Investigates the parallelism of two straight lines.	• Parallel Lines
	  • Concept
	  • Drawing (Using set squares)
	  • Examining
		06

Competency – 22 **Creates new models by exploring various solids.**		

22.1 Creates models of solids.	• Models
	  • Pyramids with Square Bases
	  • Prisms with Triangular Bases
		03

22.2 Investigates the relationships between the characteristics of solids.	• Euler's Relationship • For Solids	03
Competency – 23 **Makes decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures**.		

23.1 Names various rectilinear plane figures based on their characteristics.	• Types of Triangles
	  • Based on Angles
	  • Based on Sides
		03

23.2 Classifies polygons according to their shapes.	• Classification of Polygons
	  • Convex
	  • Concave
	  • Regular
		03

Competency – 25 **Studies the beauty of the environment by exploring the properties of various shapes**		

25.1 Investigates the symmetric properties of objects.	• Bilateral Symmetry
	  • Concept
	  • Axes of Symmetry
		05

Competencies and Competency Levels	Subject Content	Periods
Competency – 26 **Investigates the methods of using geometrical shapes to enhance beauty.**		

26.1 Investigates the methods of laying geometric shapes.	• Tessellation
	  • Concept
	  • Pure Tessellation
		05

Competency – 27 **Analyzes according to geometric laws, the nature of the locations in the surroundings.**		

27.1 Creates designs using circles.	• Circles
	  • Drawing patterns using a compass
	  • Center
	  • Radius
	  • Diameter
		05

27.2 Constructs plane figures.	• Plane Figures
	  • Line Segments
	  • Equilateral Triangles
	  • Regular Hexagons
		06

Competency – 28 **Facilitates daily work by investigating the various methods of representing data.**		

28.1 Represents data by various methods.	• Graphs
	  • Column Graphs
	  • Multiple Column Graphs
	  • Stem and Leaf Diagram
		04

Competency – 29 **Makes predictions by analyzing data by various methods to facilitate daily activities.**		
29.1 Analyses the dispersion of data.	• Minimum Value • Maximum Value • Range	03

Competencies and Competency Levels	Subject Content	Periods
Competency – 30 **Manipulates the principles related to sets to facilitate daily activities.**		

30.1 Represents by various methods, groups that have the same property.	• Concept of Sets
	  • Writing the Elements of a Set
	• Representation of Sets
	  • By Venn Diagrams
		05

Competency – 31 **Analyzes the likelihood of an event occurring to predict future events.**		

31.1 Determines the likelihood of an event occurring based on quantitative values	• Experiments
	  • Unbiased
	  • Biased
	• 0 – 1 Scale
		05

Grade 7 - Mathematics

Relationship between Subject Themes and Content

Content	Learning Outcomes
1.0 Numbers	
1.1 Directed Numbers	
• Concept	• Identifies directed numbers
• Addition	• Adds directed numbers
1.2 Divisibility	• Examines divisibility of a number by 3, 4, 6 and 9
1.3 Factors and Multiples	• Finds the factors and multiples of numbers (numbers up to 1000)
• Prime Factors	• Finds the prime factors of numbers (numbers up to 100)
• Greatest Common Factor	• Finds the greatest common factor of numbers (up to 3 numbers)
• Least Common Multiple	• Finds the least common multiple of numbers (up to 3 numbers)
1.4 Fractions	
• Comparison	• Compares fractions with unrelated denominators that are not mixed numbers (denominator ≤ 12)
• Concept of Mixed Numbers	• Identifies mixed numbers
• Mixed Numbers $\rightarrow$ Improper Fractions	• Writes mixed numbers as improper fractions
• Improper Fractions $\rightarrow$ Mixed Numbers	• Writes improper fractions as mixed numbers
• Addition, Subtraction of Fractions	• Adds fractions and mixed numbers; subtracts them
1.5 Decimals	
• Decimal $\Leftrightarrow$ Fractions	• Decimals $\Leftrightarrow$ Fractions (converts and writes) (terminating decimals)
• Multiplying, Dividing by Powers of Ten	• Multiplies and divides a decimal number by a power of 10
• Multiplying, Dividing by a Whole Number	• Multiplies and divides a decimal number by a whole number

Content	Learning Outcomes
1.6 Ratio • Dividing According to a Ratio	• Divides quantities according to a ratio (up to 3)
1.7 Percentages • Concept of Percentage • Decimal Numbers $\rightarrow$ Percentages	• Understands the concept of percentages • Writes decimal numbers as percentages
1.8 Indices • Powers with an Algebraic Symbol as Base • Expansion of Powers with Algebraic Bases • Substitution into Powers with Algebraic Bases	• Identifies powers that have an algebraic symbol as the base (with two symbols and index less than 4) • Expands powers with algebraic symbols as bases • Substitutes into powers with algebraic symbols as bases
2.0 Measurements 2.1 Length • Addition; Subtraction • Multiplication; Division • Finding the Perimeters of Plane Figures using Formulae	• Adds and subtracts measurements related to lengths • Multiplies and divides measurements related to lengths (only by a whole number) • Uses formulae to find the perimeters of triangles, squares and rectangles
2.2 Area • Standard Units (m^2, cm^2) • Estimation • Finding the Areas of Plane Figures using Formulae • Finding the Areas of Compound Plane Figures	• Identifies standard units • Estimates areas • Uses formulae to find the areas of squares and rectangles • Finds the areas of compound plane figures of rectangles and squares

Content	Learning Outcomes
2.3 Mass • Units • Conversion • Estimation • Addition; Subtraction • Multiplication; Division 2.4 Volume • Concept • Units (Arbitrary) • Units (cm^3, m^3) • Estimation 2.5 Liquid Measures • Multiplication; Division 2.6 Time • Concept of Leap Year • Concept of Century • Addition; Subtraction 2.6 Scale Drawings • Selecting Scales • Drawing	• Uses *mg*, *g* to measure mass • Recognizes the relationship between *mg* and *g* • Estimates mass • Adds and subtracts measures of mass that include *mg*, *g*, *kg* • Multiplies and divides measures of mass that include *mg*, *g*, *kg* (by whole numbers only) • Understands the concept of volume (cube, cuboid) • Uses arbitrary units to measure volume • Uses standard units to measure volume • Estimates volume • Multiplies and divides liquid measures that include *ml*, *l* (by whole numbers only) • Identifies a leap year • Identifies a century • Adds and subtracts measures related to time • Selects suitable scales • Makes a scale drawing of a rectangle
3.0 Algebra 3.1 Algebraic Expressions • Construction • Addition; Subtraction • Substitution	• Constructs algebraic expressions that include all four mathematical operations (with fractional coefficients) • Adds and subtracts algebraic expressions that include like terms and unlike terms • Converts an algebraic expression into a numerical value by substituting whole numbers (with more than one variable and not including powers and roots)

Content	Learning Outcomes
3.2 Equations • Construction • Solving	• Constructs equations according to information that is given (of the form $x \pm a = b,\ ax = b,\ ax \pm b = c$) • Solves equations using flow charts • Solves equations using algebraic methods
3.3 Inequalities • Solving • Representation of Solutions on a Number Line	• Solves inequalities of the form $x \pm a \underset{<}{>} b,\ ax \underset{<}{>} b$ • Represents the solutions of inequalities of the above form on a number line (only integer solutions)
3.4 Formulae • Construction	• Constructs simple formulae with up to three variables
3.5 Cartesian Plane • Plotting Points • Ordered Pairs	• Plots points on a Cartesian plane • Writes as an ordered pair a point on a Cartesian plane (Only the first quadrant)
4.0 Geometry 4.1 Angles • Concept • Drawing • Naming • Measuring • Size of an Angle (In degrees)	• Identifies angles through static and dynamic concepts (according to the size given) • Draws angles • Names given angles • Measures given angles • Identifies that the size of a right angle is 90^o and that the size of a straight angle is 180^o
4.2 Parallel Lines • Concept • Drawing • Examining	• Understands the concept of parallel lines • Draws parallel lines (using set squares) • Examines the parallelism of straight lines

Content	Learning Outcomes
4.3 Solids • Creation • Euler's Relationship	• Creates models (pyramids with square bases, prisms with triangular bases) • Develops Euler's relationship using edges, vertices and faces
4.4 Rectilinear Plane Figures • Classifying Triangles according to their Angles • Classifying Triangles according to their Sides • Classifying Polygons	• Names types of triangles based on their angles • Names types of triangles based on their sides • Classifies polygons (convex, concave, regular)
4.5 Symmetry • Concept • Axes of Symmetry	• Understands the concept of bilateral symmetry • Identifies axes of symmetry
4.6 Tessellation • Concept • Pure Tessellation	• Understand the concept of tessellation • Identifies pure tessellation
4.7 Circles • Circular Designs • Characteristics of a Circle	• Creates circular designs using a compass • Identifies the center, radius and diameter of a circle
4.8 Constructions • Line Segments • Equilateral Triangles • Regular Hexagons	• Constructs straight line segments • Constructs equilateral triangles • Constructs regular hexagons
5.0 Statistics 5.1 Representation of Data • By Column Graphs • By Multiple Column Graphs • By Stem and Leaf Diagrams	• Represents data by column graphs • Represents data by multiple column graphs • Represents data by stem and leaf diagrams

Content	Learning Outcomes
5.2 Interpretation of Data • Minimum Value • Maximum Value • Range	• Identifies the minimum value of a group of data • Identifies the maximum value of a group of data • Writes the range of a group of data
6.0 Sets and Probability 6.1 Sets • Concept • Elements of a Set • Representation by Venn Diagrams 6.2 Probability • Identify Experiments • 0 -1 Scale	• Understands the concept of sets • Writes the elements of a set • Represents sets by Venn diagrams • Identifies biased and unbiased experiments • Allocates marks according to a 0 - 1 scale

Grade 7

Sequence of Lessons , Competency Levels and Number of Periods

Content	Competency Level	Periods
Term 1		
01 Symmetry	25.1	05
02 Sets	30.1	05
03 Factors and Multiples	1.2, 1.3	06
04 Indices	6.1	06
05 Time	12.1	05
06 Mass	9.1	06
07 Angles	21.1, 21.2	07
08 Directed Numbers	1.1	06
09 Fractions	3.1, 3.2	08 **54**
Term 2		
10 Decimals	3.3	06
11 Algebraic Expressions	14.1, 14.2	06
12 Parallel Lines	21.3	06
13 Length	7.1, 7.2	06
14 Area	8.1	06
15 Circles	27.1	05
16 Volume	10.1	06
17 Liquid Measures	11.1	06
18 Ratios	4.1	05
19 Percentages	5.1	06
20 Cartesian Plane	20.1	06 **64**
Term 3		
21 Equations	17.1, 19.1	08
22 Inequalities	18.1	06
23 Rectilinear Plane Figures	23.1, 23.2	06
24 Constructions	27.2	06
25 Solids	22.1, 22.2	06
26 Representation and Interpretation of Data	28.1, 29.1	07
27 Scale Drawings	13.1	06
28 Tessellation	26.1	05
29 Likelihood of an Event	31.1	05 **55**
		Total 173

School Policies and Programmes

The mathematics syllabus has been prepared not only with the objective of inculcating knowledge and skills but also to highlight the deeper aims of communication, relationships, logical argument and problem solving. The latterly mentioned four aims aid more effectively in the development of behavioral and thinking skills. Mathematics is a subject that should not be restricted to just the syllabus or the classroom. It should be made into an active force within the school culture itself as it is a language; a science; an art; a tool to be used in thought, in calculations and in creations.

It is important therefore to organize school programmes so that the cultural values embedded in mathematics are developed in students. The following co-curricular programmes will aid in this.

1. Wall newspapers
2. Mathematics Laboratory
3. Mathematics Library
4. Exhibitions
5. Mathematics Societies
6. Quizzes
7. Mathematics Magazines
8. Mathematics Days
9. Mathematics Camps
10. Activity Cells
11. Excursions

In operating this co-curricular programme, the school management should aim at obtaining the help of the community when required and also gettting experts to teach some of the subject content.

If your school does not have a trained mathematics teacher for this grade, it is appropriate to engage a teacher who has the required subject knowledge and a penchant for teaching mathematics for this task. Mathematics teacher should continuously update their knowledge on subject material and teaching methodologies. For this, it is appropriate to get advice from the zonal mathematics director/ mathematics in-service advisors and senior graduate teachers. It is also necessary to participate in training sessions.

It is hoped that the school management will work towards allocating one of the free periods in the time table under the new reforms, for mathematics.

It is most likely that it will not be possible to complete a proposed exploration activity within a period, due to most activities being longer than 40 minutes. In such instances, the next mathematics period should be used to complete the activity.

To facilitate the tasks of the students as well as the teacher, chairs should be placed in a semi-circle during exploration activities. The quality inputs required for the activities are given under each activity in the chapter on learning teaching methodology. It would be easier to buy all the quality inputs for the year at once at the beginning of the year.

In guiding the learning teaching process, it is important to provide instructions by paying special attention to the following:

- Determining whether the students are engaged in exploration according to the E-5 model
- Carrying out assessment and evaluation at the appropriate times

It is also expected that attention will be paid to the following, which are proposed as remedies to the problems encountered when the competency based syllabi were operated in the school system in year 2007 in grades 6 and 10.

- Groups should be organized according to the number of students in the class. (If tasks have been assigned for 4 groups, the number of groups should be taken as a multiple of this number, depending on how many more/less students are in the class).

- The tasks in the instruction leaflet on exploration should be distributed randomly among the groups.

- Instead of appointing a leader, the opportunity should be provided for a person within the group itself to volunteer to be the leader.

- Students should first be engaged in the exploration process, and once the relevant mathematical concepts have been grasped through this process, the remaining time should be used for exercises.

- When a review is being done after the exploration process is concluded, students should be provided with the opportunity to write a summarized note on the lesson in their exercise books.

- Depending on the number of evaluations that should be carried out in a term, apart from the instruments for the extension of the learning – teaching process, to carry out the evaluations, appropriate activities should be selected and marks should be allocated.

Learning – Teaching Methodology

Introduction

In deciding upon the learning teaching methodology relevant to the course, attention has been paid to the planning of learning-teaching activities that facilitate building up of student competencies based on exploration. In preparing for a competency-based education of this manner, an obvious change in the role of the teacher is expected.

The transmission role practiced in our classroom from way back and the more recently introduced transaction role is evident in the classroom even today. When taking into consideration the deterioration of the thinking, social and personal skills of school leavers, no effort is needed to understand that there is a need for the development of the learning-teaching methodology and how it should be effected.

In the transmission role, the teacher is considered an individual who knows everything that the student should learn, and his task is that of transmitting knowledge to the student who is considered as one who does not know anything. This learning-teaching process that takes the guise of lectures is restricted only to the flow of knowledge from the teacher to the student, and does not make an adequate contribution either to the stimulation of student thinking or to the development of his personal and social skills.

The dialogue initiated by the teacher within the class is the initial stage of the transaction role. Apart from the ideas that flow from the teacher to the class and from the class to the teacher, as a result of the student-student interactions that takes place subsequently, these dialogues transform gradually into discussions. The teacher is continuously involved in the task of questioning in order to take the student from the known to the unknown, from the simple to the complex and from the concrete to the abstract.

While, in competency-based education, student tasks occupy a powerful position, the teacher takes on the role of a resource person who mediates in order to provide every student in the class with a competency that is at least proximate to the required competency. For this, the basic functions that the teacher is expected to perform include initiating the activity in a manner that will kindle interest, planning the learning environment with the necessary materials and other facilities, closely observing how students learn, identifying student abilities and inabilities and promoting student learning through the provision of feedback and feed-forward, paying close attention to student presentations and discussions, as well as preparing instruments for the extension of learning beyond the classroom. The teacher's role based essentially upon the tasks mentioned above is called the transformation role.

The series of activities that can be used in the implementation of the descriptive curriculum introduced in the first part of this teacher's instructional manual, has been included in its second part. Each of these activities has been developed so as to contain a minimum of three steps. It is expected to get the student involved in the learning process through the first step of the activities. Therefore, this step is termed the "engagement" step. As an introduction to this step, the teacher assumes the transaction role and engages in a

dialogue with the students. Subsequently, along with the transformation of this dialogue to a discussion, the students engage in exploration and are provided the opportunity to recall the pre-knowledge related to the basic competency they should develop, and to acquire a hint regarding the future of the activity. The teacher possesses a host of strategies that can be used in these exchanges of ideas. Some of the devices at the disposal of the teacher for the exchange of these ideas are questions/stimulants like pictures, newspaper advertisements and flash cards/puzzles or case studies/dialogues, role play, poems, songs and demonstrations, video tapes or audio tapes. In summary, the first step of the activities is implemented with the aim of actualizing the following three objectives.

- Winning over of the attention of the class.
- Providing the students with the opportunity for students' recall of the necessary pre-knowledge.
- Introducing the elements of the exploration the students are expected to be directed to under the second step of the activity.

It is with the objective of providing the students with the opportunity for exploration that the second step of the activity has been planned. Students base their exploration on a special leaflet prepared for the purpose. The teacher has to plan this step to enable the students to engage in co-operative learning in groups, through the exploration of various aspects of the problem. Two of the most important features of this step are the use of the resource materials provided and conscious involvement in group discussions. As a result of involvement in group activities throughout a long period of time, students will develop a number of essential skills like self-discipline, listening to others, working co-operatively with others, helping others, time management, producing high quality creations, honesty etc.

In directing students towards exploration, the teacher should avoid making decisions regarding leadership in the group, but he/she should prepare the background necessary for a leader to emerge. Accordingly, when opportune, the students will have the privilege of taking on leadership, based on inherent abilities.

During the 3rd step of the activity, every group will have the opportunity of presenting the results of its exploration for the enlightenment of the others. What the teacher has to do here is to encourage student involvement in group presentations. It would be effective if students are directed, so as to ensure that every member is given responsibility in the planning of the presentation. An important aspect of this step, related to the explanation of student findings, is the creation of the opportunity for the voice of students to be heard in the classroom, where commonly the voice of the teacher dominated.

After the explanation of the findings in the third step of the activities, students should be directed to elaboration. Each group is given the opportunity to provide constructive suggestions on its findings first, and subsequently, members of other groups are given this opportunity. Anyway, the final review is the responsibility of the teacher. During this review, the teacher is expected to clarify all the important points relevant to the students' exploration as well as to instill in students the right understanding of the concepts and rules.

The main responsibility of the teacher in this teaching methodology is to monitor continuously whether the classroom learning-teaching process is being implemented successfully and as expected. While assessment and evaluation should be made use of for this purpose, the teacher is provided the opportunity to carry this out, through planned activities, in the learning teaching process itself. The teacher is given the opportunity for assessment while the students are involved in exploration during the second stage of the activity and for evaluation when the students are involved in explanation and elaboration during the third stage. A detailed inquiry into assessment and evaluation will be provided later on in this document.

The teacher is provided direction on the transformation role by the learning – teaching methodology described so far. While priority is given to group exploration here, the teacher is also afforded the opportunity for transaction, discussion and short lectures. While there is room for transaction and discussion in the initial stage, the teacher may also give a short lecture to confirm the concepts, under review, in the final stage. In the development of the learning-teaching methodology related to this curriculum, the first to be introduced under the curriculum reforms for the new millennium, the attention paid to the important aspects of the transmission and the transaction roles of the teacher, apart from the transformation role, is a special feature of this methodology.

Activity Continuum

1. Symmetry

Competency 25 : Studies the beauty of the environment by exploring the properties of various shapes.

Competency Level 25.1 : Investigate the symmetric properties of various shapes.

Activity 25.1 : Let us identify the properties of various shapes.

Time : 60 minutes.

Quality Inputs :
- The chart of figure included in Annex 25.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 25.1.2.
- Ink, pairs of scissors, pairs of dividers, half sheets.
- Demy papers and pastels.

Learning –Teaching Process:

Step 25.1.1 :
- Present the chart of figures to the students.
- Inquire from the students about the properties of the shapes in the figure.
- Lead a discussion and highlight the following facts.

  - That there are similarities between some figures and no similarities between other figures
  - That there is a property which is common in figures that have similarities

(10 minutes)

Step 25.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, ink, pairs of scissors, pairs of dividers, half sheets, demy papers and pastels, among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 25.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That all the obtained shapes are of two equal parts.
- That such shapes are called shapes with bilateral symmetry
- That a shape with bilateral symmetry has an axis of symmetry
- That when a shape with bilateral symmetry is folded along its axis of symmetry, two parts which coincide with each other are obtained
- That shapes with bilateral symmetry can be observed in our environment
- That there are shapes which have more than one axis of symmetry

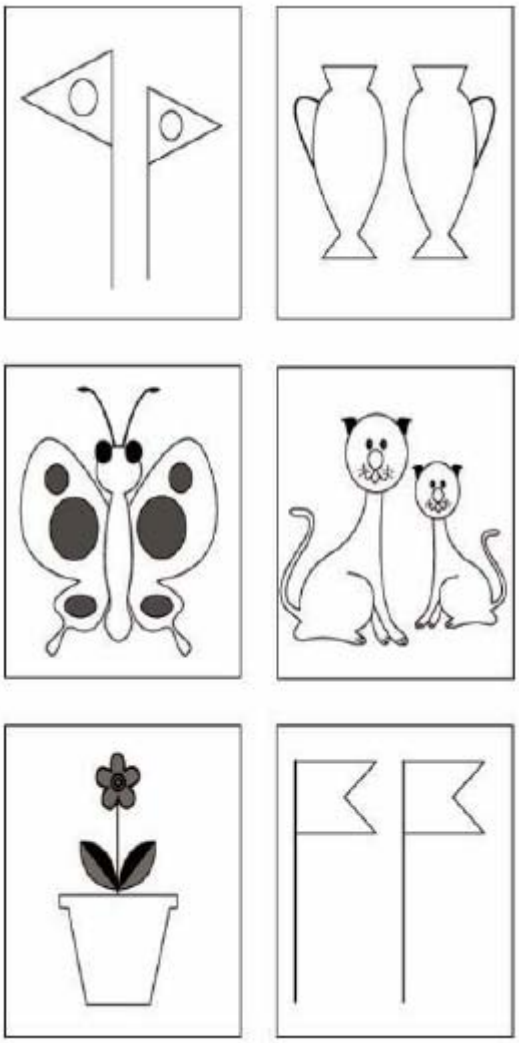
(30 minutes)

Criteria for Assessment and Evaluation:

- Names shapes with bilateral symmetry.
- Appreciates the beauty of the environment by considering properties of symmetry.
- Creates shapes with bilateral symmetry.
- Is critical when carrying out group activities and when expressing ideas.
- Creates things by observing the various properties of the shapes in the environment.

Annex 25.1.1

Chart of Figures



Annex 25.1.2

Instructions for group exploration

Let us identify the properties of various shapes

- Focus your attention on the activity assigned to your group from the activities given below.

Activity 1	**Activity 2**
Fold the paper into two, cut it in a manner such that a figure is obtained when unfolded, and unfold it	Put several drops of ink on a paper, fold the paper into two and press on it. Now unfold the paper.
Activity 3	**Activity 4**
Fold the paper into two. Using the pair of dividers make holes in the paper in a specific pattern. Now unfold the paper.	Fold the paper into two. Tear several pieces of paper out such that the crease remains, and then unfold the paper.

- Engage in the activity assigned to your group.
- At the end of the activity, observe the shape, the fold and the two sides of the fold that remain and note down your observations.
- Find the relationship between the shape of the figure you obtained and the fold.
- Draw several figures which coincide when folded into two in more than one way, and note down the lines along which the figures are folded.
- Make a list of such shapes seen in the environment.
- Creatively prepare for a presentation at the plenary session.

2. Sets

Competency 30 : Manipulates the principles related to sets to facilitate daily activities.

Competency Level 30.1 : Represents by various methods, groups that have the same property.

Activity 30.1 : Let us identify sets; let us represent them.

Time : 75 minutes.

Quality Inputs :
- Sets of cards of the figures given in Annex 30.1.2.
- An enlarged copy of the figure included in Annex 30.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 30.1.3.
- Demy papers, pastels and glue.

Learning – Teaching Process:

Step 30.1.1 :
- Display the enlarged figure in the class and inquire from the students how the given plane figures can be grouped.
- Lead a discussion and highlight the following facts.

• That a given set of objects can be separated into groups based on their common properties • That the common properties by which the selections were made can be stated with reasons • That a group which has been separated according to common properties can be represented by drawing a closed figure and writing the objects within it • That a group can be named using the common property considered to form that group

(15 minutes)

Step 30.1.2 :
- Divide the class into three small groups.
- Distribute the prepared sets of cards, instructions on exploration, demy papers, pastels and glue among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 30.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That a group of objects which can be specifically identified is called "a set"
  - That the members of a set are called "elements"
  - That a set can be represented by a closed figure
  - That when the elements of a set are represented in a closed figure, it is called a Venn diagram, in honour of the mathematician John Venn who first presented such a representation

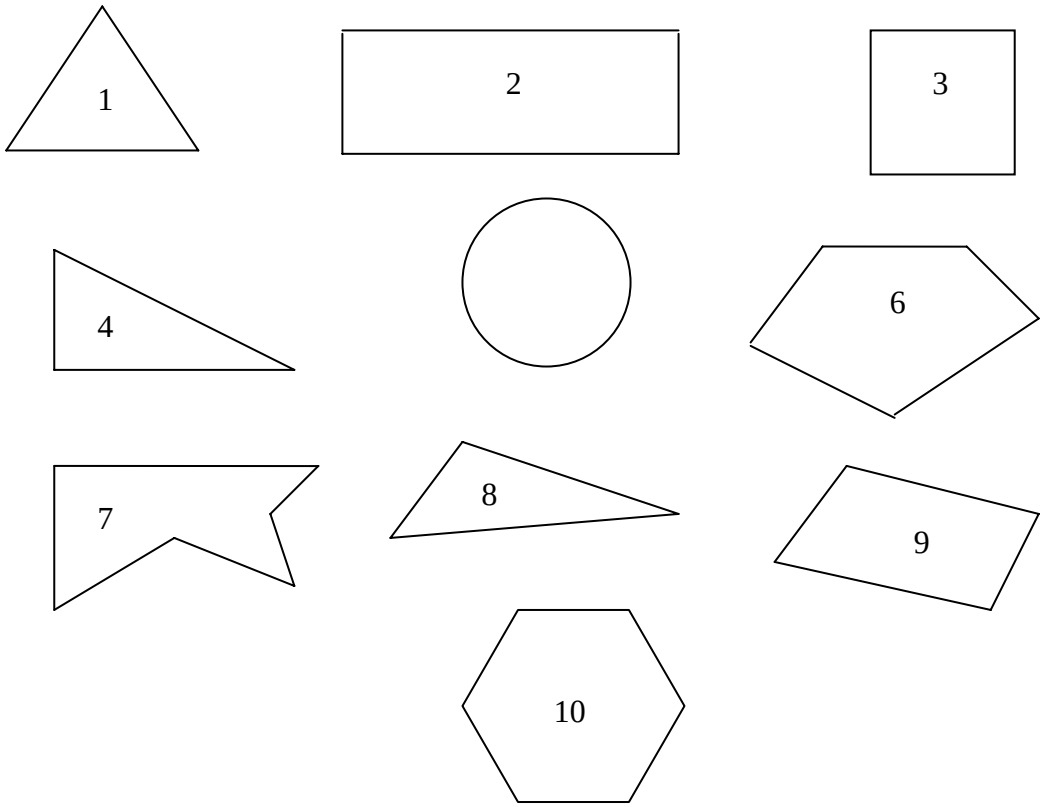
(30 minutes)

Criteria for Assessment and Evaluation:

- Describes what a set is.
- Accepts that the various objects in the environment can be grouped according to their properties.
- Represents groups of objects by Venn diagrams according to their common properties.
- Observes the environment for a better understanding of one's surrounding.
- Analyses the parts by observing the whole.

Annex 30.1.1

Figure



Annex 30.1.2

Sets of Figures

Set Number 1

Cards, each with one of the numbers
28, 75, 136, 567, 83, 354,
or one of the words
Amara, Country, Flower, Nayana,
or one of the figures

on it.

Set Number 2

The cards consisting of each of the following figures (one figure on each card):

Dog, Elephant, Cow, Crow, Parrot, Cock, Rose, Hibiscus, Araliya flower, Quadrilateral, Ball, Grass

Set Number 3

The cards consisting of each of the following figures (one figure on each card):

Wooden cupboard, Table, Chair, Bed, Rack, Knife, Plate, Winnowing fan, Pot, Tyre, Book, Leg.

Annex 30.1.3

Instructions for group exploration

Let us identify sets; let us represent them

- Focus your attention on the set of cards received by your group from the following sets of cards.

Objects of Card Set 1	Objects of Card Set 2	Objects of Card Set 3

- Separate the objects into groups using a property of your preference.
- Discuss about the properties you used to separate the objects into groups.
- If there are objects that do not belong to the groups, give reasons for it.
- Considering the properties you used to form the groups, propose names for each of the groups.
- Represent the groups by closed figures.
- Creatively prepare for a presentation at the plenary session.

3. Factors and Multiples I

Competency 1 : Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.

Competency Level 1.2 : Applies the rules of divisibility to find the factors of a number.

Activity 1.2 : Let us find the factors of a number.

Time : 60 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 1.2.1
- Demy papers and pastel.

Learning – Teaching Process:

Step 1.2.1 :
- Inquire from the students how the divisibility of a number by two, five, ten is tested.
- Lead a discussion and highlight the following facts by considering the above.

• That if the digit in the units place of a number is even, the number is divisible by 2 • That if the digit in the units place of a number is 0 or 5, the number is divisible by 5 • That if the digit in the units place is 0, the number is divisible by 10

(15 minutes)

Step 1.2.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(15 minutes)

Step 1.2.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the 'digit index' of a number is obtained by adding the digits of the number until a single digit is obtained.
- That numbers with digit index 3, 6 or 9 are divisible by 3.
- That the numbers with digit index 9 are divisible by 9.
- That if the number formed by the digits in the tens and units places is divisible by 4, then the original number is divisible by 4.
- That numbers which are divisible by both 2 and 3 are divisible by 6.

.

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the methods of obtaining the numbers that are divisible by 3, 4, 6 or 9, without dividing them.
- Accepts that there is a certain pattern in the numbers which are divisible by 3, 4, 6 or 9.
- Writes down the numbers that are divisible by 3, 4, 6 or 9.
- Determines relationships by studying the information.
- Critically considers the ideas of the other groups.

Annex 1.2.1

Instructions for group exploration

Let us find the factors of a number

- Focus you attention on the number relevant to your group from the following numbers.

Number			
3	**4**	**6**	**9**

- Write down 15 numbers of your choice and divide each number by the number assigned to your group.
- Separate the 15 numbers into two groups as those that have a remainder and those that have no remainder.
- Carefully observe the numbers in the group of numbers that do not have a remainder and propose a method to determine whether a number is divisible by the number assigned to your group, without dividing the number.
- Using what you discovered above, write down 10 numbers that are divisible by the number assigned to your group and examine whether the method you discovered is accurate.
- Prepare to make a presentation of your findings at the plenary session.

3. Factors and Multiples II

Competency 1 : Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life

Competency Level 1.3 : Investigates the methods of determining the factors and multiples of numbers.

Activity 1.3 : Let us find the greatest common factor and the least common multiple of a set of whole numbers.

Time : 80 minutes.

Quality Inputs :
- 10×10 Multiplication Table
- Four copies of the instruction leaflet on exploration included in Annex 1.3.1.
- Demy papers and pastels.

Learning – Teaching Process :

Step 1.3.1 :
- Display the 10×10 multiplication table in the class and by means of it, inquire from the students about multiples, factors and prime factors.
- Lead a discussion and highlight the following facts.

  - That by multiplying a whole number by another whole number, a multiple of the number is obtained
  - That the whole numbers by which a given whole number can be divided without remainder are the factors of the given number
  - That for any whole number, 1 and the number itself are factors
  - That for any whole number, the largest factor of the number is the number itself
  - That whole numbers with exactly two distinct factors are called prime numbers
  - That any whole number can be written as a product of prime numbers
  - That the prime numbers in the above product are called the prime factors of the number

(15 minutes)

Step 1.3.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(35 minutes)

Step 1.3.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

• That the greatest common factor and the least common multiple are unique for a given set of whole numbers • That the greatest common factor of a set of whole numbers is the largest whole number which divides all the numbers in the set without remainder • That the smallest whole number which is divisible by a set of whole numbers, is the least common multiple of the set of numbers • That the greatest common factor and the least common multiple of a set of whole numbers can be obtained by the prime factors of the numbers • That there is a method of division by which the greatest common factor and the least common multiple can be obtained. .

(30 minutes)

Criteria for Assessment and Evaluation:

- Expresses the method of obtaining the factors and multiples common to a set of whole numbers, by writing the numbers in terms of their prime factors.
- Accepts that several events that begin at the same time and occur at specific time intervals can occur together again.
- Determines the greatest common factor and the least common multiple of a given set of whole numbers.
- Selects the easiest method from several different methods that can be applied, when finding solutions to problems.
- Elicits new facts using one's previous knowledge.

Annex 1.3.1

Instructions for group exploration

Let us find the greatest common factor and the least common multiple of a set of whole numbers

- Focus your attention on the pair of numbers that your group received from the pairs of numbers given below.

Pair of Numbers
(i) 12, 18
(ii) 12, 10
(iii) 8, 20
(iv) 10, 15

- By considering the factors of the two numbers, find the largest factor common to both numbers.
- Propose a suitable name for the factor you found above.
- By writing down the multiples of each of the two numbers, find the smallest multiple common to both numbers.
- Propose a method of obtaining the above found factor and multiple using the prime factors of the two numbers.
- Find out about other methods that can be used to obtain the above found factor and multiple.
- Prepare to make a creative presentation of the group's findings at the plenary session.

4. Indices

Competency 6 : Easily solves problems in day to day life by using logarithms and calculators.

Competency Level 6.1 : Finds the numerical value of a power with an algebraic base.

Activity 6.1 : Let us find the numerical value of a power with an algebraic symbol as its base.

Time : 90 minutes.

Quality Inputs :
- The chart of numerical powers included in Annex 6.1.1.
- Two copies of the instruction leaflet on exploration included in Annex 6.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 6.1.1 :
- Display the chart of numerical powers in the class.
- Inquire from the students how to identify the index and the base of a power, how a power is read and how a power is expanded.
- Lead a discussion and highlight the following facts.

  - That powers with numerical bases and indices exist
  - That a power can be expressed as a repeated product of its base

(15 minutes)

Step 6.1.2 :
- Divide the class into two small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let each small group prepare for a presentation at the plenary session.

(35 minutes)

Step 6.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a power whose base is an algebraic symbol can be expanded as a repeated product of the algebraic base
- That by repeatedly multiplying an algebraic symbol, a power with the algebraic symbol as its base and the number of times that the multiplication is repeated as its index, is obtained.
- That a numerical value can be obtained by substituting a value for the base of a power with an algebraic symbol as a base, and simplifying it.

.

(40 minutes)

Criteria for Assessment and Evaluation:

- Names the base and the index of a power with an algebraic symbol as its base.
- Accepts that using powers is a method of writing numerical expressions in a concise way.
- Expands powers with algebraic bases.
- Develops theories logically and cooperatively within a group.
- Finds ways of simplifying complex things.

Annex 6.1.1

Chart of Powers

- The number of mangoes required to distribute 3 mangoes each among 3 children is 3×3
  3×3 expressed as a power is 3^2
  The base is 3
  The index is 2

- A doctor mentions the following to a patient:

  "Take two pills at a time, twice a day, for two days."

  The number of pills the patient has taken after two days is $2 \times 2 \times 2$
  $2 \times 2 \times 2$ expressed as a power is 2^3
  The base is 2
  The index is 3

Annex 6.1.2

Instructions for group exploration

Let us find the numerical value of a power with an algebraic symbol as its base

- Focus your attention on the section received by your group from the following sections.

Section I	Section II
The number of toffees required to be distributed among x students so that each student receives x number of toffees.	The number of pills a patient needs, if he is to take x pills at a time, x times a day, for x days.

- Propose two ways of expressing the algebraic expression relevant to the section received by your group.
- Compare the numerical values obtained when $x = 2$ and $x = 3$.
- Present every day situations, where one can construct algebraic expressions similar to the above.
- Prepare for a presentation at the plenary session.

5. Time

Competency 12 : Fulfills the needs of the world of work by time management.

Competency Level 12.1 : Manipulates measurements related to time under the basic mathematical operations.

Activity 12.1 : Let us measure time.

Time : 105 minutes.

Quality Inputs :
- Three copies of the instruction leaflet on exploration included in Annex 12.1.1.
- Three stop watches.
- Three sets of calendars as mentioned in the leaflet on exploration
- Almanac containing Sinhala and Hindu New Year rituals.
- Demy papers and pastels.

Learning – Teaching Process:

Step 12.1.1 :
- Present the almanac containing Sinhala and Hindu New Year rituals to the class and inquire from them about the auspicious times indicated in the almanac.
- Lead a discussion and highlight the following facts.

  - That the difference between two clock times is time
  - That the time taken by the earth to revolve around the sun is a year
  - That seconds, minutes, hours, days, weeks, months and years are units of time
  - That 60 seconds = 1 minute
    60 minutes = 1 hour
    24 hours = 1 day
    30 days = 1 month
    12 months = 1 year
  - That in the standard way of writing the date, in order, the year is given in 4 digits, the month in 2 digits and the date in 2 digits

(15 minutes)

Step 12.1.2 :
- Divide the class into three small groups.
- Distribute the instructions on exploration, calendars, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let each small group prepare for a presentation at the plenary session.

(50 minutes)

Step 12.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the time taken for the earth to revolve once around the sun is 365 days 5hours 48 minutes and 47.5 seconds
- That 365 days is considered as a year
- That a leap year has 366 days
- That though a year is in general a leap year if it is a multiple of 4, if the year is a multiple of 100 also, then the year becomes a leap year only if it is a multiple of 400 too
- That A.D. 1 - 100 is the first century
- That A.D. 101 - 200 is the second century
- That A.D. 2001 - 2100 is the twenty first century
- That addition and subtraction of time can be performed in daily duties by using the relationships between the units of time to convert units
- That in order to find the age of a person, the birthday of the person must be subtracted from the date

(40 minutes)

Criteria for Assessment and Evaluation:

- Describes how leap years, centuries and periods of time are found.
- Accepts that time must be used effectively, as time spent cannot be regained.
- Adds and subtracts time correctly.
- Manages time efficiently.
- Draws conclusions based on information.

Annex 12.1.1

Instructions for group exploration

Let us measure time

- Focus your attention on the set of calendars given to your group, from the following sets of calendars.

Set of Calendars - 1
year
2008
2007
2006
1996

Set of Calendars - 2
year
1999
2004
2005
2006

Set of Calendars - 3
year
1998
2006
2007
2008

- According to the calendars assigned to your group, find the number of days in each month and write down your views about the number of days in the year.
- Find out the years that have the most number of days, and discuss the reasons for it.
- Propose a name for the years that have the most number of days.
- Propose a method of identifying whether a given year is a year of this form.

'Our country gained Independence during the mid half of the 20^{th} century. 0001 A.D. to 0100 A.D. is the first century'

- Discuss by considering the above information, the centuries to which the years in the set of calendars given to you belong, and write down the first and last days of those centuries.
- Propose a method of determining the century to which a given year belongs.
- Explain how the age of a person is determined, and find out the ages of the members of your group today.
- Find the ages of your group members in 5 years, 8 months and 25 days time.
- Prepare to creatively present your findings at the plenary session.

6. Mass

Competency 9 : Fulfills daily requirements by working with an awareness of mass.

Competency Level 9.1 : Manipulates measurements related to mass under the basic mathematical operations.

Activity : Let us measure mass.

Time : 110 minutes.

Quality Inputs :
- A coconut.
- A fruit (Such as wood-apple, Belli, Papaw, Pineapple)
- Mathematics textbook.
- Four scales.
- Set of kg, g weights.
- Pills with their weights indicated in mg.
- Medicine bottles.
- A bag.
- Four copies of the instruction leaflet on exploration included in Annex 9.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 9.1.1 :
- Display the bag, the medicine bottle and pills to the class and inquire from the students about their mass.
- Lead a discussion and highlight the following facts.

• That g and kg are used to measure mass in daily life • That milligram (mg) is used to measure a small mass • That, 1000g = 1kg • That, 1000 mg = 1g

(10 minutes)

Step 9.1.2 :
- Divide the class into three small groups.
- Distribute among the groups, the instructions on exploration, demy papers, pastels and other objects required by each group.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session. (30 minutes)

Step 9.1.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That the need to estimate mass arises in daily life
  - That personal experiences aid in estimating mass

(20 minutes)

Step 9.1.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 9.1.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That when manipulating measurements in g, kg there are instances when g has to be converted to kg and other instances when kg has to be converted to g
  - That when manipulating measurements in mg, g there are instances when mg has to be converted to g and other instances when g has to be converted to mg

(20 minutes)

Criteria for Assessment and Evaluation:

- Describes the instances in daily life when mass has to be estimated.
- Accepts that mass can be estimated in situations where the mass cannot be measured exactly.
- Manipulates the measurements related to mass under the mathematical operations.
- Contributes to the success of the activity, by working logically.
- Uses measurements critically to perform daily activities efficiently.

Annex 9.1.1

Instructions for group exploration

Let us measure mass

Part I

- Focus your attention on the object received by your group from the objects given below.

A coconut	A fruit	Mathematics Textbook

- Let each member in the group estimate the mass of the object.
- Measure the mass of the object using the scales.
- Prepare a chart with the differences between the actual mass and the estimated mass.
- Discuss the experience that each group member gained by estimating the mass of the object.
- Prepare to creatively presentations your findings at the plenary session.

Part II

- The mass of several objects are given in the following table. Carefully study the table.

Object	**kg**	**g**	**mg**
Iron chain	8	600	-
School bag	2	750	-
Brass lamp	5	950	
Flower pot	4	825	
Ring	-	12	450
Necklace	-	22	800
Pair of earrings	-	4	250

- Focus your attention on the set of objects assigned to your group from the following sets of objects.

	Set of Objects -1	Set of Objects -2	Set of Objects -3
A	Brass lamp, Flower pot	Five school bags	One fourth of the iron chain
B	Necklace, Ring	Four pairs of earrings	An earring

Using the table;

- Find the mass of each object of group A.
- Find the mass of each object of group B.
- Find how much more the mass of the chain is compared to the mass of the ring.
- Prepare to make a creative presentation at the plenary session.

7 Angles I

Competency 21 **:** Investigates the relationships between various angles.

Competency Level 21.1 **:** Analyses angles using static and dynamic concepts.

Activity 21.1 **:** Let us identify angles.

Time **:** 60 minutes.

Quality Inputs **:**
- Chart of figures included in Annex 21.1.1
- Four copies of the instruction leaflet on exploration included in Annex 21.1.2
- Eakels, four clocks, half sheets, glue.
- Demy papers and pastels.

Learning – Teaching Process:

Step 21.1.1 **:**
- Present the chart of figures to the class and inquire from the students about the sizes of the angles in terms of right angles.
- Lead a discussion and highlight the following facts

> - That angles which are smaller than a right angle are defined as acute angles
> - That angles which are greater than one right angle but less than two right angles are defined as obtuse angles
> - That angles which are equal to two right angles are defined as straight angles
> - That angles which are larger than two right angles are defined as reflex angles

(10 minutes)

Step 21.1.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, half-sheets, demy papers, pastels, clocks, eakels and glue among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(20 minutes)

Step 21.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

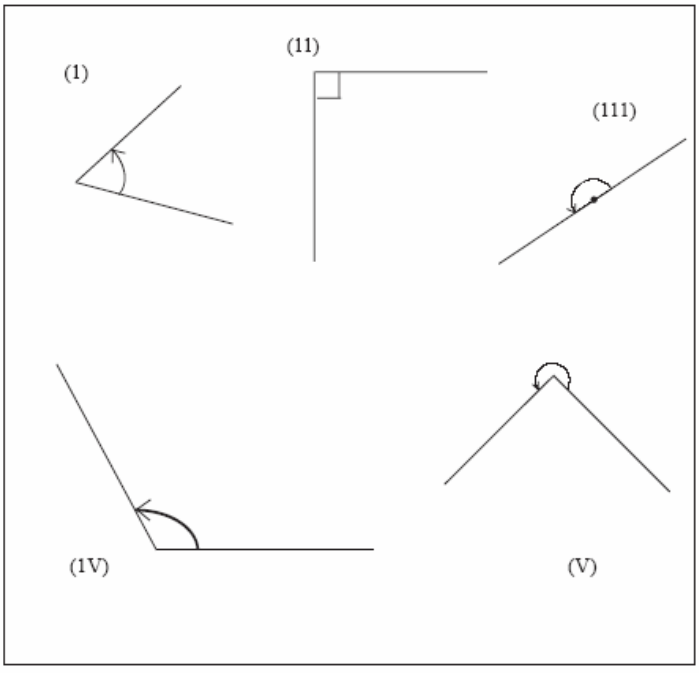
  - That an angle is formed by the intersection of two straight lines
  - That if the value of an angle is fixed, it is a static state
  - That the instant where one arm of an angle is stationary and the angle is formed by rotating the other arm is a dynamic instant
  - That some angles in the environment are in static state while others are in dynamic state

(30 minutes)

Criteria for Assessment and Evaluation:

- Explains the static and dynamic concepts of an angle.
- Accepts that angles are of two types, namely static and dynamic angles.
- Separates out angles in static and dynamic state from the different shapes in the environment.
- Is attentive to the different shapes in the environment.
- Performs activities by identifying the needs of practical life.

Annex 21.1.1



Annex 21.1.2

Instructions for group exploration

Let us identify angles

- Focus your attention on the type of angle obtained by your group from the angles given below.

A	B	C	D
Acute angle	Obtuse angle	Right angle	Straight angle

- Create the type of angle assigned to you by pasting eakels together. Draw it on a piece of paper using a straight edge.
- Obtain also the type of angle assigned to your group by keeping the hour-hand on the clock fixed and rotating the minutes-hand. Draw it on the piece of paper using the straight edge.
- Discuss about the similarities and dissimilarities you observed in the above two methods.
- Propose a name for the two straight line segments by which the angle was formed.
- Propose a name for the common point at which the two straight line segments meet.
- Prepare for a presentation at the plenary session.

7. Angles-II

Competency 21 **:** Investigates the relationships between various angles.

Competency Level 21.2 **:** Investigates the sizes of angles.

Activity 21.2 **:** Let us measure, name and draw angles.

Time **:** 180 minutes.

Quality Inputs **:**
- Figure of the protractor included in Annex 21.2.1.
- Four copies of the instruction leaflet on exploration included in Annex 21.2.2.
- Four sets of geometrical instruments, half sheets.
- Demy papers and pastels.

Learning –Teaching Process:

Step 21.2.1 **:**
- Fold a paper which is in the shape of a circle and show that four right-angles can be formed.
- Provide the students with the opportunity to study the protractor.
- Enable the students to identify the parts the semicircle is divided into, by means of an enlarged poster of a protractor.
- Lead a discussion and highlight the following facts regarding units which are suitable to measure angles.

  - That right-angles and degrees can be used as units of measuring the sizes of angles
  - That a right angle can be obtained by dividing a circle into four equal sectors and considering one of the sectors
  - That the angle of a sector obtained when a circular lamina is divided into 360 equal sectors is called a degree
  - That a protractor is divided into 180^o
  - That for convenience, the angles are marked in tens

(20 minutes)

Step 21.2.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, half sheets, demy papers, and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.

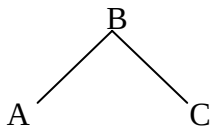
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 21.2.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That the protractor should be placed in such a way that its pedal line coincides with one arm of the angle and the mid-point of the pedal line coincides with the vertex of the angle
  - That the value of the angle can be obtained in degrees using the mark on the protractor which coincides with the other arm of the angle
  - That a right- angle is 90 degrees
  - That an acute angle is less than 90 degrees
  - That an obtuse angle is greater than 90 degrees and less than 180 degrees
  - That an angle can be measured to the nearest degree using a protractor
  - That an angle is named by placing the capital letter given to the vertex of the angle between the two letters representing the ends of the arms of the angle and placing the angle sign (^) above the middle letter

    Example:

  - That this angle is written as $A\hat{B}C$
  - That an angle with a given value can be drawn accurately using a protractor

(50 minutes)

Step 21.2.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 21.2.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

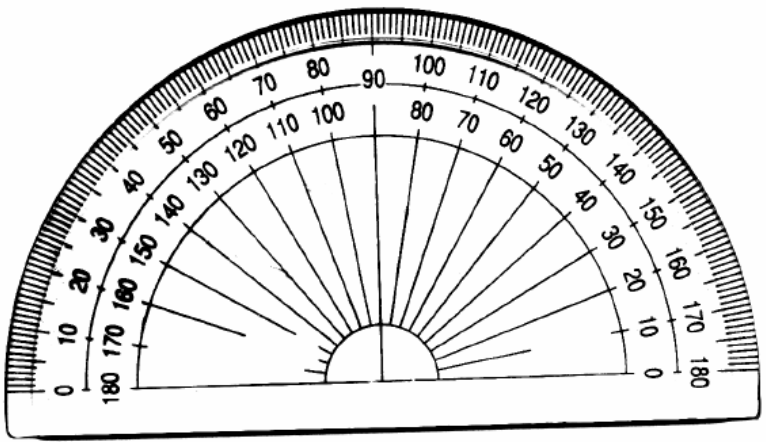
- That a new angle is formed by adding two angles together
- That by adding two acute angles, another acute angle, a right angle or an obtuse angle is formed
- That by adding an acute angle and a right angle, an obtuse angle is formed
- That by adding a right angle and an obtuse angle, a reflex angle is formed
- That by adding an obtuse angle and an acute angle, an obtuse angle, a straight angle or a reflex angle is formed
- That by adding two obtuse angles, a reflex angle is formed

(40 minutes)

Criteria for Assessment and Evaluation:
- Describes what a degree is.
- Accept that degrees can be used as a suitable unit to measure angles.
- Measures angles accurately to the nearest degree.
- Manipulates instruments correctly to obtain accurate measurements.
- Draws accurate conclusions by studying various relationships.

Annex 21.2.1

Figure of a protractor



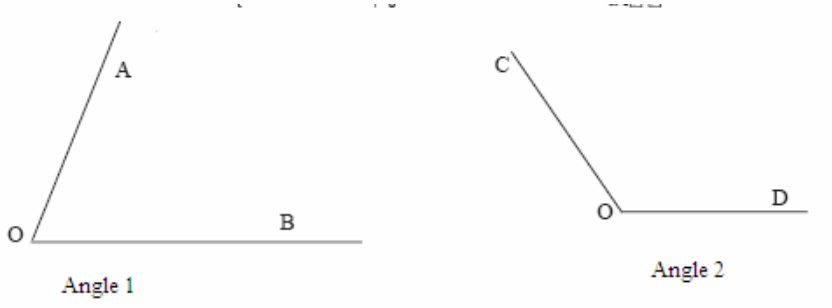
Annex 21.2.2

Instructions for group exploration

Let us measure, name and draw angles

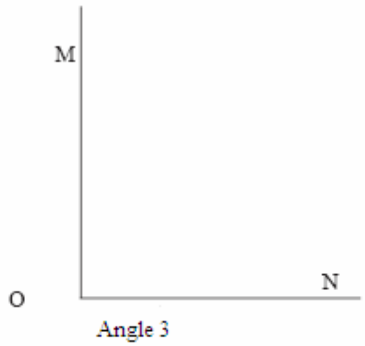
Part I

- Focus your attention on the type of angle received by your group from the following types of angles.

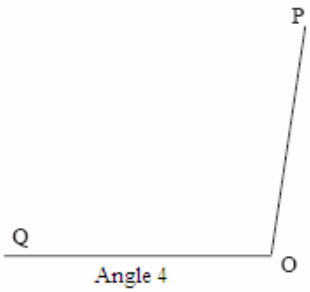


Angle 1

Angle 2



Angle 3



Angle 4

- Propose a method to determine the size of the given angle using the protractor, and obtain the size of the angle in degrees.
- Discuss about a method of naming the angle using the given letters.
- Suggest an angle of a different size that belongs to the type of angle given to your group, draw the angle and name it.
- Prepare for a creative presentation at the plenary session.

Part-II

- Focus your attention on the type of angle assigned to your group from the types of angles given below.

Type-I Three acute angles	Type-II Two acute angles and a right angle
Type-III A right angle and two obtuse angles	Type-IV Two acute angles and an obtuse angle

- Draw three angles of the type received by your group.
- Discuss about a method of joining two angles together, by attaching the vertices and the arms of the angles. Engage in exploring the type of angle formed by this method. Gather information about the angle which is formed when three angles are joined together.
- Based on the information you gathered, find out about the type of angle you obtain by adding two angles together, for various pairs.
- Prepare to make a creative presentation of the group's findings at the plenary session.

8. Directed Numbers

Competency 1 : Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day today life.

Competency Level 1.1 : Investigates the relationships between numbers.

Activity 1.1 : Let us identify directed numbers.

Time : 105 minutes.

Quality Inputs :
- Figure of the number line included in Annex 1.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 1.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 1.1.1 :
- Present the figure of the number line to the class and inquire from the students about the numbers represented by the points of the number line.
- Lead a discussion and highlight the following facts.

> - That an integer can be represented by a point on the number line
> - That the positive and negative whole numbers are defined as positive integers and negative integers

(10 minutes)

Step 1.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 1.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That numbers with positive or negative signs are called directed numbers
- That positive integers, negative integers, and fractions and decimals with direction belong to the set of directed numbers
- That the position of $+2\frac{1}{2}$ on the number line is the mid-point of the positions of $+2$ and $+3$.
- That every directed number has a place on the number line
- That since the number '0' has no direction, it is not a directed number

(25 minutes)

Step 1.1.4 **:**
- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 1.1.5 **:**
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

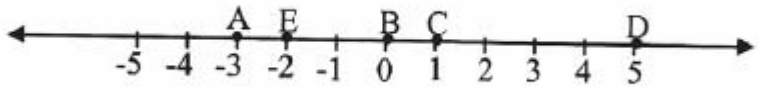
  - That the sum of two positive numbers is a positive number
  - That the sum of negative numbers is a negative number
  - That when adding numbers with different signs, the sign of the answer differs depending on the numbers involved in the addition
  - That directed numbers can be added in the same way that integers are added

(20 minutes)

Criteria for Assessment and Evaluation:
- Gives examples of directed numbers.
- Accepts that when a level is chosen as zero, directed numbers can be used to represent states that are lower and higher than it.
- Adds directed numbers.
- Uses figures to simplify complex states.
- Follows a simple procedure when engaged in complex activities.

Annex 1.1.1

Figure: The Number line



A =
B =
C =
D =
E =

Annex 1.1.2

Instructions for group exploration

Let us identify directed numbers

Part I

- Focus your attention on the set of numbers assigned to your group from the following sets.

Number set (I)	$+3, -2, +\frac{1}{4}, -0.5$
Number set (II)	$+2, -3, -\frac{1}{2}, +0.4$
Number set (III)	$+4, -5, +\frac{1}{3}, -0.2$
Number set (IV)	$+3, -3, -\frac{1}{2}, +0.6$

- Discuss about the differences between the integers and the numbers which are not integers which you have learnt about before.
- Propose a name for the set of numbers that include these numbers with direction.
- Draw a number line and mark these numbers on it.
- Describe how the positions were decided on, when marking fractions and the decimals on the number line.
- By considering the properties of the above set of numbers, discuss whether 0 belongs to the set.
- Prepare for a creative presentation of your findings.

Part II

- Focus your attention on the set of numbers assigned to your group from the following sets of numbers

Set Number I: All positive integers between 0 and 10

Set Number II: All negative integers between 0 and -10

- Write down two integers that belong to the set of numbers assigned to your group.
- Find the result of adding the two integers.
- Represent on a number line, how the above two integers are added by studying your textbook and finding out facts on adding directed numbers.

- Discuss how the answer is obtained.
- Accordingly, represent on the number line how a positive integer and a negative integer between -10 and +10 are added and the solution is obtained.
- Discuss whether this method can be used when adding two directed numbers which are not integers.
- Prepare for a creative presentation of your findings.

9. Fractions I

Competency 3 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day today life

Competency Level 3.1 : Compares quantities related to fractions and decimals.

Activity 3.1 : Let us identify the relationships between fractions and decimals.

Time : 120 minutes.

Quality Inputs :
- The chart included in Annex 3.1.1
- Three copies of the instruction leaflet on exploration included in Annex 3.1.2.
- Ten cardboard circular laminas that are divided into equal parts and shaded as given in Annex 3.1.2.
- Seven sectors of a circle with angle 90^o.
- Four sectors of a circle with angle 120^o.
- Five semi-circles.
- Demy papers and pastels.

Learning – Teaching Process:

Step 3.1.1 :
- Display the chart of figures in the class.
- Direct the students to explain what is shown in the figures.
- Lead a discussion and highlight the following facts.

  - That fractions are obtained by dividing a unit into equal parts
  - That a fraction in which the value of the numerator is less than that of the denominator is called a proper fraction
  - That numbers which include both whole numbers and fractions are called mixed numbers
  - That by multiplying or dividing the numerator and the denominator of a fraction by the same number we obtain an equivalent fraction.

(10 minutes)

Step 3.1.2 :
- Divide the class into three small groups.
- Distribute the instructions on exploration, circular laminas, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.

- Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 3.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

> - That two fractions can be compared by using either the sign < or the sign >
> - That two fractions can be compared using equivalent fractions

(30 minutes)

Step3.1.4 :
- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(20 minutes)

Step 3.1.5 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

> - That a fraction in which the numerator is greater than the denominator is called an improper fraction
> - That the method of division can be used to represent an improper fraction as a mixed number.
> - That common fractions can be converted into decimals, and that terminating decimals can be converted into common fractions

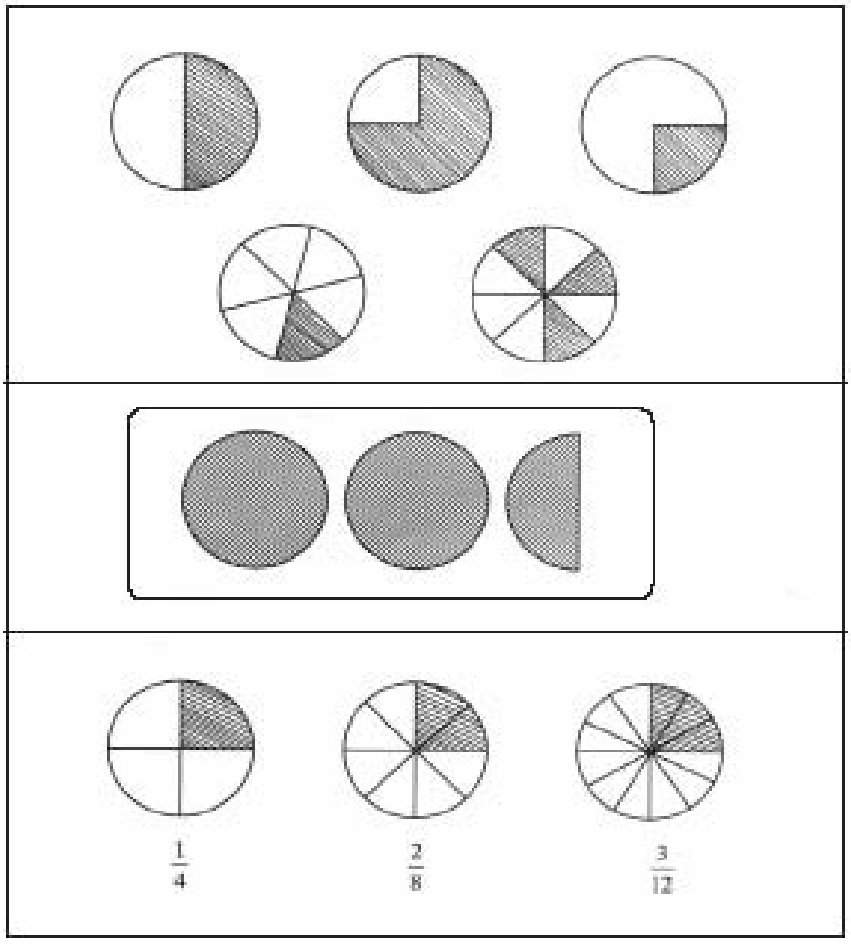
(30 minutes)

Criteria for Assessment and Evaluation:

- Describes how a fraction and a decimal are compared.
- Accepts that irrespective of whether a number is represented as a fraction, a decimal or a mixed number, the size of the number remains the same.
- Writes down fractions accurately in different ways.
- Divides things fairly by following the correct methods.
- Analyzes abstract concepts using pictorial representations.

Annex 3.1.1

Chart of Figures



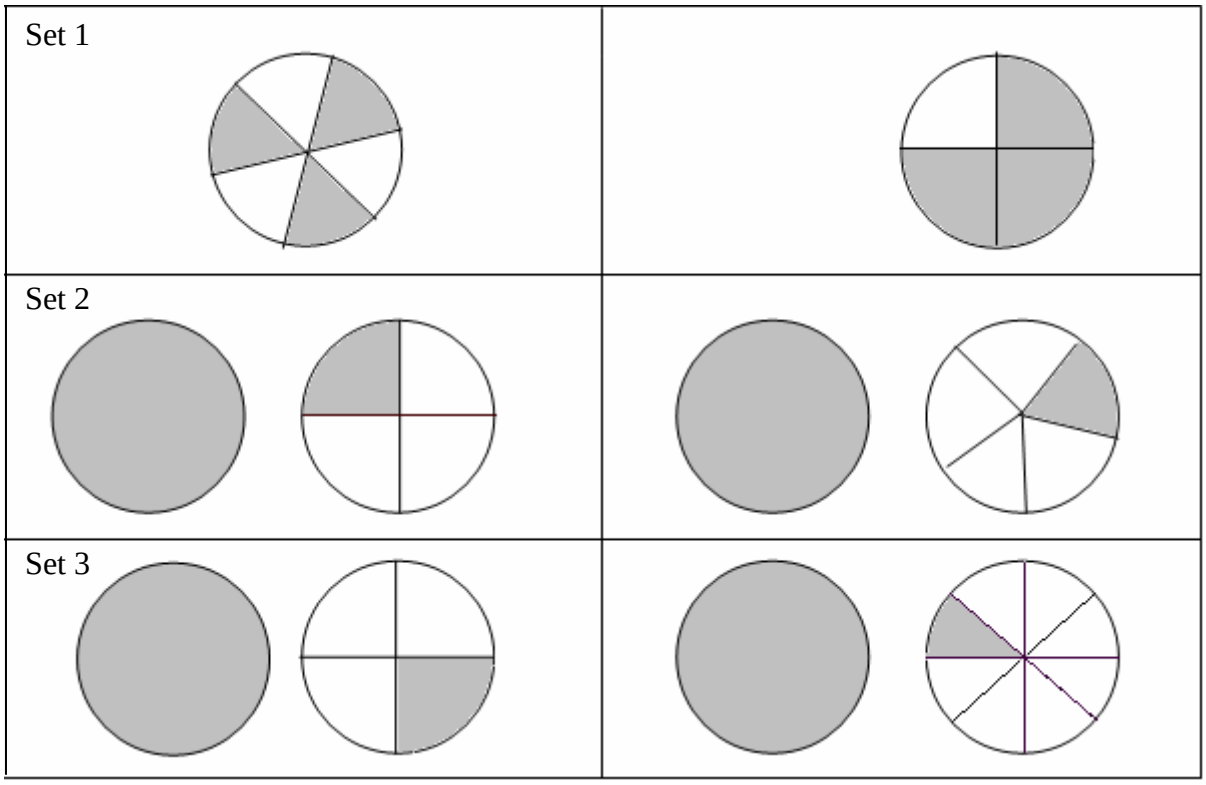
Annex 3.1.2

Instructions for group exploration

Let us identify the relationships between fractions and decimals

Part I

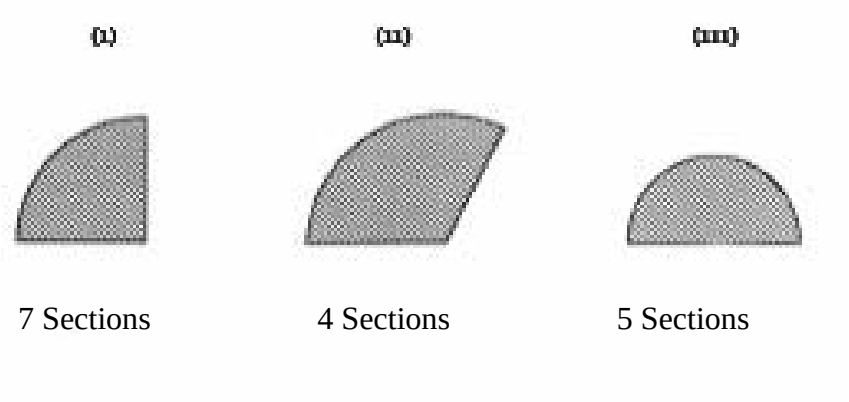
- Focus your attention on the set of figures received by your group from the sets of figures of fractions given below.



- Represent the shaded sections of the two figures as fractions.
- Compare the sizes of the shaded sections by cutting them out or by some other method.
- Relate the two fractions by correctly using either the sign < or the sign >.
- Discuss a method to compare the two fractions you wrote using equivalent fractions.
- Creatively prepare for a presentation at the plenary session.

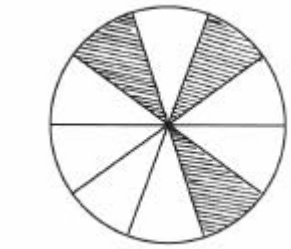
Part II

- Focus your attention on the sections of a circle received by your group from the following sections of a circle.



7 Sections 4 Sections 5 Sections

- Indicate the fraction each section is from the entire circle.
- According to the above, add all the circular sections given to you, and represent the solution as a fraction.
- Write down the mixed number that can be obtained using all the circular sections.
- Since the fraction which represents the sum of all the circular sections and the mixed number are equal, explain how a mixed number can be written as a fraction.
- Write down the number represented by the figure below as a fraction and as a decimal.



- Discuss whether there is a relationship between the fraction and the decimal you wrote down.
- Prepare to make a creative presentation of your group's findings at the plenary session.

9. Fractions II

Competency 3 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life

Competency Level 3.2 : Manipulates fractions under the mathematical operations.

Activity 3.2 : Let us add fractions; let us subtract them.

Time : 75 minutes.

Quality Inputs :
- An enlarged copy of the chart included in Annex 3.2.1.
- Four copies of the instruction leaflet on exploration included in Annex 3.2.2.
- Eleven yellow circles divided into four equal parts each.
- Twelve red squares divided into eight equal parts each.
- Ten blue rectangles divided into twelve equal parts each.
- Eleven green equilateral triangles divided into 6 equal parts each.
- Demy papers, pastels, glue and pairs of scissors.

Learning – Teaching Process:

Step 3.2.1 :
- Display the enlarged chart in the class and inquire from the students how the fractions in the chart can be added and subtracted.
- Lead a discussion and highlight the following facts.

  - That when fractions with equal denominators are added, the values of the numerators are added while the denominator is left unchanged
  - That when fractions with equal denominators are subtracted, the difference of the numerators should be taken while the denominator is left unchanged.
  - That when adding and subtracting fractions with unequal denominators, the fractions should first be converted to fractions with equal denominators by considering equivalent fractions

(15 minutes)

Step 3.2.2 : • Divide the class into four small groups.
- Distribute the instructions on exploration, sets of figures, demy papers, pastels, glue and pairs of scissors among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let each small group prepare for a presentation at the plenary session.

(30 minutes)

Step 3.2.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That when adding mixed numbers it is easier to first add the whole numbers and then the fractions
  - That when subtracting mixed numbers it is easier to first subtract the whole numbers and then the fractions
  - That when subtracting mixed numbers, if the fraction to be subtracted is larger, then a unit from the whole number must be added to the fraction to be subtracted from, before subtraction is done
  - That addition and subtraction of mixed numbers can be done by first converting them into improper fractions

(30 minutes)

Criteria for Assessment and Evaluation:

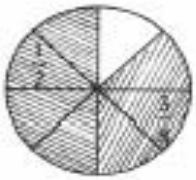
- Accurately represents given mixed numbers by figures.
- Accepts that addition and subtraction of mixed numbers can be carried out by converting them into improper fractions.
- Adds and subtracts mixed numbers.
- Represents abstract concepts in concrete form.
- Works cooperatively within the group.

Annex 3.2.1.

Chart

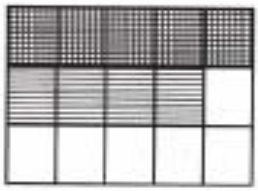
$$\frac{1}{3}+\frac{1}{3}=\frac{2}{3}$$

$$\frac{4}{5}-\frac{1}{5}$$
$$=\frac{3}{5}$$



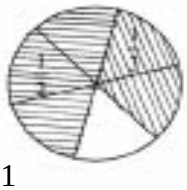
$$\frac{1}{2}+\frac{3}{8}$$
$$=\frac{7}{8}$$

$$\frac{1}{2}+\frac{3}{8}$$
$$=\frac{4}{8}+\frac{3}{8}$$
$$=\frac{7}{8}$$



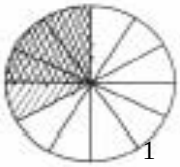
$$\frac{9}{15}-\frac{1}{3}$$
$$=\frac{4}{15}$$

$$\frac{9}{15}-\frac{1}{3}$$
$$=\frac{9}{15}-\frac{5}{15}$$
$$=\frac{4}{15}$$



$$\frac{1}{2}+\frac{1}{3}$$
$$=\frac{5}{6}$$

$$\frac{1}{2}+\frac{1}{3}$$
$$=\frac{3}{6}+\frac{2}{6}$$
$$=\frac{5}{6}$$



$$\frac{1}{3}-\frac{1}{4}$$
$$=\frac{1}{12}$$

$$\frac{1}{3}-\frac{1}{4}$$
$$=\frac{4}{12}-\frac{3}{12}$$
$$=\frac{1}{12}$$

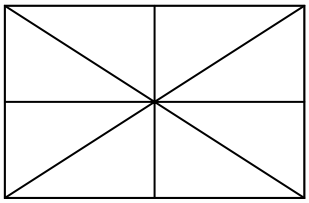
Annex 3.2.2

Instructions for group exploration

Let us add fractions; let us subtract them

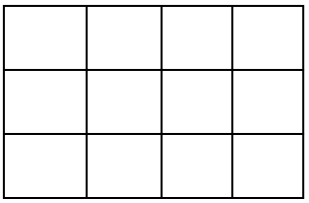
- Focus your attention on the set of figures and mixed numbers received by your group from the sets of figures and mixed numbers given below

Set of figures 1
(12 figures)



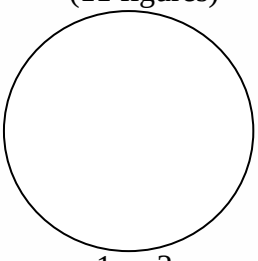
$4\frac{1}{4}, 1\frac{3}{8}$

Set of figures 2
(10 figures)



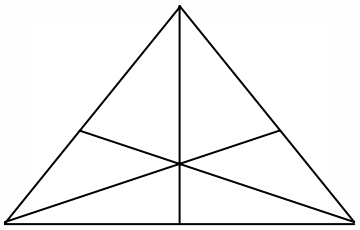
$1\frac{1}{3}, 3\frac{1}{4}$

Set of figures 3
(11 figures)



$2\frac{1}{2}, 3\frac{3}{4}$

Set of figures 4
(11 figures)



$2\frac{2}{3}, 3\frac{1}{6}$

- Obtain the sum of the two mixed numbers using the set of figures. Discuss how the sum is obtained.
- As above, describe how the set of figures is used to subtract a small mixed number from a larger mixed number.
- Propose another method to add and subtract mixed numbers using equivalent fractions instead of figures.
- Creatively prepare for a presentation at the plenary session.

10. Decimals

Competency 3 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day today life.

Competency Level 3.3 : Manipulates decimals under the mathematical operations.

Activity 3.3 : Let us multiply and divide decimals.

Time : 115 minutes.

Quality Inputs :
- A counting frame that can represent decimals.
- Three copies of the instruction leaflet on exploration included in Annex 3.3.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 3.3.1 :
- Write down a decimal number on the blackboard.
- Instruct a student to come forward and represent the decimal number on the counting frame.
- Inquire from the students about the place value of each digit of the decimal number.
- Lead a discussion and highlight the following facts.

• That a decimal number can be represented on a counting frame • That each digit in a decimal number has a definite place value.

(15 minutes)

Step 3.3.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 3.3.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when a decimal number is multiplied by a whole number, the product has the same number of decimal places as the multiplicand
- That when a decimal number is divided by a whole number, the number of decimal places in the quotient depends on the divisor

i (20 minutes)

Step 3.3.4 **:**
- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 3.3.5 **:**
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That there is a relationship between the multiplicand and the product when a decimal number is multiplied by a power of 10

  e.g: $2.583 \times 100 = 258.3$

  $2.5 \times 1000 = 2500$
- That there is a relationship between the divisor and the quotient when a decimal number is divided by a power of 10

  e.g: $17.5 \div 100 = 0.175$

  $2.5 \div 1000 = 0.0025$

(20 minutes)

Criteria for Assessment and Evaluation:
- Describes the concise methods of multiplying and dividing a decimal number by a power of 10.
- Accepts that when a decimal number is multiplied or divided by a power of 10, the solution can be obtained mentally.
- Multiplies and divides a decimal number by whole numbers.
- Critically considers the views of the other groups.
- Makes the right decisions by observing the results obtained.

Annex 3.3.1

Instructions for group exploration

Let us multiply and divide decimals

Part I

- Below are closed figures of frames made by attaching straws of equal length together. Each straw is of length 7.5cm.

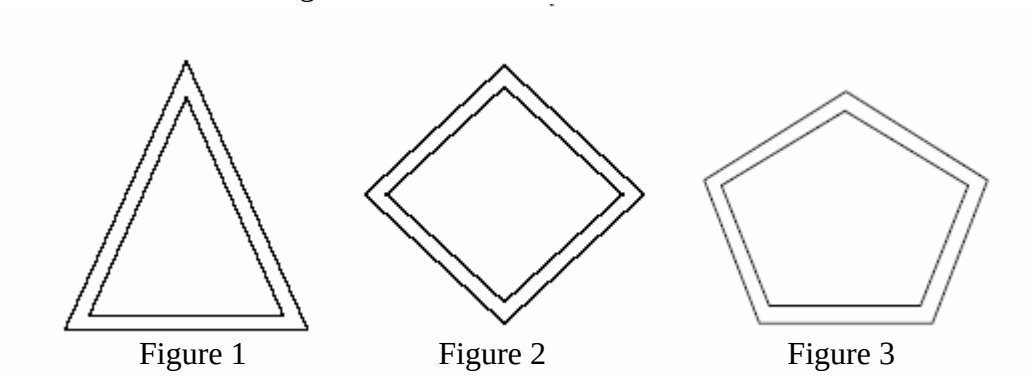


Figure 1 Figure 2 Figure 3

- Focus your attention on the figure received by your group from the above figures.
- A student who wishes to find the total length of the straws with which the frame has been made, finds it by adding the lengths of the straws together. Discuss and propose an easier method than this method, to obtain the value.
- If a frame in the shape of an equilateral triangle is made using just one straw of the above given length, find the length of one side of the frame.
- Prepare to make a creative presentation of your findings at the plenary session.

Part II

- Focus your attention on the section received by your group from the following.

Section I	Section II	Section III
2.75×10	5.63×10	8.78×10
2.75×100	5.63×100	8.78×100
$627.8\div10$	$765.9\div10$	$958.5\div10$
$627.8\div100$	$765.9\div100$	$958.5\div100$

- Work out the multiplications and divisions in the section.
- Discuss the manner in which the decimal place changes when a decimal number is multiplied by numbers such as 10, 100, 1000.
- Explain the manner in which the decimal place changes when a decimal number is divided by numbers such as 10, 100, 1000.
- Through your findings, propose a method of obtaining the answer easily by changing the position of the decimal point, when a decimal is multiplied or divided by some power of 10.
- Prepare to make a creative presentation of your findings at the plenary session.

11. Algebraic Expression I

Competency 14 **:** Simplifies algebraic expressions by systematically exploring various methods.

Competency Level 14.1 : Constructs algebraic expressions using all four mathematical operations.

Activity 14.1 **:** Let us construct algebraic expressions.

Time **:** 75 minutes.

Quality Inputs **:**
- Four copies of the instruction leaflet on exploration included in Annex 14.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 14.1.1 **:**
- Inquire from the students about the construction of algebraic expressions such as $x + 3$, $y - 5$ and $2x$ and the coefficients of the unknowns.
- Lead a discussion and highlight the following facts.

• That algebraic expressions are obtained by joining algebraic terms together using mathematical operations • That algebraic expressions can be used to present information concisely • That the number by which an unknown is multiplied is its coefficient

(15 minutes)

Step 14.1.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 14.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

• That algebraic expressions can be constructed according to the information given • That there can be instances where the coefficients of the unknowns in an algebraic expression are fractions • That communication can be facilitated using algebraic expressions

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes how an algebraic expression is constructed using information that is given.
- Accepts that communication is facilitated by using algebraic expressions.
- Constructs algebraic expressions using information that is given.
- Expresses information gathered from the surroundings in a concise way.
- Works with a team spirit.

Annex 14.1.1

Instructions for group exploration

Let us construct algebraic expressions

- A chart consisting of the prices of several stationary items is given below. Study it carefully.

• The price of a book is x rupees and the price of a pen is y rupees. • The price of a pencil is exactly half the price of a book. • The price of an eraser is Rs. 5.00 less than the price of a pen.

- According to the above information that you studied, develop an algebraic expression for the price of a pencil and an eraser.
- Focus your attention on the set of items received by your group from the sets of items given below.

Sets of items:
2 books and 1 eraser
5 pens and 3 pencils
2 books and 2 erasers
1 pencil and 1 eraser

- Develop an algebraic expression for the amount that has to be paid to buy the set of items you received.
- In relation to the price list you studied above, construct an algebraic expression to indicate the amount required to buy any set of items that you like.
- Creatively prepare for a presentation at the plenary session.

11. Algebraic Expression II

Competency 14 : Simplifies algebraic expressions by systematically exploring various methods.

Competency Level 14.2 : Simplifies algebraic expressions that include like terms and unlike terms.

Activity 14.2 : Let us simplify algebraic expressions to solve problems.

Time : 60 minutes.

Quality Inputs :
- Three copies of the instruction leaflet on exploration included in Annex 14.2.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 14.2.1 :
- Write down several algebraic terms with different algebraic symbols and several numerical values on the blackboard.
- Inquire from the students how the above terms can be classified according to their characteristics.
- Lead a discussion and highlight the following facts.

• That terms with equal algebraic parts are like terms • That terms with unequal algebraic parts are unlike terms

(10 minutes)

Step 14.2.2 :
- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session. (30 minutes)

Step 14.2.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That two like terms can be added together so that a single term is obtained
- That two like terms can be subtracted so that a single term is obtained
- That two unlike terms cannot be added or subtracted to obtain a single term
- That by substituting numerical values for unknowns and simplifying, a numerical value is obtained for the expression

(20 minutes)

Criteria for Assessment and Evaluation:

- Describes how algebraic expressions which include like terms and unlike terms are simplified.
- Accepts that like terms and unlike terms must be identified when simplifying algebraic expressions.
- Simplifies algebraic expressions with like terms and unlike terms.
- Chooses sets of objects that suit the resources.
- Applies simple methods to solve problems.

Annex 14.2.1

Instructions for group exploration

Let us simplify algebraic expressions to solve problems

- A price list prepared in terms of algebraic expressions is given below. Examine it carefully.

Price List

Item	**Price (in Rupees)**
One bun	x
One vegetable roti	$2x$
One saucer of chick-peas	y
A packet of biscuits	$5x$
A cake	$10y$
A cup of milk tea	x
A bottle of soft drink	$3y$
One yoghurt	$2y$
A fish bun	$3x$
One patties	$\frac{y}{2}$

- Engage in the given task for the set of items received by your group from the following sets of items.

Set of items
i. 1 bun, 2 saucers full of chick-peas, 2 cups of milk tea, 2 patties
ii. 2 packets of biscuits, 1 cake, 2 yoghurts, 4 patties
iii. 1 fish bun, 2 patties, 3 cups of milk tea, 4 saucers full of chick-peas
iv. 1 packet of biscuits, 1 cake, 3 cups of milk tea, 2 patties

- Write down using the given price list, and then simplify as much as possible, the algebraic expression for the total cost of the items received by your group.
- Prepare as many sets of items as possible which cost the same amount.

Unknown	Value
x	5
y	10

- Find the numerical value of the price your group obtained, by substituting the values given above for the unknowns.
- Creatively prepare for a presentation at the plenary session.

12. Parallel Lines

Competency 21 **:** Investigates the relationships between different angles.

Competency Level 21.3 **:** Investigates the parallelism of two straight lines.

Activity 21.3 **:** Let us examine the parallelism of two straight lines.

Time **:** 150 minutes.

Quality Inputs **:**
- The chart of figures included in Annex 21.3.1.
- Three copies of the instruction leaflet on exploration included in Annex 21.3.2.
- Three straight edges.
- Three pairs of set squares.
- Demy papers and pastels.

Learning – Teaching Process:

Step 21.3.1 **:**
- Present the chart of figures to the class and inquire about the relationships between pairs of lines in it.
- Lead a discussion and highlight the following facts.
  - That some straight lines do not intersect each other
  - That some straight lines intersect each other

(20 minutes)

Step 21.3.2 **:**
- Divide the class into three small groups.
- Distribute the instructions on exploration, straight edges, set squares, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 21.3.3 **:**
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That straight lines between which there is an equal gap are parallel lines
- That the gap between two parallel lines is called the perpendicular distance between the two lines
- That the gap between two non-parallel lines differs at different points
- That parallel lines do not intersect each other

(40 minutes)

Step 21.3.4 **:**

- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 21.3.5 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That parallel lines can be drawn using set squares and a straight edge
- That by using set squares and a straight edge, whether two lines are parallel or not can be examined
- That by measuring the perpendicular distance between two straight lines, it can be examined whether the two lines are parallel or not

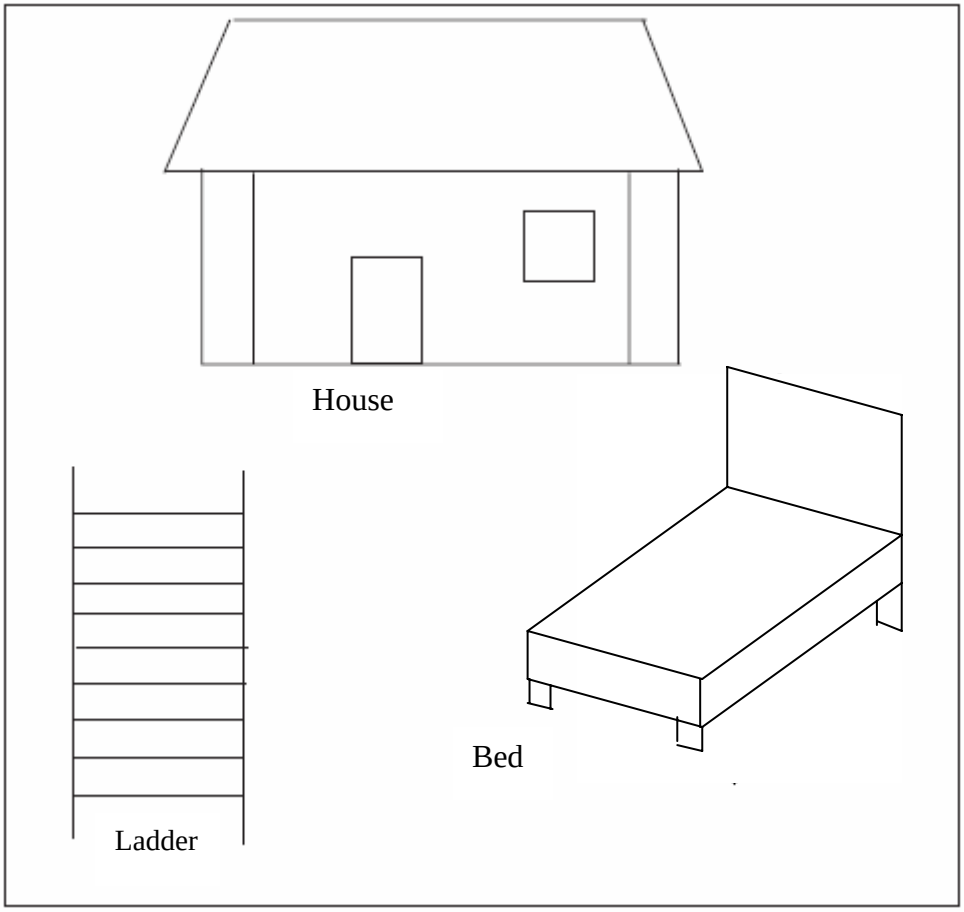
(30 minutes)

Criteria for Assessment and Evaluation:

- Expresses whether a given pair of straight lines is parallel or not.
- Accepts that the edges of different objects in the environment are either parallel or not.
- Constructs parallel lines using a straight edge and set squares.
- Is critical during group activities.
- Draws the right conclusion with the obtained measurements.

Annex 21.3.1

Chart of Figures



Annex 21.3.2

Instructions for group exploration

Let us examine the parallelism of two straight lines

Part I

- Focus your attention on the figure that your group receives from the figures given below.

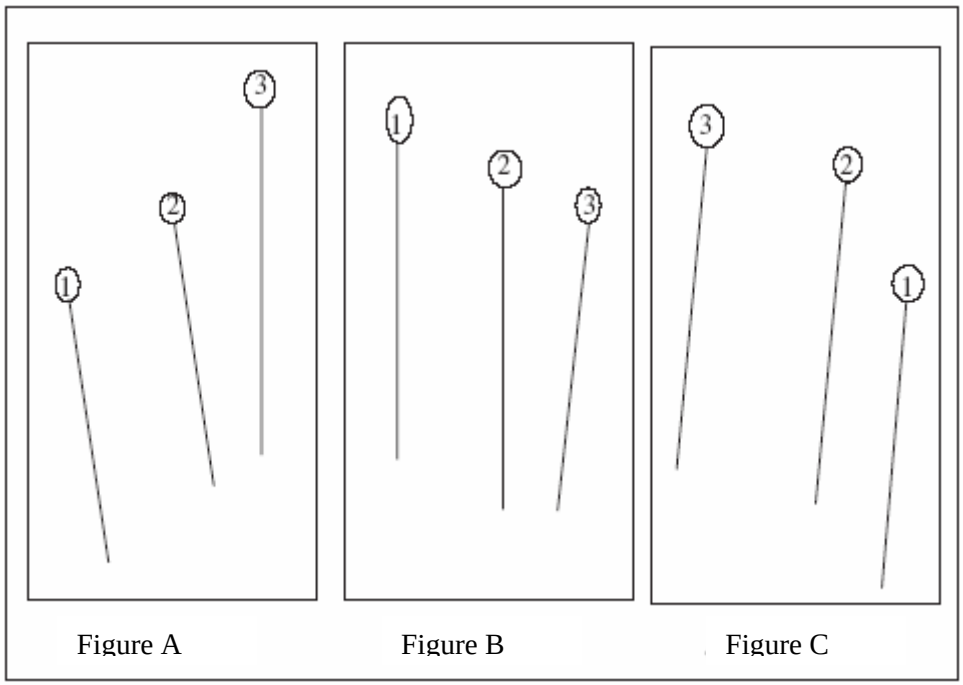


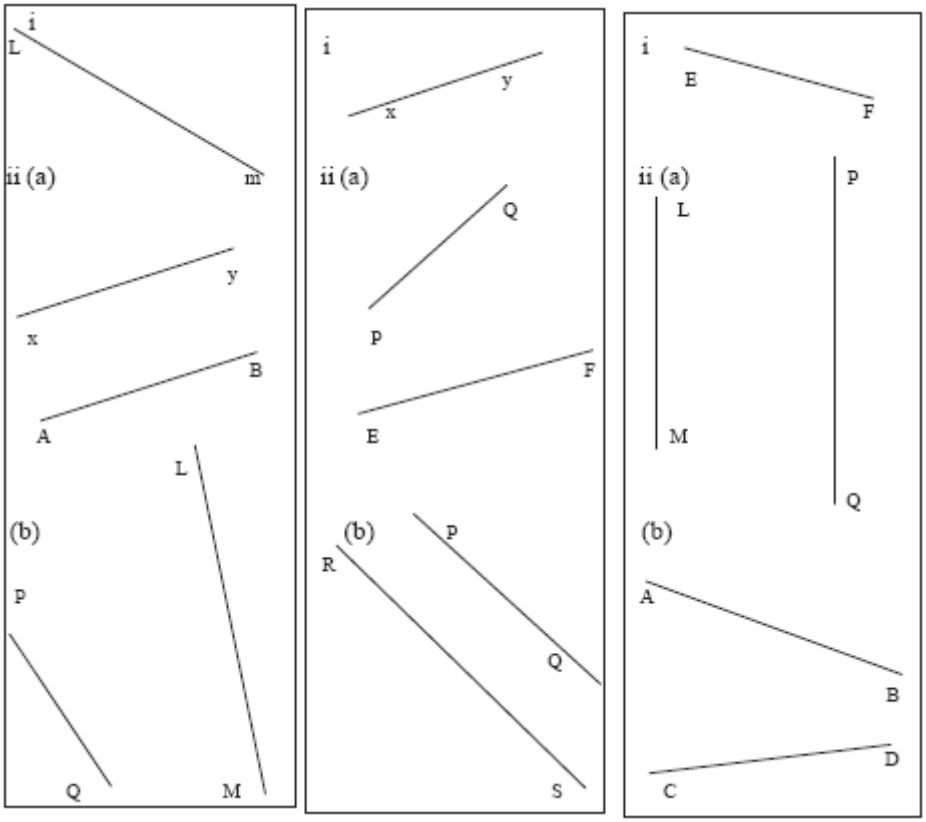
Figure A Figure B Figure C

- Using set squares and a straight edge determine the distance between each of the pairs of straight lines 1 and 2, 2 and 3, and 1 and 3, at various points.
- Write down the conclusions you can draw about the 3 pairs of lines based on the gaps between the pairs of lines.
- Prepare for a creative presentation of your findings at the plenary session.

Part II

- Focus your attention on the figure received by your group from the figures given below.

Figure 1 Figure 2 Figure 3



- Copy the straight line segment in (i) on to a demy paper. Draw a straight line segment parallel to it at a distance of 3cm from it using set squares and a straight edge.
- Write down with reasons, whether the pairs of straight lines in (ii)(a) and(b) are parallel or not.
- Prepare for a creative presentation of your findings at the plenary session.

13. Length I

Competency 7 : Carries out daily tasks effectively by investigating the various methods of finding the perimeter.

Competency Level 7.1 : Manipulates measurements related to lengths under the basic mathematical operations for various needs.

Activity 7.1 : Let us apply mathematical operations to measures of length.

Time : 70 minutes.

Quality Inputs :
- Measuring instruments (Meter ruler, tape, sound wheel)
- Four copies of the instruction leaflet on exploration included in Annex 7.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 7.1.1 :
- Present the instruments used to measure length to the class and inquire from the students about the instances when they are used.
- Lead a discussion and highlight the following facts.

• That the ruler marked with cm and mm should be used to measure small lengths • That the ruler or the measuring tape marked with m and cm should be used to measure large lengths • That 10mm = 1cm 100cm = 1m

(15 minutes)

Step 7.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 7.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That when adding measures of length, addition should be carried out according to units
  - That in instances where there is carrying over, a conversion of units should be done
  - That when subtracting measures of length, subtraction should be carried out according to units, and when there is carrying over, conversions should be done as appropriate
  - That when multiplying measures of lengths multiplication should be carried out according to units
  - That when multiplying measures of length, conversion of units should be done when needed
  - That when dividing measures of length, if there is a remainder after first dividing the values of the largest unit, then it should be converted into the next unit and added before proceeding with the division

(25 minutes)

Criteria for Assessment and Evaluation:

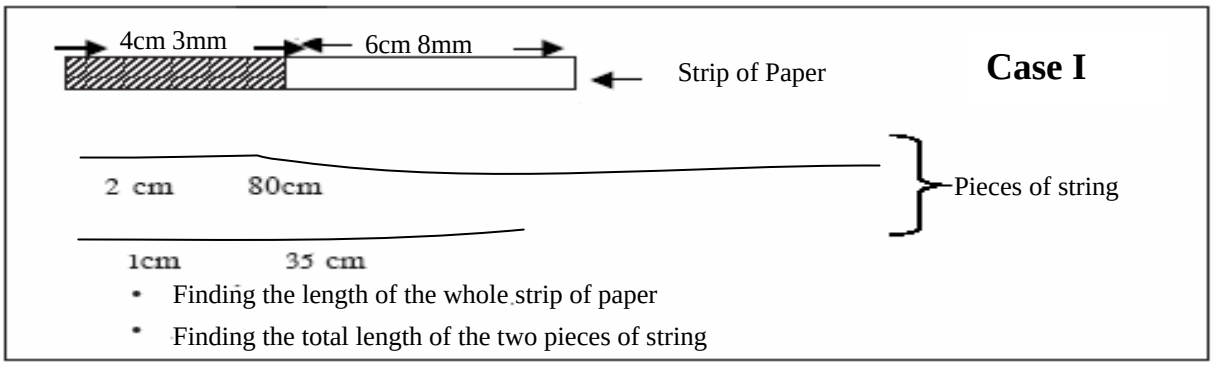
- Describes how mathematical operations are applied in relation to measures of length.
- Accepts that the measures of lengths are useful in preventing wastage in daily consumptions.
- Multiplies and divides measures related to length.
- Carries out responsibilities with commitment when working as a group.
- Carries out daily activities efficiently and accurately.

Annex 7.1.1

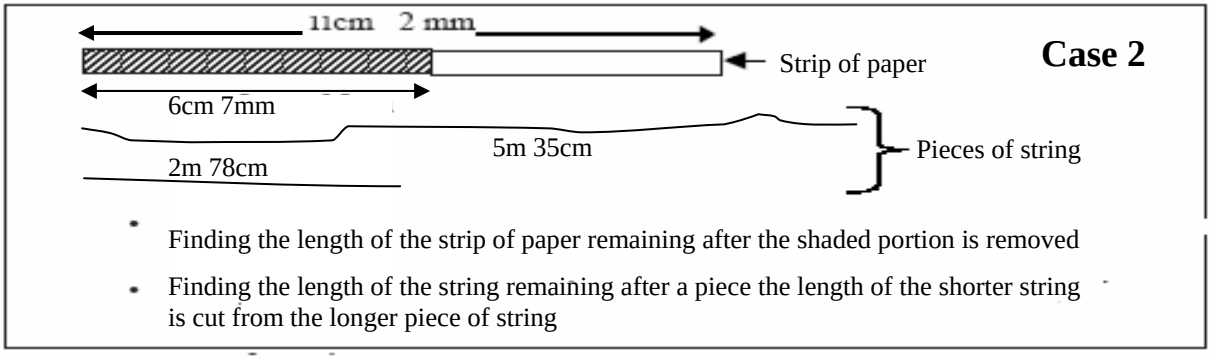
Instructions for group exploration

Let us apply mathematical operations to measures of length

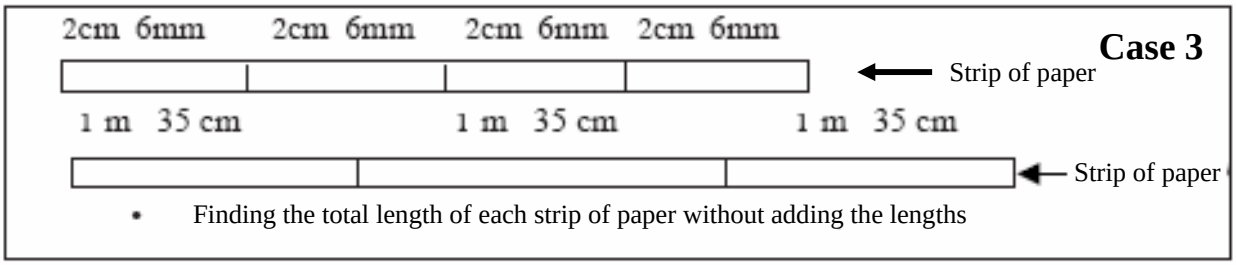
- Focus your attention on the case that your group receives from the cases given below.



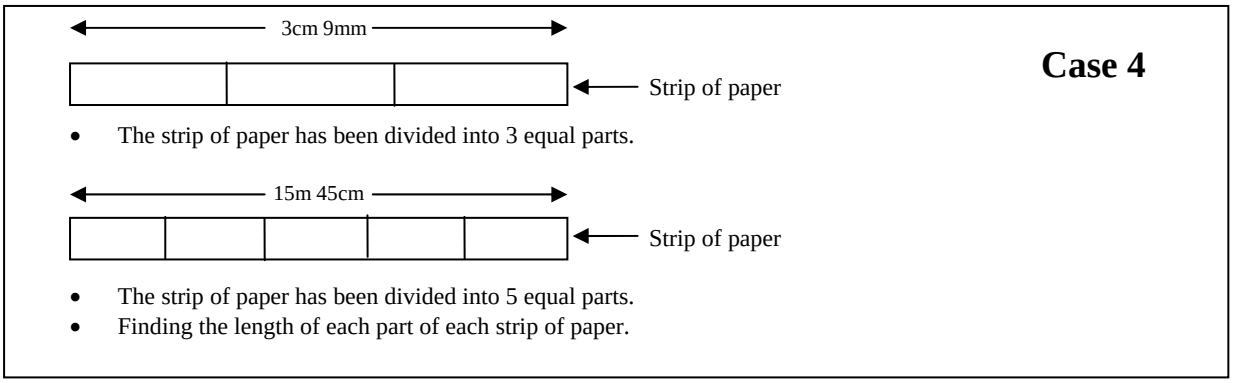
- Finding the length of the whole strip of paper
- Finding the total length of the two pieces of string



- Finding the length of the strip of paper remaining after the shaded portion is removed
- Finding the length of the string remaining after a piece the length of the shorter string is cut from the longer piece of string



- Finding the total length of each strip of paper without adding the lengths



- The strip of paper has been divided into 3 equal parts.

- The strip of paper has been divided into 5 equal parts.
- Finding the length of each part of each strip of paper.

- By studying the stated tasks carefully and using the textbook, find the relevant length.
- Discuss the method used to obtain the answer.
- Give examples of incidents in day to day life where measures of length are manipulated.
- Prepare for a creative presentation of your findings at the plenary session.

13. Length II

Competency 7 **:** Carries out daily tasks effectively by investigating the various methods of finding the perimeter.

Competency Level 7.2 **:** Uses formulae to determine the perimeters of rectilinear plane figures.

Activity 7.2 **:** Let us find the perimeter.

Time **:** 60 minutes.

Quality Inputs **:**
- Three copies of the instruction leaflet on exploration included in Annex 7.2.1.
- Three straight edges.
- Demy papers and pastels.

Learning – Teaching Process:

Step 7.2.1 **:**
- Present cards of an equilateral triangle, a square and a rectangle with their measurements marked to the class and inquire from the students how the perimeters of these objects are obtained.
- Lead a discussion and highlight the following facts.

• That the perimeter of a plane figure is the length around it • That the perimeter of a rectilinear plane figure can be found by adding the lengths of the sides together

(15 minutes)

Step 7.2.2 **:**
- Divide the class into three small groups.
- Distribute the instructions on exploration, straight edges, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(25 minutes)

Step 7.2.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That if the perimeter of an equilateral triangle with sides of length a, is P, then $P = 3a$
- That if the perimeter of a square with sides of length a, is P, then $P = 4a$
- That if the perimeter of a rectangle of length a and breadth b, is P, then $P = 2(a + b)$
- That when the data is given, the perimeter can be calculated using a formula
- That when finding the perimeter of a plane figure in which the sides are of unequal length, the lengths of the sides should be added together

(20 minutes)

Criteria for Assessment and Evaluation:

- Expresses the formulae for the perimeters of a triangle, a square and a rectangle.
- Accepts that resources can be economized by correctly finding the perimeter.
- Finds the perimeters of plane figures using formulae.
- Applies generalized results to special situations.
- Works as a team for the success of the activity.

Annex 7.2.1

Instructions for group exploration

Let us find the perimeter

- Focus your attention on the plane figure that your group receives from the plane figures given below.

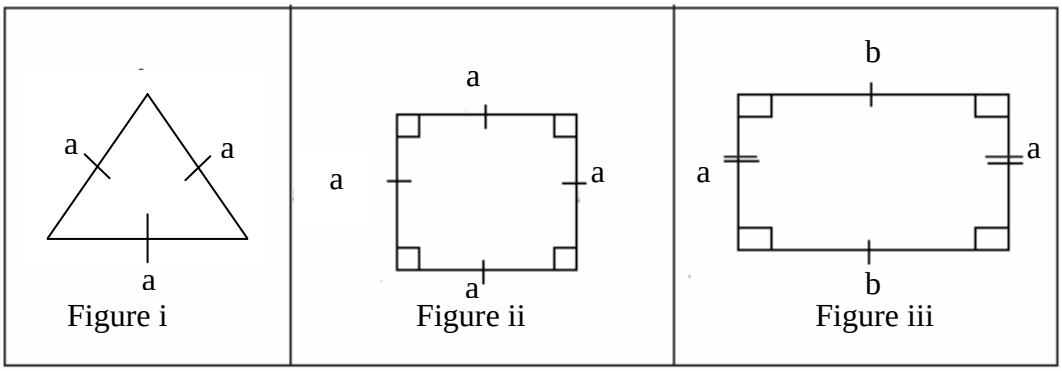


Figure i Figure ii Figure iii

- Using the textbook write an expression for the perimeter with the given algebraic terms.
- Take the perimeter of the plane figure as P and write the relationship between P and the expression you obtained.
- Measure the lengths of the sides of the plane figure, and determine the perimeter using the expression you found.
- Draw another plane figure with different measurements but of the same type as the type your group received and find its perimeter.
- Discuss situations where it is required to find the perimeter.
- Prepare to make a creative presentation of your findings at the plenary session.

14. Area

Competency 8 : Makes use of a limited space in an optimal manner by investigating the area.

Competency Level 8.1 : Investigates the areas of rectilinear plane figures.

Activity 8.1 : Let us find the areas of rectilinear plane figures.

Time : 75 minutes.

Quality Inputs :
- The chart of figures included in Annex 8.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 8.1.2.
- Two sets, each consisting of three squares with sides of length 4cm, 5cm and 7cm respectively.
- Two sets, each consisting of three rectangles with lengths and breadths equal to 4cm and 3cm, 5cm and 4cm, and 7cm and 5cm respectively.
- Four grids with $1cm^2$ squares.
- Four straight edges and 4 meter rulers.
- Demy papers and pastels.

Learning – Teaching Process:

Step 8.1.1 :
- Present the chart of figures to the class and inquire from the students about the space enclosed by the figures.
- Lead a discussion and highlight the following facts.

• That the 'space' of a surface is called area • That cm^2 is a unit of measuring area

(15 minutes)

Step 8.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, sets of squares and sets of rectangles, grids with squares of $1cm^2$, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 8.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

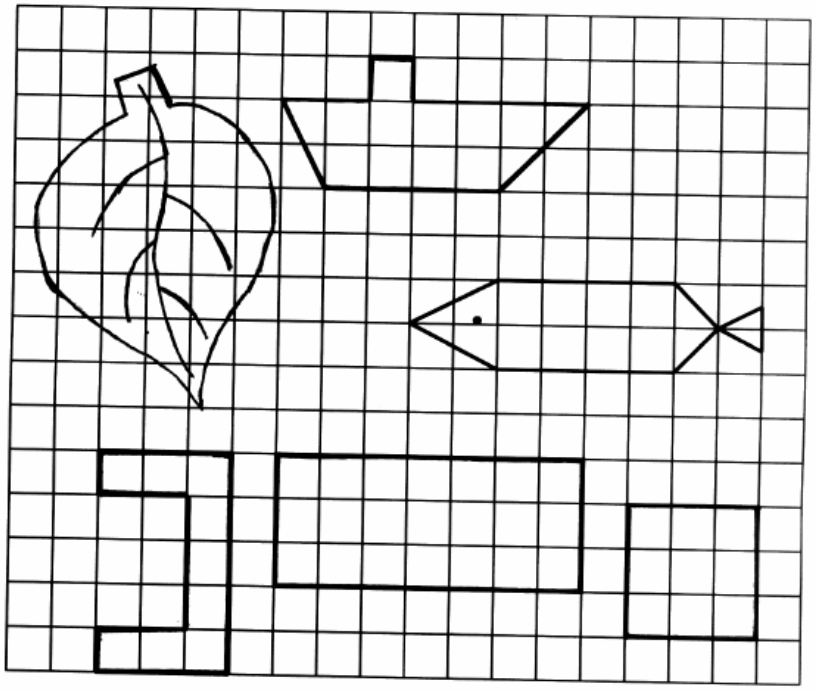
  - That if the area of a rectangle of length a and breadth b is A, then $A = a \times b$
  - That if the area of a square with sides of length a is A, then $A = a^2$
  - That m^2 is the unit used to measure the areas of large surfaces
  - That there exist rectangles with the same area but with different lengths and breadths
  - That it is useful to estimate area in day to day activities

(30 minutes)

Criteria for Assessment and Evaluation:

- Estimates the areas of plane figures.
- Accepts that it is useful to estimate area in day to day activities.
- Develops the relationships between the areas of squares and rectangles and their respective lengths and breadths.
- Compares the values that were guessed with the true values.
- Contributes to the success of the group activity.

Annex 8.1.1

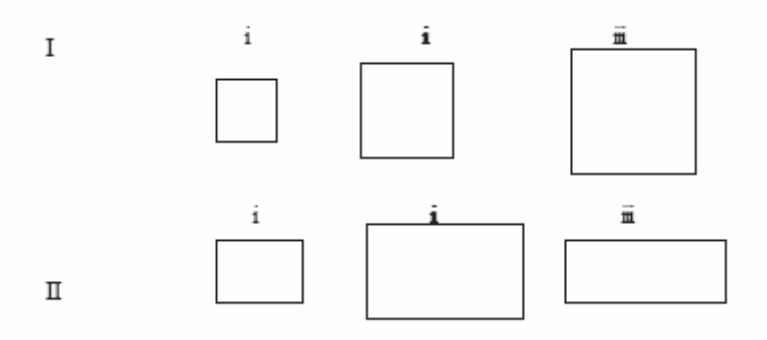


Annex 8.1.2

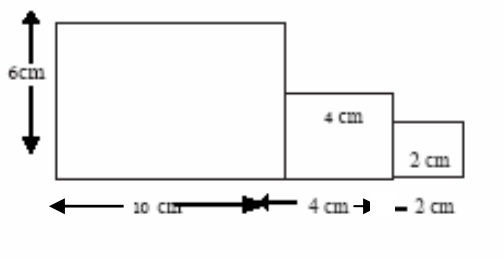
Instructions for group exploration

Let us find the areas of rectilinear plane figures

- Focus your attention on the set of rectilinear plane figures received by your group from the sets of rectilinear plane figures given below.
    - 1 and 2 – sets of squares
    - 3 and 4 – sets of rectangles



- Estimate the area of each of the plane figures in you set.
- If the area of a small square in the grid is $1cm^2$, using the grid, find the area of each of the plane figures in cm^2.
- Compare these values with the estimated values.
- Find the length and the breadth of each plane figure using the grid.
- Propose a method of finding the area using the length and the breadth.
- Using the relationship you found, find the area of the classroom floor.
- Write down the different values that could be obtained as the length and the breadth of a rectangle of area $36cm^2$.
- Present 3 situations in day to day life where it is required to estimate area.



Calculate the area of this figure using the given measurements.

- Note the information you obtained on a demy paper and prepare for a creative presentation at the plenary session.

15 Circles

Competency 27 **:** Analyses according to geometric laws, the nature of the locations in the surrounding.

Competency Level 27.1 **:** Creates designs using circles.

Activity 27.1 **:** Let us use a pair of compasses to draw circular designs.

Time **:** 75 minutes.

Quality Inputs **:**
- Four copies of the instruction leaflet on exploration included in Annex 27.1.1.
- Four pairs of compasses, four pairs of scissors.
- Half sheets.
- A bangle, a saucer, the lid of a tin, the top of a jam bottle.
- Demy papers and pastels.

Learning – Teaching Process:

Step 27.1.1 **:**
- Inquire from the students about circular shapes by showing them circular patterns.
- Lead a discussion and highlight the following facts.

  - That circular shapes can be identified from among other shapes
  - That designs can be created using circular shapes

(10 minutes)

Step 27.1.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers, pastels and other required items among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 27.1.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the mid point of a circle is defined as the "centre"
- That the longest line that can be drawn by joining two points on a circle is called "a diameter"
- That a diameter passes through the centre
- That the distance from the centre to the circle is the "radius"
- That the length of a diameter is twice the length of a radius
- That when drawing a circle using a pair of compasses, the location of the point of the pair of compasses is the centre
- That various circular patterns can be drawn by using a pair of compasses

(35 minutes)

Criteria for Assessment and Evaluation:

- Describes the relationship between the radius and the diameter of a circle.
- Accepts that the surroundings can be made beautiful using circular patterns.
- Creates circular patterns for various needs.
- Contributes to creating designs.
- Works with discipline within the group.

Annex 27.1.1

Instructions for group exploration

Let us use a pair of compasses to draw circular designs

- Focus your attention on the set of objects received by your group from the sets of objects given below.

  - A bangle
  - A saucer
  - The lid of a tin
  - The top of a jam bottle

- Using it, draw the circular shape on the paper and cut it out.
- By folding it or by measuring it or by any other method find the mid point of the circular shape.
- Using the textbook, propose a name for the mid point of the circular shape.
- Draw the longest straight line that can be drawn inside the circle and propose a name for it.
- Discuss whether there is a relationship between the length of the longest straight line that can be drawn inside the circle, and the distance from the mid point of the circle to any point on the circle.
- Place the point of the pair of compasses on the mid point of the circle, observe how the circle is drawn and then draw three circles of different sizes on the given piece of paper using the pair of compasses.
- Create an attractive design for a wall hanger by drawing circles using the pair of compasses.
- Prepare for a creative presentation at the plenary session.

16. Volume

Competency 10 **:** Gets the maximum out of space by working critically with respect to volume.

Competency Level 10.1 **:** Has an awareness of the amount of space occupied by solids.

Activity 10.1 **:** Let us find the space required by a solid.

Time **:** 75 minutes.

Quality Inputs **:**
- The figure included in Annex 10.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 10.1.2.
- Four sets consisting of 8, 10, 12 and 16 empty matchboxes.
- Four cuboids made of 8, 10, 12 and16 centi-cubes each.
- Demy papers and pastels.

Learning – Teaching Process:

Step 10.1.1 **:**
- Present the figure to the class.
- Inquire from the students about the shape and size of the two boxes of oranges and also about the decisions that we can therefore make.
- Lead a discussion and highlight the following facts.

  - That one box of oranges takes the shape of a cube while the other takes the shape of a cuboid
  - That the size of the box that has the shape of a cuboid is about twice the size of the other box
  - That the number of oranges in one of the boxes can be estimated by considering the number of oranges in the other box

(10 minutes)

Step 10.1.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, matchboxes, cuboids made of centi-cubes, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session. (30 minutes)

Step 10.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the space required by a solid is defined as its "volume".
- That on occasions such as when expressing the volume of a cuboid made of matchboxes, by the number of boxes used, "a matchbox" is called an "arbitrary unit"
- That the standard units of volume are cubic centimeters (cm^3) and cubic meters (m^3)
- That the volume of a cuboid can be obtained by $\text{length} \times \text{width} \times \text{height}$
- That the volume of a cube can be obtained by raising the length of a side to the 3rd power
- That the volumes of certain solids have to be estimated in day today life activities

(35 minutes)

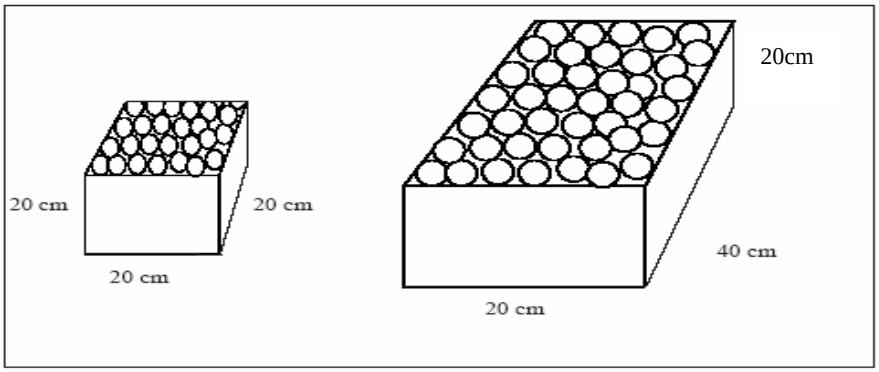
Criteria for Assessment and Evaluation:

- Describes the methods that can be used to determine the volume of a cube and a cuboid.
- Accepts that it is useful to have an idea about the volumes of items when they are being arranged.
- Calculates the volume of a cuboid using arbitrary units and standard units.
- Displays patience and carefulness in obtaining measurements and in creative work.
- Draws correct conclusion, when using objects.

Annex 10.1.1

Figure

The figures show how equal sized oranges have been arranged in two boxes



Annex 10.1.2

Instructions for group exploration

Let us find the space required by a solid

- Focus your attention on the set of objects assigned to your group.

Number of the set of objects	
1	8 matchboxes and a cuboid made of 8 centi-cubes
2	10 matchboxes and a cuboid made of 10 centi-cubes
3	12 matchboxes and a cuboid made of 12 centi-cubes
4	16 matchboxes and a cuboid made of 16 centi-cubes

- Fill one matchbox with sand.
- When the above amount of sand is taken on to a paper, what can you say about the amount of sand and the size of the matchbox?
- According to the above, propose a name for the space in the matchbox.
- Using all the matchboxes received; arrange them to form the shape of a cuboid.
- How many matchboxes are used for the length, width and the height of the cuboid?
- Form a relationship between the total number of matchboxes and the number of matchboxes used for the length, width and the height.
- A measure for the size of the cuboid can be expressed, using the amount of sand occupying the lid of a matchbox. What is it?
- Estimate the number of centi-cubes in the centi-cube cuboid received.
- How many centi-cubes are there in the length, width and the height of the cuboid?
- What is the length, width and the height of one centi-cube?
- Discuss and decide on a suitable unit to define your measurement.
- Give examples of a cuboid and a cube, note down the measurements of their lengths, widths and heights and propose a method of calculating the space the cube and cuboid require.
- Write down the answers and conclusions on a demy paper and prepare for a presentation at the plenary session.

17. Liquid Measures

Competency 11 : Fulfills daily needs by working critically with the knowledge of liquid measure.

Competency Level 11.1 : Manipulates measurements related to liquids under the basic mathematical operations.

Activity 11.1 : Let us multiply liquid measures; let us divide them.

Time : 75 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 11.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 11.1.1 :
- Write down two liquid measures in l and ml on the blackboard and inquire from the students how the two measures are added and subtracted.
- Lead a discussion and highlight the following facts.

• That liquids are measured in liters and milliliters • That 1000 milliliters equals 1 liter • That when adding and subtracting liquid measures there are instances when milliliters should be converted to liters and other instances when liters should be converted to milliliters

(15 minutes)

Step 11.1.2 :
- Divide the class into two small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(30 minutes)

Step 11.1.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

• That there are instances when milliliters have to be converted into liters when multiplying liquid measures in liters and milliliters • That there are instances when liters have to be converted into milliliters when dividing liquid measures in liters and milliliters

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes how liquid measures are multiplied and how they are divided.
- Accepts that short methods can be used when multiplying and dividing liquid measures.
- Engages in calculations associated with liquid measures.
- Makes the right decisions based on experience.
- Achieves success by working cooperatively.

Annex 11.1.1

Instructions for group exploration

Let us multiply liquid measures; let us divide them

- The figure indicates a cup of capacity 2l 250ml used to measure liquids.

- Focus your attention on the activity assigned to your group, from the activities given below.

Activity (i)	Activity (ii)
• Filling the cup with soft drink and pouring it six times into a drink bottle	• Filling the cup with soft drink and pouring it into 9 equal sized glasses.

- At the end of the activity, discuss a method of determining the amount of soft drink in the bottle/ a glass.
- Accordingly, find the soft drink volume in the bottle/ a glass.
- Prepare to make a creative presentation of your findings at the plenary session.

18. Ratios

Competency 4 **:** Uses ratios to facilitate day to day activities.

Competency Level 4.1 **:** Uses ratios to divide things.

Activity 4.1 **:** Let us divide according to a ratio.

Time **:** 90 minutes.

Quality Inputs **:**
- Three copies of the instruction leaflet on exploration included in Annex 4.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 4.1.1 **:**
- The cement mixture used in the construction of buildings, consist of sand and cement in the ratio 6:1. Inquire from the students about such situations where ratios are used.
- Lead a discussion and highlight the following facts.

  - That the numerical relationship between two amounts of the same quantity is a ratio
  - That the amounts of the quantities in a ratio, must be in the same units
  - That when the units of the quantities differ, the quantities must be expressed in the same units in order to write ratios
  - That when the ratio between two quantities is $a:b$ it is expressed as a to b
  - When a ratio is indicated by $a:b$ it can be expressed in fraction form as $\frac{a}{b}$

(20 minutes)

Step 4.1.2 **:**
- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 4.1.3 : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That the terms of the ratio should be added in order to find out the total number of parts a quantity is divided into by a ratio
- That the value of one portion can be obtained by dividing the quantity by the total number of parts it has to be divided into
- That by multiplying the value of one portion by each term of the ratio, the due portions can be obtained
- That the total amount that was divided is obtained by adding the portions related to each term of the ratio

(40 minutes)

Criteria for Assessment and Evaluation:

- Describes how the total number of parts a quantity is divided into by a ratio is obtained.
- Accepts the necessity of ratios in day to day activity.
- Divides any given amount according to a given ratio.
- Acts impartially in activities that involve sharing.
- Minimizes the wastage in day today activities.

Annex 4.1.1

Instructions for group exploration

Let us divide according to a ratio

- Focus your attention on the case received by your group, from the cases given below.

	Number of parts			Amount divided
	Saman	Radha	Nissam	
Case 1	3	1	2	Rs.300.00
Case 2	2	5	1	40 Mangoes
Case 3	1	2	4	45 Olives

- Write down the ratio according to which the items are divided among the three.
- Accordingly, write down as a fraction the amount each person gets.
- Calculate the amounts Saman, Radha and Nissam received.
- Discuss the matters that should be considered in situations such as the above that occur in day to day life.
- Prepare for a creative presentation of your findings at the plenary session.

19. Percentages

Competency 5 : Makes successful transactions in the modern world of commerce, by using percentages.

Competency Level 5.1 : Represents decimal numbers as percentages.

Activity 5.1 : Let us write decimals as percentages.

Time : 135 minutes.

Quality Inputs :
- An enlarged copy of the mark sheet included in Annex 5.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 5.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 5.1.1 :
- Present the chart of marks to the class and inquire about it from the students.
- Lead a discussion and highlight the following facts.

> - That a fraction can be converted into a fraction having 100 as the denominator by means of equivalent fractions
> - That such fractions can be seen in the environment

(15 minutes)

Step 5.1.2 :
- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastel among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 5.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a fraction can be written as a fraction with denominator equal to 100
- That fractions having 100 as the denominator can be expressed as percentages
- That percentages are indicated by the symbol "%"
- That $\frac{1}{100} = 1\%$

(30 minutes)

Step 5.1.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 5.1.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That depending on the number of decimal places in a decimal number, it can be converted into a fraction having a power of 10 as the denominator
- That by converting a decimal into a portion of 100, it can be represented as a percentage
- That by multiplying a decimal or a fraction by $\frac{100}{100}$ it can be converted into a percentage with the symbol %

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes how a decimal is written as a fraction.
- Accepts that by converting a decimal into a portion of 100, it can be written as a percentage.
- Writes a decimal as a percentage.
- Makes comparisons based on day to day experiences.
- Works with team spirit.

Annex 5.1.1

Chart of Marks

Marks for the final term examination	Evaluation Marks			
	Mathematics	Sinhala	Science	Religion
$\frac{80}{100}$	$\frac{7}{10}$	$\frac{15}{20}$	$\frac{18}{20}$	$\frac{40}{50}$

Annex 5.1.2

Instructions for group exploration

Let us write decimals as percentages

Focus your attention on the figure and the grid assigned to your group, from the figures given below.

Figure 1

Figure 2

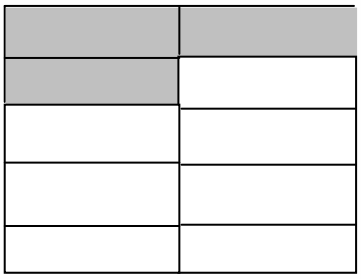


Figure 2

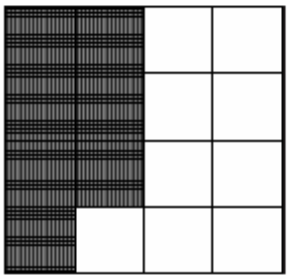
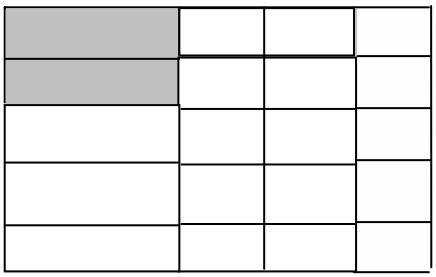
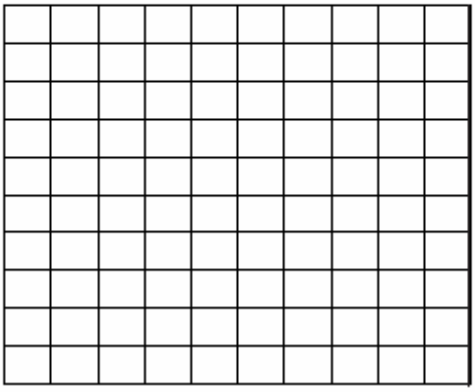


Figure 4



Grid



- Discuss what fraction the shaded portion is from the entire figure.
- Shade the section relevant to the above fraction on the grid given to you.
- By taking a small shaded part of the grid as one unit, write the fraction relevant to the shaded part.
- Describe the relationship between the fraction you obtained first, and the fraction corresponding to the shaded part of the grid.
- Considering the denominator of the fraction you obtained using the grid, and using the textbook, propose a name for it.
- Prepare for a creative presentation at the plenary session.

Part II

- Focus your attention on the decimal assigned to your group, from the decimals given below.

0.5	0.07	0.28	1.5

- Write the decimal number as a fraction.
- Write the above fraction as a percentage.
- Suggest other methods of writing a decimal as a percentage.
- Creatively prepare for a presentation at the plenary session.

20. Cartesian Plane

Competency 20 **:** Easily communicates the mutual relationships that exist between two variables by exploring various methods.

Competency Level 20.1 **:** Analyses the location of a place relative to two mutually perpendicular axes.

Activity 20.1 **:** Let us represent locations.

Time **:** 60 minutes.

Quality Inputs **:**
- Picture included in Annex 20.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 20.1.2.
- Four square ruled papers.
- Demy papers and pastels.

Learning – Teaching Process:

Step 20.1.1 **:**
- Present the picture to the class and inquire from the students about the location of the house.
- Lead a discussion and highlight the following facts.
  - That it is easy to describe a certain location in a figure using two mutually perpendicular straight lines
  - That the distances from two mutually perpendicular directions can be used to describe a location

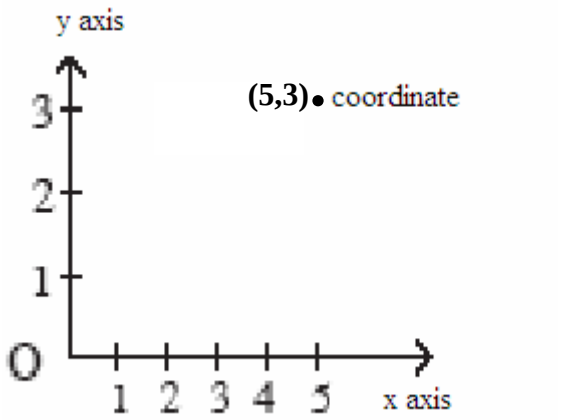
(10 minutes)

Step 20.1.2 **:**
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers, square ruled papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 20.1.3 **:**
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the plane having two mutually perpendicular number lines, is called the Cartesian plane (coordinate plane)



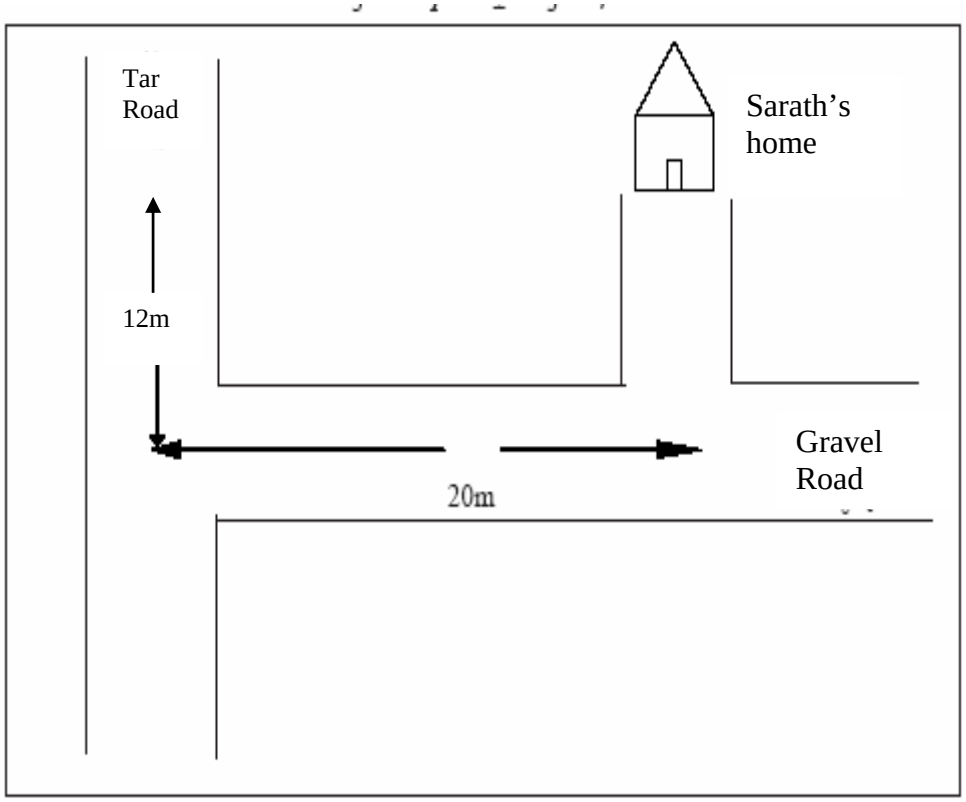
- That the horizontal number line Ox is called the x axis and the vertical number line Oy is called the y axis
- That the pair of numbers, consisting of the distance along the x axis and the distance along the y axis is called an ordered pair or a coordinate
- That when writing a coordinate the x value is written first and the y value is written second
- That an ordered pair is written within a pair of brackets, separated by a comma
- That the point (0,0) in the Cartesian plane is called the origin
- That a point in the coordinate plane can also be named using a capital letter

(20 minutes)

Criteria for Assessment and Evaluation:

- Describes the location of a point in a Cartesian plane using two mutually perpendicular axes.
- Accepts that the locations in the environment can be specified, using the distances to two mutually perpendicular straight line boundaries.
- Represents different locations graphically.
- Displays the ability to provide specific information to others.
- Plans ones activities methodically.

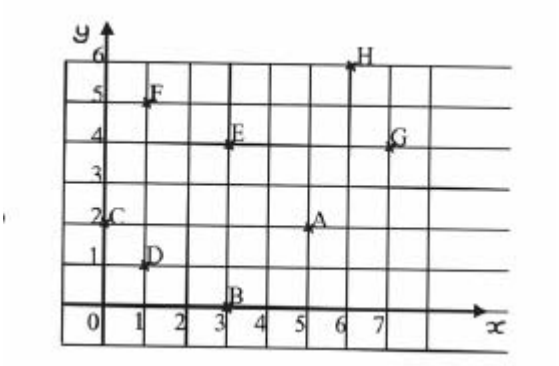
Annex 20.1.1



Annex 20.1.2

Instructions for group exploration

Let us represent locations



- Focus your attention on the figure indicating the two mutually perpendicular number lines named *x* and *y*, and the pair of points assigned to your group from the pairs of points given below.

A, B	C, D	F, H	G, D

- Write down the distances from each of these points to the lines named *x* and *y*, by counting the number of squares from the points to these lines.
- Express them in the form (p, q).

- In the square ruled paper given to you, draw the *x* and *y* number lines as shown in the figure.
- Focus your attention on the set of points your group received from the sets of points given below.

Set of points	1	(2,1), (2,4), (2,3), (2,6), (2,2), (2,0),(2,5)
Set of points	2	(1,4), (5,6), (3,4), (6,4), (0,4), (4,4),(2,4)
Set of points	3	(1,1), (4,4), (2,2), (3,3), (5,5), (0,0),(6,6)
Set of points	4	(1,5), (2,4), (3,3), (4,3), (5,4), (6,5),(5,5), (4,5), (3,5), (2,5)

- Use the "× sign" to indicate the points in the square ruled paper with the number lines.
- Near each × write down the corresponding pair of numbers.
- Using the textbook, propose special names for the following.
  - i. The two number lines
  - ii. The square ruled paper with the two number lines.
  - iii. The pair (*x* , *y*)
  - iv. The point (0,0)
- Prepare for a creative presentation at the plenary session.

21. Equations

Competency 17 : Manipulates the methods of solving equations to fulfill the needs of day to day life.

Competency Level 17.1 : Uses simple equations to solve problems that are encountered in day to day life.

Activity 17.1 : Let us solve equations.

Time : 130 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 17.1.1.
- Demy papers and pastels.

Learning –Teaching Process:

Step 17.1.1 :
- Rs.15 was spent on bus fare from the money you brought from home. If the balance was Rs. 50, how much was brought from home? Ask the students this question.
- Lead a discussion and highlight the following facts.

> - That when the money spent is subtracted from a given amount of money, the balance can be found
> - That by using an algebraic symbol for the money brought, an algebraic expression can be obtained for the balance

(20 minutes)

Step 17.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 17.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are

- That an expression with an equality can be expressed as an equation using symbols
- That certain equalities that we come across in day to day life, can be written as equations

(20 minutes)

Step 17.1.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 17.1.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a flow chart is used to represent the order of an activity
- That flow charts can be used to represent how an equation is developed
- That the inverse operation of the mathematical operation addition, is subtraction
- That the inverse operation of subtraction is addition
- That the inverse operation of the mathematical operation multiplication, is division
- That the inverse operation of division is multiplication
- That an inverse flow chart can be used to solve a simple equation
- That the algebraic method of solving the equation is included in the above method
- That algebraic methods can be used to solve simple equations

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the different methods of solving simple equations.
- Accept that simple equations can be used to solve problems.
- Solves simple equations correctly.
- Applies the right thinking to fulfill one's aims.
- Uses easy methods to solve problems.

Annex 17.1.1

Instructions for group exploration

Let us solve equations

Part I

- Focus your attention on the statement assigned to your group from the following statements.

1.	When 3 is added to x the answer is 10.
2.	When 5 is subtracted from x the answer is 4.
3.	When 3 is added to twice that of x the answer is 9.
4.	When 1 is subtracted from twice that of x the answer is 9.

- Write the statement you received using symbols.
- Propose a suitable name for statements of the type you wrote using symbols.
- Write down another statement similar to the statement given to your group.
- Write this statement using symbols.
- Prepare for a creative presentation of your findings at the plenary session.

Part II

- Focus your attention on the equation received by your group from the following equations.

Equation I - $2x+7=17$
Equation II - $x+4=10$
Equation III - $3x-1=11$
Equation IV - $x-8=3$

- Using the textbook, study carefully how flow charts and inverse flow charts have been used to solve equations.
- Find the value of x in the equation assigned to your group, by drawing a flow chart and an inverse flow chart.
- Write down another equation of the above type and use flow charts to solve it.
- Using the text book find another method of solving equations.
- Solve the equation received by your group using this method too.
- Prepare for a creative presentation of your findings at the plenary session.

21. Equations II

Competency 19 : Solves problems encountered in day today life by exploring the methods by which formulae can be applied.

Competency Level 19.1 : Constructs simple formulae.

Activity 19.1 : Let us construct simple formulae.

Time : 75 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 19.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 19.1.1 :
- Request a student to draw a square and a rectangle on the blackboard.
- Inquire how the perimeter of the square and the area of the rectangle are found.
- Lead a discussion and highlight the following facts.

> - That $P = 4a$, for a square with sides of length a and perimeter P
> - That $A = lb$, for a rectangle with length l, breadth b and area A

(15 minutes)

Step 19.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare creatively for a presentation at the plenary session.

(30 minutes)

Step 19.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That several variables connected together with the sign "=" is called a formula
  - That this relationship is an equation
  - That formulae can be used to carry out various calculations in mathematics methodically and easily
  - That formulae are also used in other subjects such as Science too

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the properties of a formula.
- Accepts that day to day calculations can be carried out easily using formulae.
- Constructs simple formulae using the relationships between the given variables.
- Manipulates the data to obtain the correct conclusions.
- Works cooperatively with the other members of the group on the assigned task.

Annex 19.1.1

Instructions for group exploration

Let us construct simple formulae

- Focus your attention on the case assigned to your group from the following cases

Case	
1	Finding the total mass A of a box of mass a and a parcel of mass b
2	Finding the balance A when Rs. a is given to buy an item worth Rs. b .
3	Finding the required number of pills A if a pills per day have to be taken for b days.
4	Finding the number of mangoes A a child receives if a mangoes are distributed equally among b children.

- Construct an expression showing the relationship between $a, b,$ and A for the given case.
- Describe another situation such as the above and discuss how an expression using suitable symbols can be constructed to represent it.
- Creatively prepare for a presentation of your findings at the plenary session.

22. Inequalities

Competency 18 : Analyses the relationships between various quantities related to real life problems.

Competency Level 18.1 : Display pictorially the limits of the values that variables can take under given restrictions.

Activity 18.1 : Let us solve inequalities.

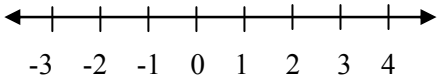
Time : 60 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 18.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 18.1.1 :
- Inquire from the students about solving simple equations and representing integers on the number line.
- Lead a discussion and highlight the following facts.

  - That simple equations can be solved using algebraic methods
  - That two whole numbers can be compared using the symbols < and >
  - That integers can be represented on a number line



(10 minutes)

Step 18.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentation at the plenary session.

(30 minutes)

Step 18.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the relationship developed with the information of a given incident and using an algebraic symbol and one of the signs " < " or " > " is called an inequality
- That the basic axioms used to solve equations can be used to solve inequalities too
- That the set of solutions of an inequality can be represented by points on a number line

(20 minutes)

Criteria for Assessment and Evaluation:

- Describes how inequalities are solved using algebraic methods.
- Accepts that the solutions of an inequality can be represented on a number line.
- Solves given inequalities.
- Is inclined to find solutions satisfying given restrictions.
- Uses simple methods in communication.

Annex 18.1.1.

Instructions for group exploration

Let us solve inequalities

- Focus your attention on the event received by your group from the events stated below.

  Event i:
  Currently, a state school in Sri Lanka admits a child into the school only after the completion of five years of age.
  Let x be the age of a child currently learning in a pre-school.

  Event ii:
  Only students over 15 years of age are selected for a sports competition.
  Let x be the age of a student participating in the competition.

  Event iii:
  Only vehicles of mass less than 8 metric tones are allowed to cross a bridge.
  Let x be the mass of a vehicle that can cross the bridge.

  Event iv:
  Currently, the price of an orange in the market is more than Rs 10.
  Let x be the price of an orange in the market.

- Considering the values that x could take in the event given to you, write the relationship involving x using either the symbol $<$ or the symbol $>$.
- Is the relationship you wrote down an equation? If not, suggest a name for it.

- Out of the relationships given below, focus your attention on the relationship received by your group.

  - $2x < 10$
  - $2x > 10$
  - $x + 1 > 6$
  - $x - 1 < 6$

- Using the algebraic methods followed to solve equations, attempt to solve the given inequality and find the values of x.
- From the solutions you obtain, write down all the whole numbered solutions which are less than 10.
- Draw a number line and represent your solutions on it.
- Prepare for a presentation at the plenary session.

23. Rectilinear Plane Figures I

Competency 23 : Makes decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.

Competency Level 23.1 : Names various rectilinear plane figures based on their characteristics.

Activity 23.1 : Let us classify triangles.

Time : 135 minutes.

Quality Inputs :
- Three sets consisting of three equilateral, isosceles and scalene triangles cut from thick paper.
- Three sets consisting of three acute-angled, right-angled, obtuse-angled triangles cut from thick paper.
- Three copies of the instruction leaflet on exploration included in Annex 23.1.1.
- Demy papers and pastels.

Learning – Teaching Process :

Step 23.1.1 :
- Draw a triangle on the blackboard and inquire from the students about the characteristics of the triangle.
- Lead a discussion and highlight the following facts.

> - That a closed rectilinear plane figure consisting of three sides is a triangle
> - That the lengths of the sides of a triangle can be measured using a cm, mm scale
> - That a protractor can be used to measure the magnitude of an angle

(15 minutes)

Step 23.1.2 :
- Divide the class into three small groups.
- Distribute the instructions on exploration, sets of triangles, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 23.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That triangles can be classified according to the lengths of their sides
  - That triangles with sides of equal length are defined as equilateral triangles
  - That triangles with two sides equal in length are defined as isosceles triangles
  - That triangles with sides of unequal length are defined as scalene triangle

(30 minutes)

Step 23.1.4 : • Organize the groups again.

- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for presentations at the plenary session.

(40 minutes)

Step 23.1.5 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That triangles can be classified according to the sizes of the angles
  - That a triangle in which all angles are acute angles is defined as an acute angled triangle
  - That a triangle with a right angle is defined as a right-angled triangle
  - That a triangle with an obtuse angle is defined as an obtuse angled triangle

(20 minutes)

Criteria for Assessment and Evaluation:

- Names types of triangles according to their sides and angles.
- Accepts that triangles can be classified according to the lengths of their sides as well as the sizes of the angles.
- Classifies a given triangle based on its sides and based on its angles.
- Is inclined to classify based on common characteristics.
- Uses shapes for decorations.

Annex 23.1.1

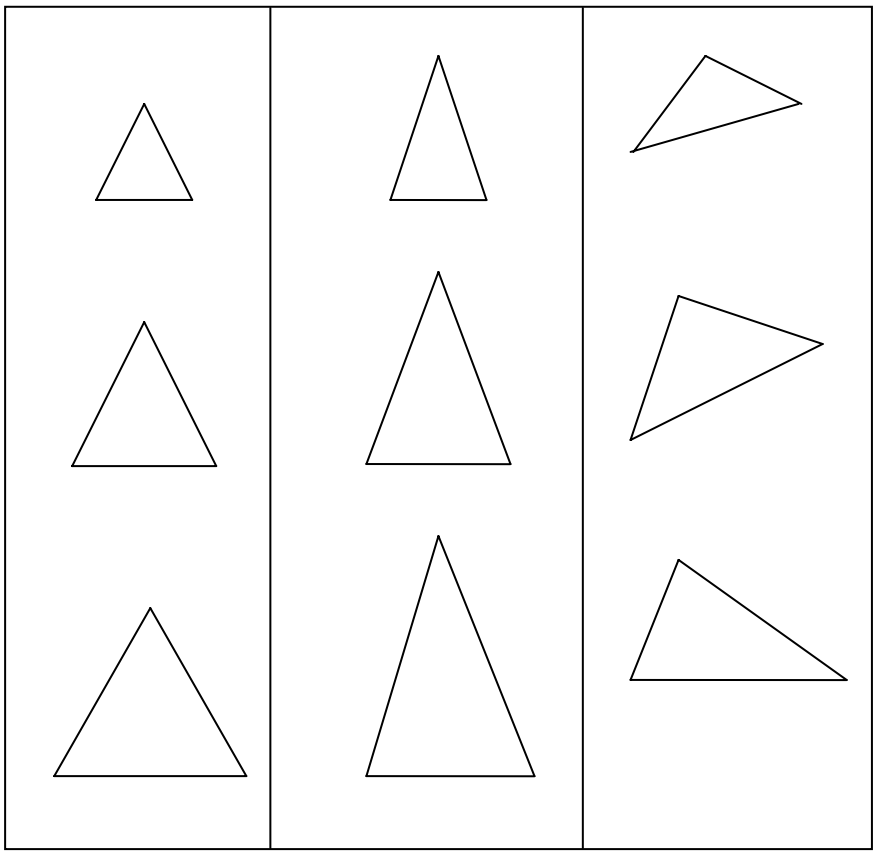
Instructions for group exploration

Let us classify triangles

Part I

- Study the manner in which triangles can be classified according to their sides and the relationships between the sides of the triangle as given in the textbook.
- Focus your attention on the set of triangles assigned to your group from the sets of triangles given below.

Set I Set II Set III

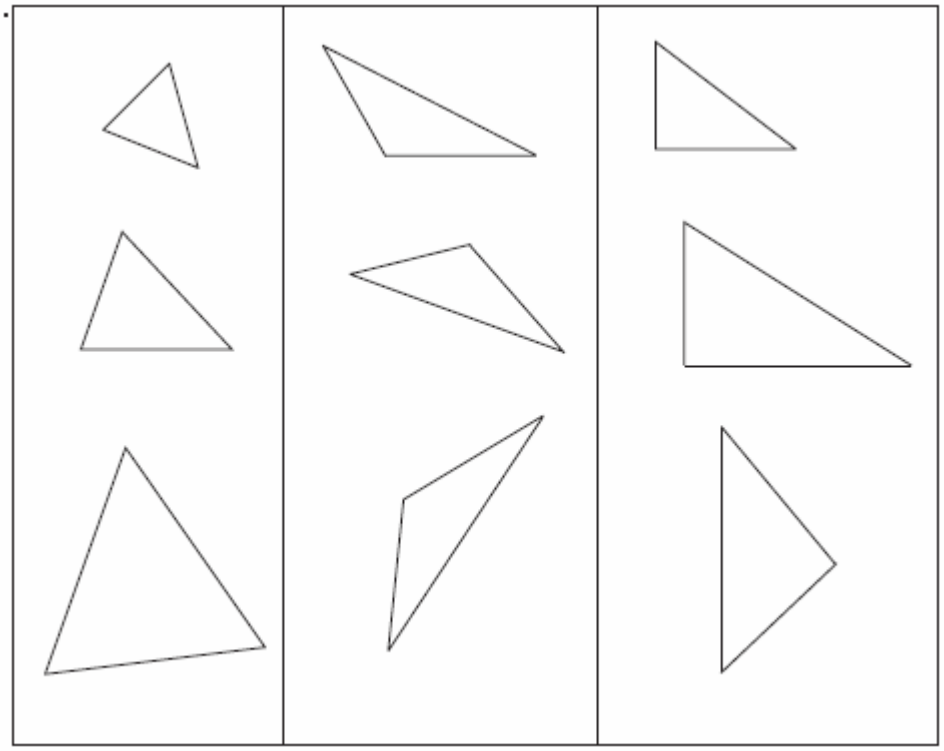


- Discuss to which type the set of triangles assigned to your group belong, based the relationships between the sides of the triangles, as studied in the text book.
- According to the above, propose a name for the type of triangles you received.
- Prepare for a creative presentation at the plenary session.

Part II

- Study the manner in which triangles can be classified according to their angles and the relationships between the angles of the triangle as given in the text book.
- Focus your attention on the set of triangles assigned to your group from the sets of triangles given below.

Set I Set II Set III



- Measure the sizes of the angles in each triangle.
- Discuss to which type the set of triangles assigned to your group belongs, based on the relationship between the angles, as studied in the text book.
- According to the above, propose a name for the type of the triangles you received.
- Using the type of triangle you identified, create a beautiful drawing.
- Prepare for a creative presentation at the plenary session

23. Rectilinear Plane Figures II

Competency 23 : Makes decision regarding day to day activities based on geometrical concepts related to rectilinear plane figures.

Competency Level 23.2 : Classifies polygons according to their shapes.

Activity 23.2 : Let us identify polygons.

Time : 75 minutes.

Quality Inputs :
- An enlarged copy of the chart of figures included in Annex 23.2.1
- Two copies of the instruction leaflet on exploration included in Annex 23.2.2. (with large figures)
- Teacher's demonstration protractor
- Demy papers and pastels.

Learning – Teaching Process:

Step 23.1.1 :
- Present the chart of figures to the class and inquire from the students about the line segments of the figures and the 'open ness', 'closed ness' of the figures.
- Lead a discussion and highlight the following facts.

• That figures containing at least one curved line segment, are not rectilinear plane figures • That rectilinear plane figures can be classified as open or closed • That a plane figure bounded by straight line segments is called a polygon • That there are methods of measuring reflex angles also using the protractor

(15 minutes)

Step 24.1.2 :
- Divide the class into two small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 24.1.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

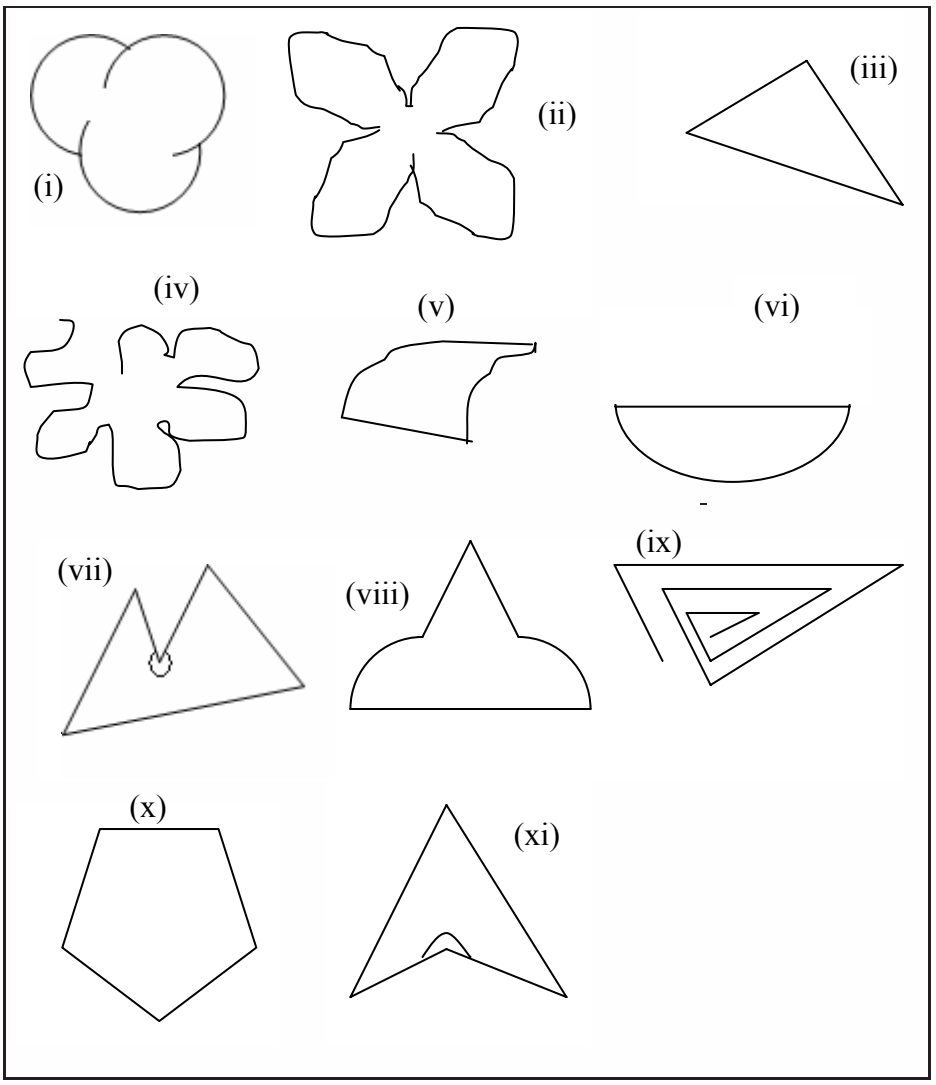
• That a polygon in which each internal angle is less than 180^o is a convex polygon • That a polygon with at least one internal angle greater than 180^o is a concave polygon • That a polygon with all sides equal and all angles equal is a regular polygon

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the characteristics of a convex polygon, a concave polygon and a regular polygon.
- Accepts that a regular polygon is always a convex polygon.
- Classifies polygons based on geometric characteristics.
- Engages in creating designs based on the new knowledge that has been gained.
- Is attentive to the patterns in nature and in the surroundings.

Annex 23.2.1



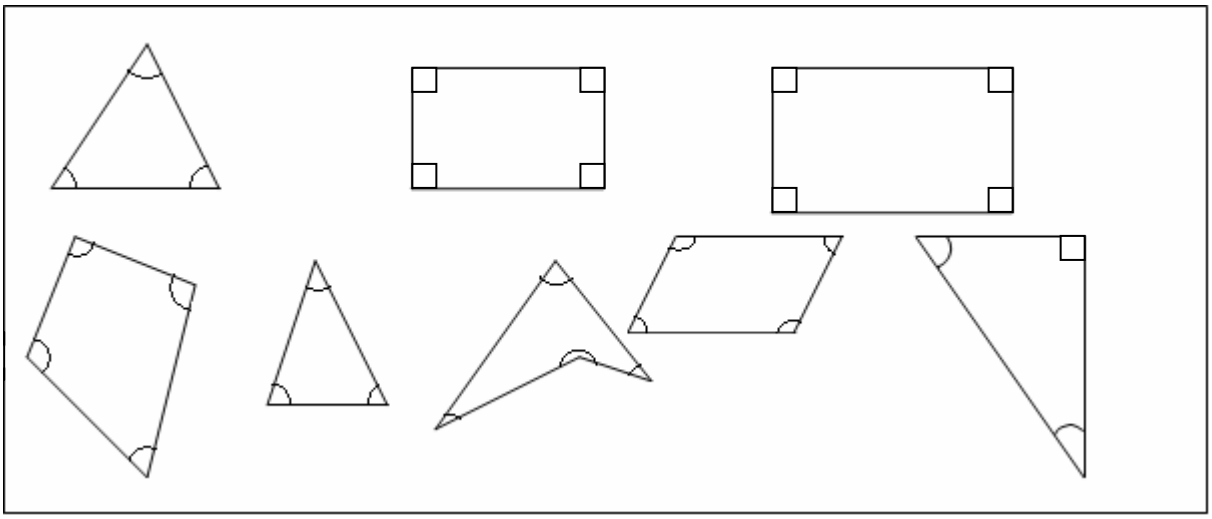
Annex 23.2.2

Instructions for group explorations

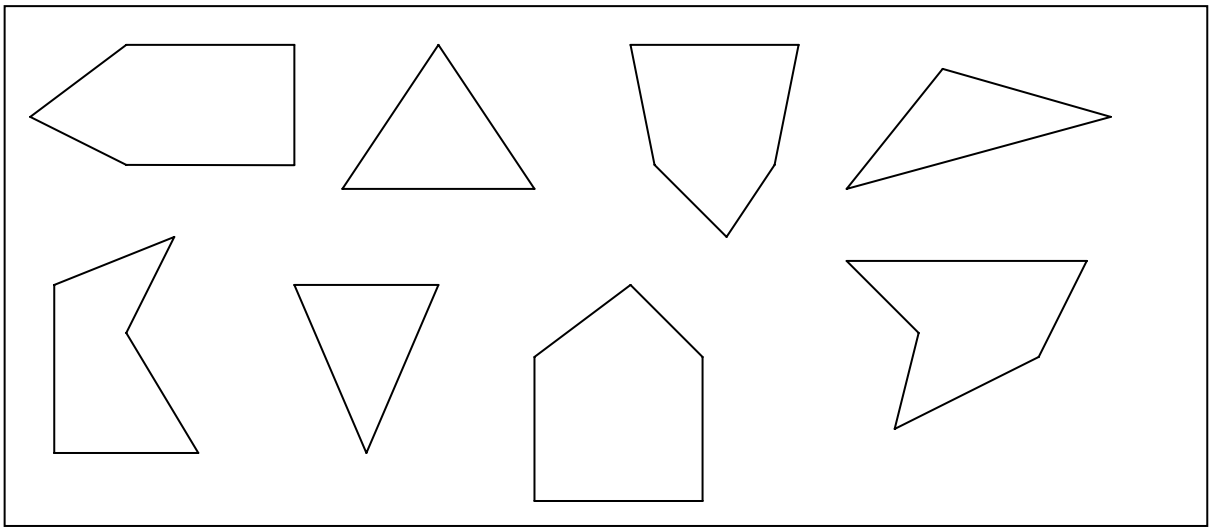
Let us identify polygons

- Focus your attention on the set of figures received by your group from the following sets of figures

Set of Figures I



Set of Figures 2



- Examine whether there are reflex angles among the internal angles of the figures.
- Separate the plane figures that have internal angles which are reflex angles from the plane figures that do not have any internal angles which are reflex angles.
- Propose names for these two types of plane figures, by studying the text book.
- Measure the lengths of the sides of the plane figures you chose that do not have reflex angles.
- Separate these figures into two groups as those with all sides equal and those with all sides not equals.
- Measure and see whether the internal angles of the polygons with equal sides, are equal.
- Propose a name for polygons with all sides equal and all angles equal.
- Choose any plane shape you like and create a design for a cushion cover/table cloth.
- Prepare for a creative presentation of your findings at the plenary session

24. Constructions

Competency 27 : Analyzes according to geometric laws, the nature of the locations in the surroundings.

Competency Level 27.2 : Constructs plane figures.

Activity 27.2 : Let us draw plane figures accurately.

Time : 120 minutes.

Quality Inputs :
- An enlarged copy of the chart of figures included in Annex 27.2.1
- Four copies of the instruction leaflet on exploration include in Annex 27.2.2.
- A set of geometrical instruments.
- Demy papers and pastels.

Learning – Teaching Process:

Step 27.2.1 :
- Present the chart of figure to the class and inquire from the students about the characteristics of each figure.
- Lead a discussion and highlight the following facts.

> - That there are closed plane figures with three or more sides
> - That the rectilinear plane figure consisting of three equal sides is an equilateral triangle
> - That the angles of an equilateral triangle are equal
> - That polygons with equal sides and equal angles are regular polygons

(10 minutes)

Step 27.2.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Prepare for a group presentation at the plenary session.

(30 minutes)

Step 27.2.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a straight line segment of given length can be constructed using a straight edge and compass
- That an equilateral triangle can be constructed using a straight edge and compass
- That an equilateral triangle having a straight line segment of given length as one of its sides can be constructed

(30 minutes)

Step 27.2.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 27.2.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a circle can be divided into six equal parts by chords the length of the radius
- That a regular hexagon can be formed by joining the points of division
- That there other methods of creating regular hexagon

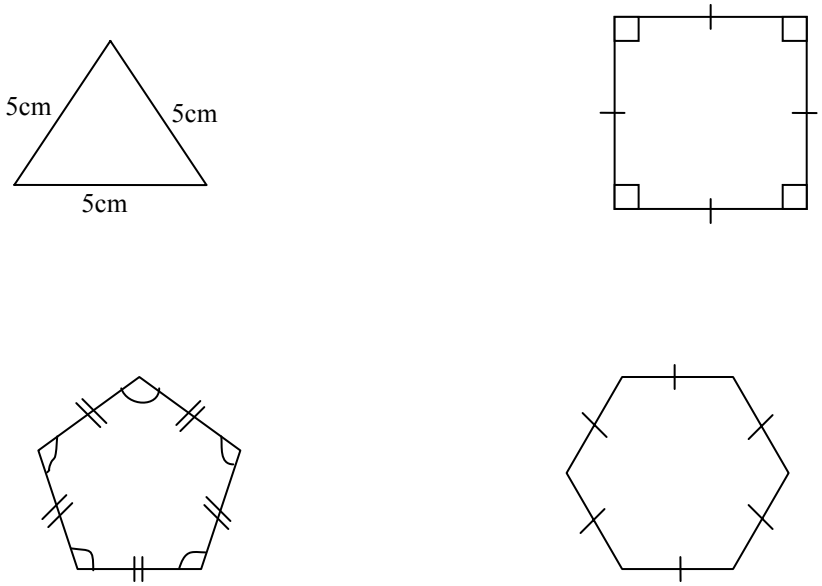
(30 minutes)

Criteria for Assessment and Evaluation:

- Describes how equilateral triangles and regular hexagons are created.
- Accepts that equilateral triangles and regular hexagons can be created accurately and efficiently by using a straight edge and compass.
- Creates equilateral triangles and regular hexagons.
- Manipulates instruments appropriately in order to gain successful results.
- Focuses on making new creations.

Annex 27.2.1

Chart of figures

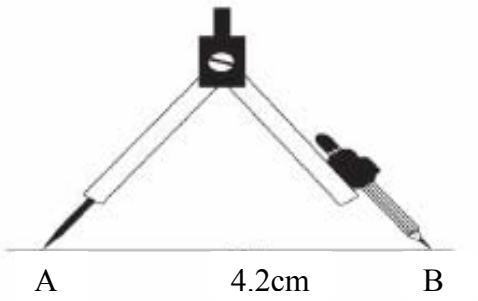


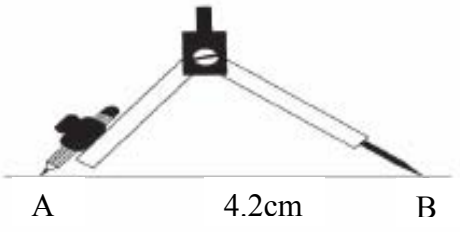
Annex 27.2.2

Instructions for group exploration

Let us draw plane figures accurately

Part I





- Carefully study the above figures.
- Focus your attention on the measurement received by your group from the measurements given below.

	I	II	III	IV
Measurement	3.5cm	4.3cm	5.2cm	4.8cm

- By considering the facts observed above, construct a line segment of the given length using a straight edge and compass and name it AB.
- Taking the lengths of the other two sides to be the same length as AB, find the point C and create the triangle ABC by using the compass.
- Identify the characteristics of the triangle constructed by joining the points A,B and C, and propose a name for it.
- Measure the 3 angles of the above triangle and determine whether it is a regular polygon.
- Prepare for a creative presentation at the plenary session.

Part II

- Focus your attention on the measurement received by your group from the measurements given below.

	I	II	III	IV
Measurement	3.2cm	3.5cm	4.4cm	4.6cm

- Draw a circle with radius equal to the given measurement.
- Find out how points can be marked off on the circle at equal distances from each other using the radius of the circle.
- Create a plane figure by joining the marked points.
- Find the special properties of this plane figure and propose a name for the figure.
- Propose other methods of creating this plane figure.
- Prepare for a creative presentation at the plenary session.

25. Solids I

Competency 22 : Creates new models by exploring various solids.

Competency Level 22.1 : Creates models of solids

Activity 22.1 : Let us make various solids.

Time : 75 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 22.1.1.
- Two graph papers with division done in centimeters, for each group.
- Pairs of scissors, gum or cello tape and Bristol boards.
- Demy papers and pastels.

Learning – Teaching Process:

Step 22.1.1 :
- Present a model of a tetrahedron to the class.
- Also present its net and inquire from the students about the characteristics of a tetrahedron.
- Lead a discussion and highlight the following facts.

  - That it is necessary to prepare a net when making solids
  - That a tetrahedron consists of six edges, four vertices and four faces
  - That solids of different shapes are used in day to day life

(10 minutes)

Step 22.1.2 :
- Divide the class into two small groups.
- Distribute the instructions on exploration, graph papers, pairs of scissors, glue or cello tape, Bristol boards, demy papers and pastels among the groups.
- Focus the attention of the groups on to the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 12.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

  - That a square pyramid has a square base and four triangular faces.
  - That a triangular prism has two triangular faces and three rectangular faces.
  - That technological methods are required for a good creation

(25 minutes)

Criteria for Assessment and Evaluation:

- Describes the shapes of the faces of the solid that was created.
- Accept that such models can be used to decorate the surroundings.
- Draws and cuts the net accurately and creates the model of the solid.
- Makes use of resources appropriately to maximize productivity.
- Works with discipline within the group.

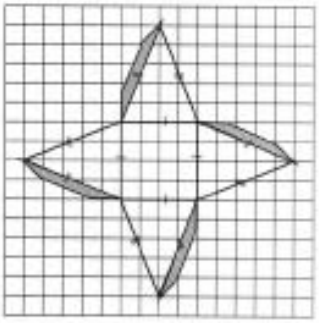
Annex 22.1.1

Instructions for group exploration

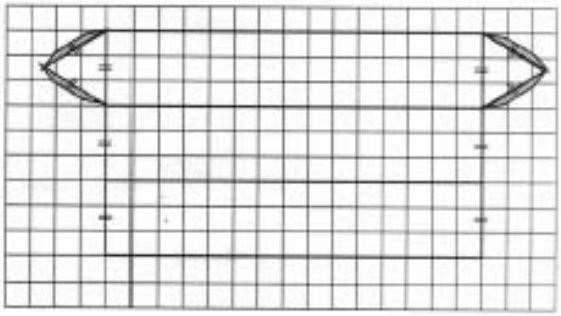
Let us make various solids

- Focus your attention on the net received by your group from the nets given below.

net



net



- Draw the net received by your group on a graph paper.
- Paste the graph paper on a Bristol board and cut out the net.
- By folding and pasting the allowances in a suitable manner obtain a solid.
- Discuss and write down the number of edges, vertices and faces of the solid.
- Examine the shapes of the faces.
- Propose a suitable name for the solid.
- Describe and write down instances when members of your group have seen solids of this shape.
- Prepare for a creative presentation of your findings.

25. Solids II

Competency 22 : Creates new models by exploring various solids.

Competency Level 22.2 : Investigates the relationships between the characteristics of solids.

Activity 22.2 : Let us develop relationships between the characteristics of solids.

Time : 75 minutes.

Quality Inputs :
- Two copies of the instruction leaflet on exploration included in Annex 22.2.1.
- A cube with edges of length $4cm$.
- Two square pyramids with bases of dimension $4cm \times 4cm$.
- Four regular tetrahedrons with edges of length $4cm$.
- A cuboid with length, width and height $4cm$, $4cm$ and $10cm$ respectively.
- A triangular prism having an equilateral triangular shaped cross section with sides of length $4cm$ each, and length $10cm$.
- Demy papers and pastels.

Learning – Teaching Process:

Step 22.2.1 :
- Present several solids such as a cube, a cuboid and a tetrahedron to the class.
- Lead a discussion and highlight the following facts.

> - That a solid consist of faces, vertices and edges
> - That different solids have different numbers of faces, vertices and edges.

(15 minutes)

Step 22.2.2 :
- Divide the class into two small groups.
- Distribute the instructions on exploration, solids, demy papers and pastel among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 22.2.3 **:**

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

• That the sum of the number of vertices and the number of faces of a solid, exceeds the number of edges of the sold, by two • That this relationship is known as Euler's relationship • That only solids with plane faces and straight edges satisfy Euler's relationship.

(30 minutes)

Criteria for Assessment and Evaluation:

- Identifies the faces, vertices and edges of different solids.
- Accepts that only solids having only straight edges satisfy Euler's relationship.
- Develops Euler's relationship for solids.
- Engages in innovations using the things that were explored.
- Critically presents the outcomes of the group.

Annex 22.2.1

Instructions for group exploration

Let us develop relationships between the characteristics of solids

- Focus your attention on the set of solids received by your group from the sets of solids given below.

Set 1	Set 2
Cube 2 square pyramids 2 tetrahedrons	Cuboid 2 triangular prisms 2 tetrahedrons

- Count the number of faces, vertices and edges of each of the given solids and tabulate it.
- Carry out a discussion to find out whether there is a relationship between the number of faces, number of vertices and number of edges of each of the solids.
- Write down the relationship developed by your group.
- Using the solids received by your group, make other compound solids.
- See whether the number of faces, vertices and edges of each of the compound solids you made satisfy the obtained relationship.
- Prepare for a creative presentation of your findings at the plenary session.

26. Representation and Interpretation of Data I

Competency 28 : Facilitates daily work by investigating the various methods of representing data.

Competency Level 28.1 : Represents data by various methods.

Activity 28.1 : Let us communicate information using graphs.

Time : 120 minutes.

Quality Inputs :
- An enlarged copy of the chart included in Annex 28.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 28.1.2.
- Yellow and blue colour pencils.
- Demy papers and pastels.

Learning – Teaching Process:

Step 28.1.1 :
- Present the chart to the class.
- Using the chart, lead a discussion to highlight the following facts.

• That it is easy to present information that has been gathered using a table • That communication is facilitated by presenting tabulated data pictorially • That the greatest and the least values can be easily identified in a given figure • That there are other easy methods of communicating information

(15 minutes)

Step 28.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, colored pencils, demy papers and pastel among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 28.1.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- The graphs that represent data by columns of equal width, are called column graphs
- That column graphs can be drawn horizontally, as well as vertically
- That the length of a column represents its number
- That when information of two types are represented in a single graph the column graph is called a multiple column graph

(30 minutes)

Step 28.1.4 : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(15 minutes)

Step 28.1.5 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a stem and leaf diagram can be used as a convenient method of representing data
- That the stem and leaf diagram consists of two columns; the first column is identified as the stem while the second column is identified as the leaf
- That the data can be arranged in ascending order after it has been included in the stem and leaf diagram

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the methods of representing data.
- Accepts that is it is easy to interpret data through the representation of information by graphs.
- Represents a group of data in different ways.
- Uses short methods to communicate information.
- Easily grasps the information that is represented in different ways in day today life.

Annex 28.1.1

Chart

A fruit seller's income obtained by selling olives during 5 days of a week is given in the following table

Date	Monday	Tuesday	Wednesday	Thursday	Friday
Income (rupees)	30	45	40	20	55

A student's representation of the above data in a figure is given below.

Annex 28.1.2

Instructions for group exploration

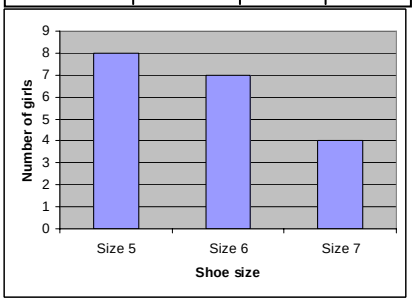
Let us communicate information using graphs

Part I

- Focus your attention on the case assigned to your group, from the cases given below.

Case 1: Shoe sizes of grade 7 students

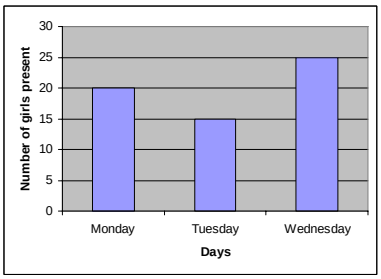
Shoe size	Size 5	Size 6	Size 7
Number of girls	8	7	4



Shoe size	Size 5	Size 6	Size 7
Number of boys	5	9	6

Case 2: Attendance of grade 7 students for 3 days

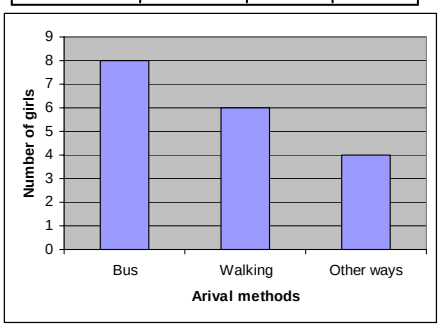
Day	Monday	Tues	Wed
Number of girls	20	15	25



Day	Monday	Tues	Wed
Number of boys	25	20	30

Case 3: Method of arrival of grade 7 students

Method	By Bus	Walk	Other
Number of girls	8	6	4



Method	By bus	Walk	Other
Number of boys	4	8	8

- Study how the tabulated information related to girls for the case your group received has been represented in a graph.
- In the same manner, represent the information related to boys in a graph.
- Colour this graph in blue.
- Propose a name for this graph.
- By studying the textbook, represent the information related to the girls and the information related to the boys in your case on the same graph.
- Propose a suitable name for this graph too.
- Prepare to creatively present your findings at the plenary session.

Part II

Below is a chart with the numbers 537, 558, 536, 522, 525, 530 in it.
Study it carefully

52	2, 5
53	0, 6, 7
55	8

- Focus your attention on the set of numbers assigned to your group, from the sets of numbers given below.

Number set I	Number set 2	Number set 3
7, 48, 34, 39	103, 94, 108, 109	304, 312, 285, 298
9, 2, 12, 15	105, 105, 107, 103	307, 296, 340, 321
25, 12, 11, 17	107, 104, 93, 98	317, 309, 323, 293
23, 28, 29, 41	104, 108, 107, 99	314, 340, 328, 299
40, 30, 23, 23	97, 101, 109, 102	308, 319, 333, 338

- By studying the chart and the text book, represent the numbers that you received in a suitable manner in a chart.
- Propose a suitable name for the chart.
- Discuss how the numbers appropriate for the first column were selected.
- Write down a set of numbers of the same form as the set of numbers your group received and represent these numbers also in a similar chart.
- Prepare to present your findings creatively at a plenary session.

26. Representation and Interpretation of Data II

Competency 29 : Makes predictions by analyzing data by various methods to facilitate daily activity.

Competency Level 29.1 :. Analyses the dispersion of data.

Activity 29.1 : Let us analyze the dispersion of data.

Time : 80 minutes.

Quality Inputs :
- Three copies of the instruction leaflet on exploration included in Annex 29.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 29.1.1 :
- Write down on the blackboard, the attendance of students during each day of two weeks.
- Lead a discussion and highlight the following facts.

• That there are differences in the attendance of students on each day • That the attendance can be represented in a stem and leaf diagram • That various conclusions can be drawn from the information

(20 minutes)

Step 29.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers, and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 29.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the least value of a set of data is defined as the minimum value
- That the greatest value is defined as the maximum value
- That the difference between the maximum value and the minimum value is defined as the range
- That the maximum value, minimum value and the range can be used to draw conclusions about the set of data
- That if one or more data points vary by a large amount from the other data points, since the range will be large, conclusions drawn using the range will be inaccurate

(20 minutes)

Criteria for Assessment and Evaluation:

- Describes the maximum value, the minimum value and the range of a set of data.
- Accepts that an idea about the distribution of the data can be obtained using the range.
- Calculates the maximum value, the minimum value and the range of a set of data.
- Is attentive to the extreme values.
- Draws the right conclusions based on information.

Annex 29.1.1

Instructions for group exploration

Let us analyze the dispersion of data

- Focus your attention on the set of numbers received by your group, from the sets of numbers given below.

Set of numbers - I
The attendance of grade 7 students during 10 days is given below.
30, 35, 31, 29, 40, 28, 34, 35, 39, 33

Set of numbers - II
The lengths in meters of several pieces of cloth that cut and discarded from a garment factory are given below.
0.1, 0.9, 1.1, 0.3, 0.2, 0.3, 1.2, 0.5, 0.4, 0.8

Set of numbers - III
The stem and leaf diagram of the information on 10 days of rainfall (given in ml) is given below.

Stem	Leaf
0	2, 3, 5, 9
1	4, 6, 7, 8
2	2, 5

Set of numbers - IV
The stem and leaf diagram of the information on the amount of rice sold (in kg) in a market during 10 days is given below.

Stem	Leaf
10	2, 5, 8
11	4, 7, 8, 9
12	1, 3, 6

- Find out between which values the numbers assigned to your group are spread.
- Explain the importance of the greatest value and the least value and propose suitable names for them.
- Determine the difference between these values and find a name for this difference using the textbook. Discuss whether there is a relationship between the increase or the decrease of this difference and the validity of the data.
- Give examples of instances where such values are used.
- Prepare for a creative presentation of your findings at the plenary session.

27. Scale Drawings

Competency 13 : Uses scale drawings in practical situations by exploring various methods.

Competency Level 13.1 : Represents by geometrical plane figures, measurements related to lengths that are obtained from the environment.

Activity 13.1 : Let us make scale drawings.

Time : 75 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 13.1.1.
- Demy papers, square ruled papers and pastels.

Learning – Teaching Process:

Step 13.1.1 :
- Lead a discussion by inquiring from the students whether a figure of the floor of a rectangular shaped hall in the school can be drawn in the exercise book.
- During this discussion highlight the following facts.

> - That a figure of a location with large measures cannot be drawn in the exercise book.
> - That in order to draw a figure such as the above, it should be scaled down in size to fit the exercise book in such a manner that the shape of the figure remains unaltered

(10 minutes)

Step 13.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers, square –ruled papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 13.1.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a figure drawn by increasing or decreasing real measures using some ratio, is called a scale drawing
- That a suitable scale must be chosen when making a scale drawing
- That the ratio between the length represented by $1cm$ in the scale drawing and the corresponding length in centimeters of the actual figure is called the scale
- That there are instances when a simple scale is represented by $1cm \rightarrow xcm$ or $1cm \rightarrow ycm$
- That 1cm represents $x$cm can be given by $1: x$
- That a scale drawing can be done according to the selected scale
- That scale drawings can also be used to enlarge and draw a small figure
- That by multiplying the measures in a scale drawing by the scale, the actual measures can be obtained

(25 minutes)

Criteria for Assessment and Evaluation:

- Expresses a suitable scale in order to make a scale drawing of a given rectangle.
- Accepts that a suitable scale must be chosen in order to make a scale drawing.
- Makes a scale drawing according to a selected scale.
- Presents pictorial representations using appropriate methods to facilitate communication.
- Selects and applies what is appropriate for the situation.

Annex 13.1.1

Instructions for group exploration

Let us make scale drawings

- Focus your attention on the place assigned to your group, from the places given in the following table

Place	The length of the actual floor (m)	The width of the actual floor (m)
The rectangular floor of a class room	**6**	**5**
The volleyball court	**18**	**9**
The rectangular floor of a main hall	**40**	**25**
The rectangular play ground	**600**	**400**

- Discuss based on the length and width, whether a figure of the place received by your group can be drawn in your exercise book.
- If the figure cannot be drawn, propose suitable values for the length and the width of a representation, such that the shape of the figure drawn is identical to the shape of the given place.
- Draw the figure on a square ruled paper using the length and width you proposed.
- Discuss and determine how many cm in actual length is represented by a length of $1cm$ in the figure drawn.
- Write the ratio between $1cm$ length in your figure and the corresponding length in cm of the actual place.
- Using the textbook, find a name for the ratio obtained.
- If $300cm$ is represented by $1cm$, obtain the actual length and width in cm of a rectangle represented by a figure of length $5cm$ and width $3cm$. Now determine the length and width in m.
- Prepare for a creative presentation at the plenary session.

28. Tessellation

Competency 26 : Investigates the methods of using geometrical shapes to enhance beauty.

Competency Level 26.1 : Investigates the methods of laying geometrical shapes.

Activity 26.1 : Let us creates designs using geometrical shapes.

Time : 75 minutes.

Quality Inputs :
- Four copies of the instruction leaflet on exploration included in Annex 26.1.1.
- 16 photocopy papers in four colours.
- Two Bristol boards.
- Eight pairs of scissors.
- Glue and pastel.
- One copy each of the polygons in the leaflet on exploration drawn to scale and cut out.

Learning – Teaching Process:

Step 26.1.1 :
- Draw polygons studied by students to date, and inquire from the students about their characteristics.
- Lead a discussion and highlight the following facts.

• That there are different geometrical shapes • That a closed plane figure consisting of a set of straight line segments is called a polygon • That the sides of a regular polygon are equal • That the angles of a regular polygon are equal

(15 minutes)

Step 26.1.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, photocopy papers, Bristol boards, shapes of polygons, pairs of scissors and glue among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(45 minutes)

Step 26.1.3 :
- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a plane surface can be completely covered using certain polygonal shapes in a manner such that there are no gaps between the shapes and such that the shapes do not overlap with each other.
- That such a creation is called a tessellation
- That a tessellation done using only one shape is called a pure tessellation
- That any triangle can be used for a pure tessellation
- That any quadrilateral can be used for a pure tessellation
- That a regular hexagon can be used for a pure tessellation
- That a pure tessellation cannot be done using certain polygons

(15 minutes)

Criteria for Assessment and Evaluation:

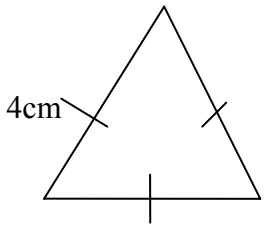
- Describes the properties of a pure tessellation.
- Accept that a plane surface can be completely covered using certain polygonal shapes.
- Constructs pure tessellations using geometrical shapes.
- Constructs ornamental patterns according to the situation.
- Focuses on making the environment attractive.

Annex 26.1.1

Instructions for group exploration

Let us create designs using geometrical shapes

- Focus your attention on the shape received by your group from the shapes given below.

<table>
<tr>
<td>Shape 1
 
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 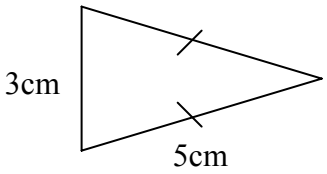
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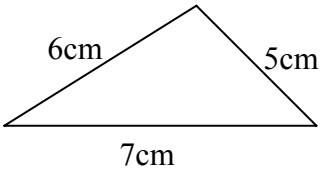
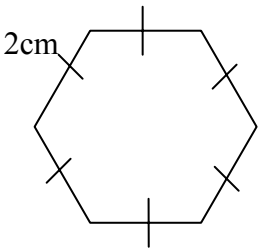
 
</td>
<td>Shape 4
 
</td>
</tr>
</table>

- Draw as many copies of the shape as you can on the coloured paper and cut them out.
- Paste the shapes methodically and attractively on the Bristol board in a manner such that there are no gaps between the shapes and such that the shapes do not overlap with each other.
- Propose a name for your creation.
- Name places where such patterns formed with geometrical shapes can be seen.
- Discuss whether such a creation can be done using any polygonal shape.
- Prepare for a creative presentation of your findings at the plenary session.

29. Likelihood of an Occurence

Competency 31 : Analyses the likelihood of an event occurring to predict future events.

Competency Level 31.1 : Determines the likelihood of an event occurring based on quantitative values.

Activity 31.1 : Let us give marks for the likelihood of an event occurring

Time : 75 minutes.

Quality Inputs :
- The chart of events included in Annex 31.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 31.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 31.1 :
- Present the chart of events to the class.
- Let the students volunteer to mark in the chart, (√) for the events that definitely occur, (×) for the events that definitely do not occur, and (-) for the events where the likelihood of occurrence is not definite.
- By considering the responses of the students also, inquire from them about the likelihood of occurrence of an event.
- Lead a discussion and highlight the following facts.

> - That certain events can be classified according to the likelihood of occurrence
> - That events can be separated into three types as those that definitely occur, those that definitely do not occur and those for which the result cannot be stated definitely beforehand

(10 minutes)

Step 31.2 :
- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastel among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session. (30 minutes)

Step 31.1.3 : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That for the likelihood of an event occurring, marks can be awarded based on the scale 0 - 1
- That the mark awarded for the likelihood of an event which is definite is 1
- That the mark awarded for the likelihood of an event that definitely does not occur is 0
- That a mark awarded for the likelihood of an event where occurrence is not certain is between 0 and 1
- That in an experiment consisting of exactly two equally likely results, the mark awarded for the likelihood of each one of those results is $\frac{1}{2}$
- That if the likelihood of an event occurring is high, then the mark awarded for it will be between $\frac{1}{2}$ and 1
- That if the likelihood of an event occurring is low, then the mark awarded for it will be between 0 and $\frac{1}{2}$
- That in experiments where the likelihood of every event is equal, the items used are unbiased
- That in experiments where the likelihood of every event is not equal, the items used are biased

(35 minutes)

Criteria for Assessment and Evaluation:

- Describes events by considering the likelihood of occurrence.
- Is inclined to make predictions about events based on the likelihood of occurrence.
- Determines the likelihood of occurrence in probabilistic experiments.
- Logically inquires into events that one experiences.
- Makes decisions based on reasons.

Chart of Events

A person who buys a lottery ticket winning the lottery

A full-moon appearing on a new moon day

Divisibility by 2 of a number which is divisible by 10

A man traveling in the air on a carpet

Obtaining a head or tail when a coin is tossed in the air

A kitten being born from an egg

Obtaining a card with a prime number from a set of cards with the numbers 90 to 100 written on them

.

Annex 31.1.2

Instructions for group exploration

Let us give marks for the likelihood of an event occurring

- Focus your attention on the set of events that your group receives from the sets of events given below.

Set of events I

A A pen drawn from a box of red pens being a red pen
B Obtaining 7 by tossing a balanced dice having the six sides marked 1, 2, 3, 4, 5, 6.
C A mango drawn out of a box containing five ripe mangoes and an unripe mango all of the same size, being a ripe mango.
D Obtaining an even number from a set of cards with the numbers 2, 5, 7, 11 written on them.
E Obtaining head when a balanced coin is tossed.

Set of events II

A Obtaining 1 by tossing a balanced dice having all six sides marked with 1.
B Drawing a card with an odd number written on it from a set of cards with the numbers 2, 4, 6, 8 written on them.
C A day being a rainy day, during a period of heavy rain fall.
D A student in the class, being born in January.
E A ball drawn out of a bag containing a red ball and a blue ball of equal size being the red ball.

Set of events III

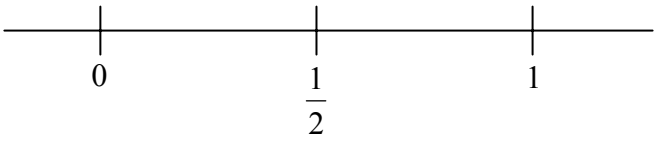
A The sun rising from the East.
B A ball drawn out of a bag containing only equal sized red balls and blue balls being a black ball.
C Draw a card with an odd number written on it from a set of cards with the numbers 2, 5, 7, 11 written on them.
D A card drawn from a set of cards with the numbers 2, 5, 7, 11 written on them being an even numbered card.
E The note drawn from two notes with 1 and 2 written on them being the note with 1 written on it.

Set of events IV

A Drawing a card with an even number written on it from a set of cards with the numbers 2, 4, 6, 8 written on them.
B The sun rising from the West.
C A card drawn from a set of cards with the names of 9 boys and the name of one a girl written on them, being a card with a boy's name written it.

D A day being a rainy day during a period of drought.
E A toffee drawn from a parcel containing a toffee with an orange taste and a toffee with a tamarind taste being the toffee with an orange taste.

- Carefully study the marks given for the likelihoods of events occurring under the lesson "likelihood of an occurrence" in the text book.
- By considering the likelihood of an event occurring, indicate the mark awarded for A, B, C, D and E on the line below.



- Discuss the reasons for indicating the marks in these locations.
- Write down the results of each of the following experiments separately.

  Tossing an oyster shell
  Tossing a balanced coin
- By considering the likelihood of the results, indicate the marks awarded on a line similar to the above.
- By considering the marks awarded for the result in each experiment and using the text book, propose names for each experiment.
- Prepare for a creative presentation at the plenary session.

Assessment and Evaluation

Introduction

Assessment and evaluation can be defined as two interconnected programmes that could be conveniently implemented in the classroom in order to identify the levels of competence achieved by the students and to establish that the students have actualized the learning outcomes expected through the learning-teaching process. If the assessment is implemented properly, it is not difficult for all the students studying in the class to acquire a competency at least proximate to the relevant skill. On the other hand, what is expected from evaluation is the identification of the levels of competence that the students have achieved.

Teachers involved in assessment can provide their students with two types of guidance. These are commonly called "feedback" and "feed forward". It is the task of the teacher to provide feedback to students to overcome their learning difficulties, when the weaknesses and inabilities of students are discovered, and to provide feed forward to further improve their skills when their abilities and strengths are discovered.

For the success of the learning-teaching process, it is necessary that students discover which competencies they have been able to actualize and the relevant levels. It is expected therefore that the teacher will judge the competency levels achieved by the students through the evaluation process, and communicate their progress to the students themselves, to their parents as well as other relevant parties.

This curriculum has a student centered, competency-based, activity oriented approach. In the transformation role of the teacher, 'learning through action for a meaningful life' is the core.

An attempt has been made in this curriculum which is implemented through a pre-determined activity continuum, to integrate assessment and evaluation with learning and teaching. The teacher will be able to assess the students when they are involved in exploration within groups under the second step of each activity, and then to evaluate them when they present their findings and subject the same to elaboration. The teacher is expected to move among the students engaged in exploration, observe the tasks they are involved in, help them to solve in the classroom itself any problems they happen to encounter and provide them with facilities and guidance.

Five common criteria are suggested to facilitate the task of assessment and evaluation. Out of these criteria, the first three are based on knowledge, attitudes and skills that combine to develop each competency. The final two criteria support students in mastering two skills that are important in life. The teacher should make an effort to identify the five behavioral changes related to these criteria within the classroom itself while the students are active, strengthen them under assessment and make judgments regarding the level of achievement under evaluation.

The learning-teaching process can be broadened through the improvement of the assessment and evaluation programme. To broaden the learning teaching process in this manner, the

activities in the activity continuum should first be divided into several clusters. Next, learning aids that will enhance student learning and are based on the syllabus content related to each activity cluster should be identified. Preparing the instrument which will broaden the learning teaching process is the next step. The instrument should be based on the selected learning aids and should include instructions for the teacher as well as for the students. It is expected that the teacher will introduce the instrument to the students at the beginning of the activity cluster. Below is a list of learning aids that can be used to prepare instruments that broaden the learning teaching process.

Concept maps
Wall newspapers
Quizzes
Question and answer books
Portfolios
Exhibitions
Debates
Panel discussions
Seminars
Impromptu speeches
Role play
Presentation of literature reviews
Field books/ nature diaries
Practical tests

The third part of this teacher's instructional manual has been planned in order to introduce instruments to broaden the learning teaching process. By assessing and evaluating in a two-fold manner, between and through the activities, the learning teaching process is further extended with students involving themselves in learning with interest and understanding.

Instruments for the extension of the learning – teaching process

Instrument - 1

1. Time of evaluation : 1st term

2. The competency levels covered : 25.1 and 30.1

3. Relevant subject content :
   - Symmetry
   - Sets

4. Nature of the instrument :
   - Preparing creations for wall newspapers

5. Aims of the instrument :
   - Is attentive to bilateral symmetry.
   - Creates pictures having bilateral symmetry and writes down the number of axes of symmetry.
   - Classifies items based on common properties.
   - Creates attractive wall newspapers.

6. Instructions to implement the instrument:

   - For the teacher :
     - Introduce this instrument to the class at the start activity 25.1.
     - Inform the students that this activity should be completed within a week after the end of the second lesson.
     - Divide the students into groups as appropriate.
     - Inform the students that the pictures that each student creates should be pasted on an A – 4 sheet for the final outcome.
     - Display the work of every group on the wall newspaper.
     - Allocate marks according to the given criteria.
   - For the students :
     - Each student should create an attractive picture with bilateral symmetry on a piece of paper with dimensions 8cm × 8cm. The picture can have one or more axes of symmetry.
     - Write down below the picture, the number of axes of symmetry and the name of the picture.
     - Prepare the final outcome by pasting every group member's creation on an A – 4 sheet.
     - Separate the pictures into sets based on the number of axes of symmetry or some other property.

- Write the elements of the sets within dual brackets at the bottom of the A – 4 sheet.
- Display your final outcomes on the wall newspaper within a week of the conclusion of the second lesson.

7. Method of allocating marks :

- Criteria :
  - Creates a picture with bilateral symmetry and writes down the axes of symmetry.
  - Is inclined towards making an attractive creation.
  - Separates the pictures into sets and writes down the elements of the sets.
  - Completes the activity within the time allocated.
  - Contributes towards preparing a quality group work of the collection of all the creations of the group members

- Marks range :

Very Good	04
Good	03
Average	02
Should Improve	01

Instrument - 2

1. Time of evaluation : 1st term

2. The competency levels covered : 1.2, 1.3and 6.1

3. Relevant subject content :
   - Rules of Divisibility (Numbers divisible by 3, 4, 6 and 9)
   - Factors and Multiples (Up to 1000)
   - Prime factors (Up to 100)
   - Greatest Common Factor
   - Least Common Multiple
   - Introducing powers with algebraic bases

4. Nature of the instrument :
   - Number Puzzles.

5. Aims of the instrument :
   - Applies the knowledge on factors, multiples and indices.
   - Develops skills of completing number puzzles.
   - Creates number puzzles.

6. Instructions to implement the instrument**:**

- For the teacher :
  - Introduce the instrument to the class at the beginning of the lesson on factors and multiples.
  - Educate the students on how to complete a number puzzle.
  - Give instructions to write just one number in a square.
  - Give each group the number puzzle given below.
  - Give the students the task of completing the puzzle.
  - Instruct the students to write the necessary clues to create a number puzzle using the given 4×4 square grid.
  - Ask the students to provide the answers.

Part I

- For the students : • Copy the given puzzle.

a		b	c		d	e
		f				
	g				h	
i			j	k		
l		m			n	r
		o	p			
			q			

- Complete the puzzle by writing the numbers relevant to the 'across' and 'down' clues.

Down

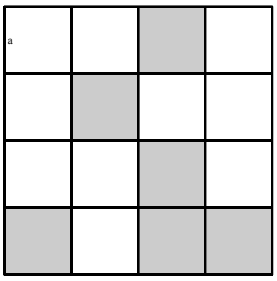
(a) A whole number less than 10, to the power 2
(b) The value of $(7^2 \times 2) + 15$
(c) The value of x^2y^4 when x = 5 and y = 5

(e) A number that is divisible by 9
(g) The least common multiple of 45, 90 and 60
(h) The value of 23 × 351
(i) The greatest odd number less than 10000
(k) The value of a power of 7
(m) The value of 6^2
(p) An odd number
(r) A multiple of 100

Across

(a) 38 □□ is divisible by 4
(d) The value of the 4^{th} power of an even number
(f) 9 is one factor of this number
(g) A multiple of 12
(h) The value of 3^4
(i) When this number is divided by 49, the answer is 2
(j) A number which is divisible by 6
(l) 3 is a factor of this number
(n) An odd number which is a multiple of 5
(o) The smallest number which has a remainder of 1 when divided by 3, 4 and 5
(q) The largest prime less than 100
(s) The least common multiple of 6 and 5

Part II



- Copy the above square grid.
- Write down the necessary clues to create the puzzle.
- Write down the solution based on the above clues.
- Hand over the puzzle and the solution on the assigned date.

7. Method of allocating marks **:**

- Criteria **:**
  - Completes the puzzle correctly.
  - Accepts that completing a puzzle should be done with discipline.
  - Creates puzzles.
  - Uses different methods to solve problems.
  - Presents an attractive final outcome

- Marks range **:**

Very Good	04
Good	03
Average	02
Should Improve	01

Instrument - 3

1. Time of evaluation : 1st term

2. The competency levels covered : 12.1, 9.1, 21.1, 21.2, 3.1and 3.2

3. Relevant subject content :
   - Time
   - Mass
   - Angles
   - Fractions

4. Nature of the instrument : A quiz

5. Aims of the instrument :
   - Uses the knowledge on time, mass, angles and fractions to construct questions.
   - Displays the set of questions written on the relevant topics on the wall newspaper.
   - Participates in the competition with team spirit.
   - Makes right decisions in daily tasks using the experiences related to time, mass, angles and fractions.

6. Instructions to implement the instrument:
   - For the teacher :
     - Introduce the instrument to the students at the commencement of activity 12.1.
     - Divide the class into four groups.
     - Give each group the relevant subject areas according to the following.

Group	Time	Mass	Angles	Fractions
1	Concept of leap year	Addition and Subtraction	Measuring	Mixed numbers ⇔ Improper Fractions
2	Concept of century	Multiplication	Drawing, Naming	Adding Fractions
3	Adding Time	Division	Concept	Comparing Fractions Concept of Mixed Numbers
4	Subtracting Time	Conversion of Units Estimation	Size of an Angle in Degrees	Subtracting Fractions

- Instruct the students to prepare 5 parallel questions under each theme, totaling 20 questions, and the relevant solutions and to hand them over within a week of the completion of activity 3.2.
- Display the sets of questions prepared by the students on the wall newspaper for two days.
- From these sets of questions select questions that are suitable for the quiz.
- On a suitable occasion, select two teams at a time and hold the quiz.

• For the students :
- Prepare 20 questions on the subject areas assigned to your group and hand them over to the teacher.
- The questions have to be prepared only on the subject areas relevant to your group.
- Hand over the solution sheet relevant to your question sheet at the same time.
- Study the sets of questions displayed on the wall newspaper carefully and prepare for the quiz.

7. Method of allocating marks :

• Criteria :
- Prepares the question sheet on the subject areas assigned to the group.
- Provides the relevant answer sheet.
- Provides the correct answers to the questions asked.
- Shows a willingness to face a challenge.
- Accepts a win or a loss cheerfully.

• Marks Range : Very Good 04
Good 03
Average 02
Should Improve 01

Instrument - 4

1. Time of evaluation : 2nd term

2. The competency levels covered : 3.3, 4.1 and 5.1

3. Relevant subject content :
   - Multiplying and Dividing Decimals
     - By powers of 10
     - By whole numbers
   - Dividing into a Ratio
   - Concept of Percentages
   - Decimal Numbers as Percentages

4. Nature of the instrument :
   - Preparing a questions and answers booklet.

5. Aims of the instrument :
   - Searches for situations in daily life where decimals, ratios and percentages are used.
   - Collects statements related to them.
   - Tabulates solutions to given questions.
   - Prepares a questions and answers booklet related to decimals, ratios and percentages.

6. Instructions to implement the instrument:

   - For the teacher :
     - Introduce the instrument to the students before teaching the relevant lessons.
     - Explain to the students about the information and documents that need to be collected.
     - State that the answers to the questions have to be noted down according to the instructions provided in the question paper.
     - Give instructions to prepare a booklet including all these
     - Explain about the outer cover.

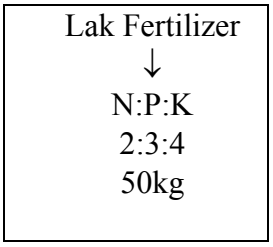
   - For the students :
     - While the lessons on decimals, ratios and percentages are being carried out, cut out and collect advertisements, leaflets (from banks and financial institutes) and articles from newspaper magazines which are relevant to the lessons.
     - Prepare a booklet by including the information collected by everyone in the group, organized under the different topics in different pages.
     - Include in the next few pages, the answers to the following questions with the relevant table.

- Draw a rectangle and a circle on the cover.
- Divide the rectangle in the ratio 1:2:3 and colour the three sections in three different colours.
- Divide the circle in the ratio 1:3 and colour the two sections in two different colours.
- **Set of questions**
  - (1) Multiplying the numbers 0.5, 0.25 and 7.5 (i) by 4 (ii) by 12 (iii) by 10 (iv) by 100 (v) by 1000. Write the answers in the following table.

×	4	12	10	100	1000
0.5					
0.25					
7.5					

- (2) Divide the numbers 0.4, 4.4 and 1.21 (i) by 2 (ii) by 11 (iii) by 10 (iv) by 100 (v) by 1000. Use a table similar to the above to note down your answers.

(3)



- The information given on the fertilizer bag in the figure is the ratio in which Nitrogen (N), Phosphorus (P) and Potassium (K) have been combined.

(a) Write as fractions the amount of Nitrogen, Phosphorus and Potassium in the bag.

(b) If the bag of fertilizer weighs 50 kg, calculate the weight of
  (i) Nitrogen
  (ii) Phosphorus
  (iii)Potassium

(c) Create a problem similar to the above by relating another instance in which two or 3 types are combined together to form a mixture.

(d) Convert the fractions you obtained in part (a) into fractions with 100 as the denominator.

(e) Accordingly, calculate the percentages of each of the three materials in the fertilizer.

7. Method of allocating marks :

- Criteria :
  - Collects sufficient material and organizes it appropriately.
  - Accepts that decimals, ratios percentages are used in daily activities.
  - Correctly solves problems related to decimals, ratios and percentages.
  - Contributes to making an attractive creation.
  - Works with commitment to prepare a quality outcome.

- Marks Range : Very Good 04
  Good 03
  Average 02
  Should Improve 01

Instrument - 5

1. Time of evaluation : 2nd term

2. The competency levels covered : 21.3 and 27.1

3. Relevant subject content :
   - Parallel Lines
   - Circles
   - Designs using a pair of compasses

4. Nature of the instrument :
   - Wall newspapers

5. Aims of the instrument :
   - Creates a design using parallel lines, circles and parts of circles.
   - Uses designs appropriately.
   - Pays attention to the designs in various places.

6. Instructions to implement the instrument:

   - For the teacher :
     - Introduce this instrument to the class at the start of the lesson on parallel lines.
     - Divide the students into groups as appropriate.
     - Give instructions to create a design suitable for the given occasion using parallel lines, circles and parts of circles (using the compass).
     - State that every student must create at least one design.
     - Inform the students that the work must be completed within a week of the conclusion of lesson 15.

   - For the students :
     - Create a design suitable for one of the following using parallel lines, circles and parts of circles. Use a pair of compasses when required.
       - The border of a saree.
       - A bedspread.
       - A valance board.
       - The floor or ceiling of a religious place.
       - A "sesatha".
     - Each student in the group should present at least one design.
     - Prepare a wall newspaper using the designs of all the members of the group.
     - Complete the work by the assigned date

7. Method of allocating marks :

- Criteria :
  - Identifies designs which include parallel lines, circles and parts of circles.
  - Accepts that designs have to be created as appropriate for the situation.
  - Creates appropriate designs.
  - Presents new creations.
  - Prepares an attractive wall newspaper.

- Marks range :

Very Good	04
Good	03
Average	02
Should Improve	01

Instrument - 6

1. Time of evaluation : 2nd term

2. The competency levels covered : 7.1, 7.2 and 8.1

3. Relevant subject content :
   - Measurements of Length
     - Addition; Subtraction
     - Multiplication; Division
   - Formulae for the Perimeter
     - Square; Rectangle
   - Estimation of Area
     - Areas of compound plane figures (Squares and Rectangles)

4. Nature of the instrument :
   - Preparing a report on the perimeters and areas of the selected plane figures.

5. Aims of the instrument :
   - Manipulates the measurements related to length under the basic mathematical operations.
   - Finds the perimeter of a plane figure in the shape of a square/ rectangle using the formulae.
   - Writes what the length and the breadth of the square/rectangle could be, when the perimeter is given.
   - Estimates the area of a square/rectangle.
   - Finds the area of a square, rectangle and a compound plane figure.

6. Instructions to implement the instrument:
   - For the teacher :
     - Introduce this instrument to the class before the start of the 13th lesson.
     - Divide the students into 4 groups.
     - Inform the students that the relevant tasks should be carried out individually.
     - Give instructions to complete the table based on the field book of each student and to write the report in the class.
     - Inform the students that the work must be completed and the report handed over within a week of the conclusion of lesson 14.

- For the students :
  - Select a square and two rectangular shapes that you come across at home or in the school.
  - Measure the lengths and the breadths of the shapes using a cm/mm scale, and enter the information in your field book by drawing a sketch of the figures.
  - Include the values noted in the field books of all the students of the group in a table of the following form. Extend the table as required.

Number	Name of Figure	Length	Breadth	Perimeter	Perimeter when the length and breadth are doubled	Perimeter when the length and breadth are halved

  - Estimate the areas of the selected plane figures and write them down as
  - Figure 1 ……..
  - Figure 2 ……..
  - Find the areas of the figures by finding the lengths and breadths to the nearest centimeter and write them down as
  - Figure 1 ……...
  - Figure 2 ……
  - Write down the difference between the estimated value and the calculated value.
  - Select two of the sketches that you noted down in the field book and combine them together to form a compound plane figure, sketch it, indicate the measurements and find the area.
  - If the perimeter of a rectangular floor is 30m50cm, suggest several pairs of values that the length and the breadth could be.

7. Method of allocating marks :

- Criteria :
  - Accurately fills the table according to the information noted in the field book.
  - Accepts that there are several rectangles with the same perimeter but different lengths and breadths.
  - Measures the length and breadth of a rectangle and calculates its perimeter and area.
  - Completes the work during the given time.
  - Prepares and presents the final report of the group, clearly and methodically.

- Marks range : Very Good 04
  Good 03
  Average 02
  Should Improve 01

Instrument - 7

1. Time of evaluation : 3rd term

2. The competency levels covered : 17.1, 19.1 and 18.1

3. Relevant subject content :
   - Constructing Equations
     - Of the form $ax \pm b = c$ ($a, b, c \in Z^+, a \neq 0$)
   - Solving Equations
     - Using flow charts
     - By algebraic methods
   - Solving Inequalities
   - Of the form $ax \begin{matrix} < \\ > \end{matrix} b$
   - Of the form $x \pm a \begin{matrix} < \\ > \end{matrix} b$
   - Representation on the number line
     - Integral solutions of equations of the form $ax \begin{matrix} < \\ > \end{matrix} b$, $x \pm a \begin{matrix} < \\ > \end{matrix} b$

4. Nature of the instrument :
   - Collection of questions and answers.

5. Aims of the instrument :
   - Constructs equations based on the given data.
   - Solves equations using flow charts.
   - Solves equations by algebraic methods.
   - Writes and solves inequalities of the form $ax \begin{matrix} < \\ > \end{matrix} b$, $x \pm a \begin{matrix} < \\ > \end{matrix} b$.
   - Represents the solutions of equations of the above form on a number line.

6. Instructions to implement the instrument:
   - For the teacher :
     - Introduce this instrument to the class before commencing activity 17.1.
     - Inform the students that this activity should be carried out individually.
     - Make sufficient copies of the instruction leaflet with the card given in the annex.
     - Distribute the instruction leaflet among the students at the beginning of activity 17.1.
     - Inform the students that the completed work should be handed over within a week of the conclusion of activity 18.1.
     - Asses the students' outcomes according to the given criteria.

- For the students : • Study the instruction leaflet with the card carefully and engage in the given task.
  • Present the completed work written creatively as a set on the assigned date.

7. Method of allocating marks :

- Criteria : • Constructs simple equations and inequalities.
  • Accepts that equations have a unique solution while inequalities have several solutions.
  • Correctly solves simple equations and inequalities.
  • Gives pictorial representations of solutions.
  • Presents the outcomes creatively.

- Marks range : Very Good 04
  Good 03
  Average 02
  Should Improve 01

Annex

2x	30	4a	2
5	1	3x	12
4p	6	30	3a
2p	5p	3y	12
10	6m	20	x
15			
+,	-,	<,	>, =

- Write down as many simple equations as possible using the algebraic terms, constants (numbers) and mathematical operations given in the card.
- Solve 10 of these equations using flow charts.
- Solve the equations using algebraic methods.
- Write down separately the equations with solutions that are whole numbers and the equations with solutions that are not whole numbers.
- Write 10 inequalities with the terms given in the card.
- Select the inequalities with solutions that are whole numbers which are less than 10 and represent them on a number line.
- Write down your ideas about the solutions of simple equations and inequalities.

Instrument - 8

1. Time of evaluation : 3rd term

2. The competency levels covered : 13.1 and 27.2

3. Relevant subject content :
   - Scale Drawings
   - Constructions

4. Nature of the instrument :
   - An Explorative Study

5. Aims of the instrument :
   - Makes a sketch of the floor plan of a building.
   - Proposes suitable scales to do scale drawings.
   - Does scale drawings using a suitable scale.

6. Instructions to implement the instrument:

- For the teacher :
  - Introduce this instrument to the class at the start of activity 13.1.
  - Divide the students into groups as appropriate.
  - Engage the students in drawing a sketch of the floor plan of the building in which the class room is.
  - Give the students the task of measuring the length and the breadth of the building during an appropriate time period.
  - Instruct the students to do a scale drawing of the floor plan of the building using an appropriate scale.
  - Show the students a rectangular shaped area such as a playground, sports field or a flower-bed and ask them to do a scale drawing of it.
  - Give the students the task of collecting information regarding the occasions when scale drawings are used in day to day life.
  - Inform the students of the date when the final outcomes have to be handed over.
  - Evaluate the outcomes based on the given criteria.

- For the students :
  - Sketch the floor plan of the building in which your classroom is.
  - Measure the length and the breadth of the building during the period that your teacher indicates.
  - The different areas of the building (class rooms, corridors etc) should be measured separately.
  - Do a scale drawing of the floor plan of the building by selecting a suitable scale.
  - By following the same procedure as the above, do a scale drawing of the other location that the teacher indicates too.
  - Collect information on the occasions that scale drawing are used in day to day life.
  - Hand over your completed work to the teacher during the allocated time.

7. Method of allocating marks :
   - Criteria :
     - Names occasions when it is required to do a scale drawing.
     - Accepts that there are instances in day to day life when it is necessary to make scale drawings.
     - Selects an appropriate scale and does a scale drawing.
     - Obtains accurate measurements in daily activities.
     - Works with commitment to prepare a high quality outcome.
   - Marks range : Very Good 04
     Good 03
     Average 02
     Should Improve 01

Instrument - 9

1. Time of evaluation : 3rd term

2. The competency levels covered : 23.1 and 23.2, 22.1, 22.2 and 26.1

3. Relevant subject content :
   - Types of Triangles
     - Based on sides
     - Based on angles
   - Polygons
     - Convex/ concave/regular
   - Pure Tessellation

4. Nature of the instrument :
   - Exhibition

5. Aims of the instrument :
   - Creates tessellations using various shapes.
   - Prepares an attractive instrument by combining various solids.
   - Is inclined towards making new creations.

6. Instructions to implement the instrument:

   - For the teacher :
     - Introduce this instrument to the class at the start of the lesson on rectilinear plane figures.
     - Divide the students into groups as appropriate.
     - Inform the students that the tasks relevant to this instrument have to be carried out individually.
     - Instruct the students to obtain the required raw material from things that are being discarded.
     - State that this activity has to be completed before the assigned date which will be informed at the end of the lesson on tessellation.
     - Prepare the students for an exhibition of various models of tessellations and solids.
     - Indicate a date and place for the exhibition.
   - For the students :
     - Make an attractive creation for a wall decoration using tessellation.
     - Prepare a lamp shade, a lantern, an ornament for the house, using solids that you have learnt about.
     - Attempt to collect the raw materials for your creations from items that have been discarded.
     - The items that are being prepared should be suitable for an exhibition.
     - Handover the items that have been prepared for the exhibition before the date the teacher assigns.

7. Method of allocating marks :

- Criteria : • Identifies the subject content required to create items suitable for the end of term exhibition.
  • Is inclined to hold a successful exhibition.
  • Engages in making creations using facts on rectilinear plane figures and solids.
  • Works efficiently.
  • Successfully completes a task that has been started.

- Marks range : Very Good 04
  Good 03
  Average 02
  Should Improve 01