



Grade

8

Mathematics

Teacher's Guide

(Implemented from year 2017)



Department of Mathematics

Faculty of Science & Technology

National Institute of Education

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Sri Lanka.

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Message of the Director General

The first phase of the new competency based curriculum, with 8 years curriculum cycle was introduced to secondary education in Sri Lanka in 2007 replacing the existed content based education system with basic objective of developing the national level competencies recommended by the National Education Commission.

The second phase of the curriculum cycle to be introduced to grades 6 and 10 starts from 2015. For this purpose, National Institute of Education has introduced a rationalization process and developed rationalized syllabi for these grades using research based outcomes and various suggestions made by different stakeholders.

In the rationalization process, vertical integration has been used to systematically develop the competency levels in all subjects from fundamentals to advanced levels using the bottom up approach. Horizontal integration is used to minimize the overlapping in the subject content and to reduce the content over loading in the subjects to produce more students friendly and implementable curricular.

A new format has been introduced to the teachers' guide with the aim of providing the teachers with the required guidance in the areas of lesson planning, teaching, carrying out activities and measurement and evaluation. These guidelines will help the teachers to be more productive and effective in the classroom.

The new teachers' guides provide freedom to the teachers in selecting quality inputs and additional activities to develop the competencies of the students. The new teachers' guides are not loaded with subject content that is covered in the recommended textbooks. Therefore, it is essential for the teacher to use the new teachers' guides simultaneously with the relevant textbooks prepared by Education Publication Department as reference guides to be more aware of the syllabi.

The basic objectives of the rationalized syllabi and the new format of teachers' guide and newly developed textbooks are to bring a shift from the teacher centered education system into a student centered and more activity based education system in order to develop the competencies and skills of the school leavers and to enable the system to produce suitable human resource to the world of work.

I would like to take this opportunity to thank the members of Academic Affairs Board and Council of National Institute of Education and all the resource persons who have immensely contributed in developing these new teacher guides.

Director General
National Institute of Education

Message of the Deputy Director General

Education from the past has been constantly changing and forging forward. In recent years, these changes have become quite rapid. Past two decades have witnessed a high surge in teaching methodologies as well as in the use of technological tools and in the field of knowledge creation.

Accordingly, the National Institute of Education is in the process of taking appropriate and timely steps with regard to the education reforms of 2015.

It is with immense pleasure that this Teachers' Guide where the new curriculum has been planned based on a thorough study of the changes that have taken place in the global context adopted in terms of local needs based on a student-centered learning-teaching approach, is presented to you teachers who serve as the pilots of the schools system.

An instructional manual of this nature is provided to you with the confidence that, you will be able to make a greater contribution using this.

There is no doubt whatsoever that this Teachers' Guide will provide substantial support in the classroom teaching-learning process at the same time. Furthermore the teacher will have a better control of the classroom with a constructive approach in selecting modern resource materials and following guide lines given in this book.

I trust that through the careful study of this Teachers Guide provided to you, you will act with commitment in the generation of a greatly creative set of students capable of helping Sri Lanka move socially as well as economically forward.

This Teachers' Guide is the outcome of the expertise and unflagging commitment of a team of subject teachers and academics in the field Education.

While expressing my sincere appreciation of this task performed for the development of the education system, my heartfelt thanks go to all of you who contributed your knowledge and skills in making this document such a landmark in the field.

M.F.S.P. Jayawardhana
Deputy Director General
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Pictures:	Try outing the lesson plans in schools of Western and North-western Provinces

Instructions on the use of the Teacher's Guide



The Department of Mathematics of the National Institute of Education has been preparing for the new education reforms to be implemented in 2015 for the first time since 2007, in accordance with the education reforms policy which is implemented once every eight years. The Grade 8 Mathematics Teacher's Guide which has been prepared accordingly has many special features.


The **Grade 8 syllabus** is included in the first chapter. The syllabus has been organized under the titles Competencies, Competency Levels, Content, Learning Outcomes and Number of Periods. The proposed **lesson sequence** is given in the second chapter. The **Learning-Teaching-Evaluation methodology** has been introduced in the third chapter. A special feature of this is that the best method to develop each of the subject concepts in students has been identified from various methods such as the discovery method, the guided discovery method, the lecture-discussion method etc and the lesson plan has been developed based on it.

Following the proposed lesson sequence, the relevant competency and competency levels as well as the number of periods required for each lesson have been included at the beginning under each topic. Specimen lesson plans have been prepared with the aim of achieving one or two of the learning outcomes related to a selected competency level under each competency. These lesson plans have been carefully prepared to be implemented during a period or a maximum of two periods.

To create awareness amongst the students regarding the practical applications of the subject content that is learnt, a section titled '**Practical Use**' which contains various such applications has been introduced in some of the lessons.

You have been provided with the opportunity to prepare suitable lesson plans and appropriate assessment criteria for the competency levels and related learning outcomes for which specimen lesson plans have not been included in this manual. Guidance on this is provided under the title '**For your attention**'.

Another special feature of this Teacher's Guide is that under each lesson, websites which can be used by the teacher or the students, in the classroom or outside which contain resources that include videos and games to enhance students' knowledge is given under the title '**For further use**' and the symbol . Although it is not essential to make use of these, the learning-teaching-evaluation  process can be made more successful and students' subject knowledge can be enhanced by their use, if the facilities are available.

Further, in selected lessons, under the title "**For the teacher only**" and the symbol , facts which are especially for the teacher are included. This information is only to enhance the teacher's knowledge and is not given to be discussed with the students directly. The teacher has the freedom to make necessary amendments to the specimen lesson plan given in the new teacher's manual which includes many new features, depending on the classroom and the abilities of the students. We would be grateful if you would send any amendments you make or any new lessons you prepare to the Director, Department of Mathematics, National Institute of Education. The mathematics department is prepared to incorporate any new suggestions that would advance mathematics educations in the secondary school system.

Project Leader

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Syllabus

1.0 Syllabus

1.1 Common National Goals

The national system of education should assist individuals and groups to achieve major national goals that are relevant to the individual and society.

Over the years major education reports and documents in Sri Lanka have set goals that sought to meet individual and national needs. In the light of the weaknesses manifest in contemporary educational structures and processes, the National Education Commission has identified the following set of goals to be achieved through education within the conceptual framework of sustainable human development.

- I Nation building and the establishment of a Sri Lankan identity through the promotion of national cohesion, national integrity, national unity, harmony and peace, and recognizing cultural diversity in Sri Lanka's plural society within a concept of respect for human dignity.
- II Recognizing and conserving the best elements of the nation's heritage while responding to the challenges of a changing world.
- III Creating and supporting an environment imbued with the norms of social justice and a democratic way of life that promotes respect for human rights, awareness of duties and obligations, and a deep and abiding concern for one another.
- IV Promoting the mental and physical well-being of individuals and a sustainable life style based on respect for human values.

- V Developing creativity, initiative, critical thinking, responsibility, accountability and other positive elements of a well-integrated and balance personality.
- VI Human resource development by educating for productive work that enhances the quality of life of the individual and the nation and contributes to the economic development of Sri Lanka.
- VII Preparing individuals to adapt to and manage change, and to develop capacity to cope with complex and unforeseen situations in a rapidly changing world.
- VIII Fostering attitudes and skills that will contribute to securing an honourable place in the international community, based on justice, equality and mutual respect.

1.2 Common National Competencies

The following Basic Competencies developed through education will contribute to achieving the above National Goals.

(I) Competencies in Communication

Competencies in Communication are based on four subsets; Literacy, Numeracy, Graphics and IT proficiency.

Literacy: Listen attentively, speak clearly, read for meaning, write accurately and lucidly and communicate ideas effectively.

Numeracy: Use numbers for things, space and time, count, calculate and measure systematically.

Graphics: Make sense of line and form, express and record details, instructions and ideas with line form and colour.

IT proficiency: Computer literacy and the use of information and communication technologies (ICT) in learning, in the work environment and in personal life.

(II) Competencies relating to Personality Development

- Generic skills such as creativity, divergent thinking, initiative, decision making, problem solving, critical and analytical thinking, team work, inter-personal relations, discovering and exploring;
- Values such as integrity, tolerance and respect for human dignity;
- Emotional intelligence.

(III) Competencies relating to the Environment

These competencies relate to the environment: social, biological and physical.

Social Environment: Awareness of the national heritage, sensitivity and skills linked to being members of a plural society, concern for distributive justice, social relationships, personal conduct, general and legal conventions, rights, responsibilities, duties and obligations.

Biological Environment: Awareness, sensitivity and skills linked to the living world, people and the ecosystem, the trees, forests, seas, water, air and life- plant, animal and human life.

Physical Environment: Awareness, sensitivity and skills linked to space, energy, fuels, matter, materials and their links with human living, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, wastes and excretion.

Included here are skills in using tools and technologies for learning working and living.

(IV) Competencies relating to Preparation for the World of Work

Employment related skills to maximize their potential and to enhance their capacity

- to contribute to economic development,
- to discover their vocational interests and aptitudes,
- to choose a job that suits their abilities, and
- to engage in a rewarding and sustainable livelihood.

(V) Competencies relating to Religion and Ethics

Assimilating and internalizing values, so that individuals may function in a manner consistent with the ethical, moral and religious modes of conduct in everyday living, selecting that which is most appropriate.

(VI) Competencies in Play and the Use of Leisure

Pleasure, joy, emotions and such human experiences as expressed through aesthetics, literature, play, sports and athletics, leisure pursuits and other creative modes of living.

(VII) Competencies relating to “learning to learn”

Empowering individuals to learn independently and to be sensitive and successful in responding to and managing change through a transformative process, in a rapidly changing, complex and interdependent world.

1.3 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 junior secondary stage, so that their mathematical thinking, understanding and abilities are formally enhanced.

- (1) The development of computational skills through the provision of mathematical concepts and principles, as well as knowledge of mathematical operations, and the development of the basic skills of solving mathematical problems with greater 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 connections 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 conversations.
- (5) The development of the ability to use mathematical knowledge and techniques to formulate and solve problems, both familiar and unfamiliar and which are not limited to arithmetic or the symbolical or behavioral, which arise in day to day life.

1.4 Subject Content

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
Competency – 1 Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.	1.1 Inquires into the relationships between whole numbers.	<ul style="list-style-type: none"> • Whole square Numbers • Square (1 – 20) • Square root (1 – 1000) <ul style="list-style-type: none"> • By observation • Using prime factors 	<ul style="list-style-type: none"> • Finds the square of whole numbers between 1 and 20. • Inquires into the last digit of a whole and its square. • Represents square root of a number by $\sqrt{\quad}$. • Finds the square root of whole square numbers between 1 and 1000 by inspection. • Finds the square root of whole square numbers between 1 and 1000 using prime factors. 	05
	1.2 Manipulates directed numbers under the basic mathematical operations.	<ul style="list-style-type: none"> • Integers <ul style="list-style-type: none"> • Subtraction • Multiplication • Division • Directed Numbers <ul style="list-style-type: none"> • Subtraction • Multiplication • Division 	<ul style="list-style-type: none"> • Subtracts integers using the number line. • States that addition can be used for the subtraction of integers. • Subtracts integers. • Multiplies integers. • Divides integers. • Subtract integers using directed numbers. • Multiplies directed numbers. • Divides directed numbers. 	05
Competency – 2	2.1 Simplifies problems by analyzing different	<ul style="list-style-type: none"> • General Term • Multiples of numbers 	<ul style="list-style-type: none"> • Identifies n^{th} term of a number pattern as the general 	05

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
<p>Makes decisions for future requirements by investigating various relationships in numbers.</p>	<p>characteristics and observing relationships among terms of number patterns.</p>	<ul style="list-style-type: none"> • Even number • Odd number • Square numbers • Triangular numbers 	<p>term.</p> <ul style="list-style-type: none"> • Identifies that n^{th} term of the multiplication pattern of a number 'a' in a counting number set is 'an'. • Writes the general term of the multiplication pattern of a number of a set of counting numbers. • Writes the general term of the even number pattern of a counting number set. • Writes the general term of the odd number pattern of a counting number set. • Writes the general term of the square number pattern of a counting number set. • Writes the general term of the triangular numbers of a counting number set. • Solves problems related to number patterns. 	

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
<p>Competency – 3</p> <p>Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.</p>	<p>3.1 Manipulates units and parts of units under multiplication.</p>	<ul style="list-style-type: none"> • Multiplication <ul style="list-style-type: none"> • A fraction by a whole number • A fraction by a fraction • A fraction by a mixed number • A mixed number by a mixed number 	<ul style="list-style-type: none"> • Describes the method of multiplying a fraction by a whole number by repeated addition. • Multiplies a fraction by a whole number. • States that numerator and denominator have to be multiplied separately when two fractions are multiplied. • Multiplies a fraction by another fraction. • Multiplies a fraction by a mixed number • Multiplies a mixed number by a fraction. • Multiplies a mixed number by a mixed number. 	<p>06</p>
	<p>3.2 Manipulates units and parts of units under division.</p>	<ul style="list-style-type: none"> • Reciprocal <ul style="list-style-type: none"> • A whole number • A fraction • Division <ul style="list-style-type: none"> • A fraction by a whole number • A whole number by a fraction • A fraction by a fraction • A fraction by a mixed number • A mixed number by a mixed 	<ul style="list-style-type: none"> • Identifies that the number by which another number should be multiplied to get 1 is its reciprocal. • Writes the reciprocal of a fraction. • Writes the reciprocal of a whole number. • Describes a method to divide fraction by using the property that the value obtained by dividing a number by it and 	<p>06</p>

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
		number	<p>the value obtained by multiplying that number by its reciprocal are equal.</p> <ul style="list-style-type: none"> • Divides a fraction by a fraction. • Divides a fraction by a whole number. • Divides a whole number by a fraction. • Divides a fraction by a mixed number. • Divides a mixed number by a mixed number. 	
	3.3 Manipulates decimal numbers under the mathematical operations of multiplication and division.	<ul style="list-style-type: none"> • Decimals \Leftrightarrow Fractions • Multiplication <ul style="list-style-type: none"> • A whole number by a decimal • A decimal by a decimal • Division <ul style="list-style-type: none"> • A whole number by a decimal • A decimal by a decimal 	<ul style="list-style-type: none"> • Converts decimals to fractions and fractions to decimals. • Describes multiplication of two decimals through multiplication of two fractions whose denominators are powers of 10. • Multiplies whole number by a decimal. • Multiplies a decimal by a decimal. • Describes the division of decimals using division of two fractions with 	07

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			denominators of powers of 10. <ul style="list-style-type: none"> • Divides a whole number by a decimal. • Divides a decimal by a decimal. 	
Competency – 4 Uses ratios to facilitate day to day activities.	4.1 Uses ratios in day to day activities.	<ul style="list-style-type: none"> • Denoting a ratio as a fraction • Dividing in a ratio <ul style="list-style-type: none"> • Situations connect with compound scales 	<ul style="list-style-type: none"> • Denotes a ratio as a fraction and describes its definition. • Divides according to a ratio developed by compounding into two quantities. 	03
	4.2 Solves problems constructing relationships between two ratios.	<ul style="list-style-type: none"> • Compound ratios (using equivalent ratios) 	<ul style="list-style-type: none"> • Develops compound ratios by compounding three scales when, ratio of two scales and ratio of one of them and another scale are given. • Solves problems with compound ratios. 	03
Competency - 5 Uses percentages to make successful transactions in the modern world.	5.1 Develops the relationship between fractions, ratios and percentages.	<ul style="list-style-type: none"> • Conversion <ul style="list-style-type: none"> • Fractions \Leftrightarrow Percentages • Ratios \Leftrightarrow Percentages 	<ul style="list-style-type: none"> • Identifies basic characteristics of a percentage and writes fractions as percentages. • Writes percentages as fractions. • Writes a ratio as a percentage. • Writes a percentage as a ratio. 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
	5.2 Solves problems related to percentages.	<ul style="list-style-type: none"> • Solving problems <ul style="list-style-type: none"> • Percentage of a scale • The scale when a percentage is given 	<ul style="list-style-type: none"> • Calculates a certain percentage of a scale when the scale and the quantity of its are given. • Finds the quantity of scale when the quantity of whole scale and the percentage are given. • Calculates the total, when the quantity of the scale and the certain percentage are given. 	03
Competency – 6 Uses logarithms and calculators to easily solve problems in day to day life.	6.1 Simplifies powers of a product using expansion.	<ul style="list-style-type: none"> • Expansion of a power of a product <ul style="list-style-type: none"> • $(ab)^n \Leftrightarrow a^n b^n$ ($n \leq 3$); $n \in \mathbb{N}$ 	<ul style="list-style-type: none"> • Expands powers with natural numbers when the index of a product of two natural numbers or algebraic terms is not more than three. 	03
	6.2 Expands a power of a negative integer and finds the value.	<ul style="list-style-type: none"> • Power of a negative integer (Index 1 – 4) 	<ul style="list-style-type: none"> • Writes the value expanding a power of a negative integer when the index is less than 4. • Explains the how the value changes when the power of a negative integer becomes odd or even. 	02
Competency – 7 Investigates the various	7.1 Satisfies various requirements by investigating the	<ul style="list-style-type: none"> • Perimeter <ul style="list-style-type: none"> • Compound plane figures (Consisting of two figures 	<ul style="list-style-type: none"> • Accepts that attention has to be paid to the complete figure when finding the perimeter of 	05

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
methods of finding the perimeter to carry out daily tasks effectively.	perimeter of rectilinear plane figures.	from equilateral/isosceles triangles, squares, rectangles)	<p>a compound plane figure.</p> <ul style="list-style-type: none"> • Finds the perimeter of a compound plane figure consisting of either similar or different two plane figures of equilateral triangles, isosceles triangles, squares and rectangles. • Solves problems related to compound plane figures consisting of two plane figures namely equilateral triangles, isosceles triangles, squares and rectangles. 	
<p>Competency – 8</p> <p>Makes use of a limited space in an optimal manner by investigating the area.</p>	8.1 Finds the area of compound plane figures in the environment and has an awareness of the space allocated for them.	<ul style="list-style-type: none"> • Area <ul style="list-style-type: none"> • Right angled triangles • Triangles • Compound plane figures (Consisting of two plane figures from triangles, rectangles and squares) 	<ul style="list-style-type: none"> • Finds the area of a right-angled triangle based on the area of a rectangle. • Accepts that area of any triangle can be calculated by $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$. • Finds the area of a triangle using the formula. • Solves problems relating to the area of a triangle. • Accepts that compound plane figures have to be divided into appropriate parts when its area is calculated. 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> • Finds the area of compound plane figures consisting of plane figures triangles, squares and rectangles similar or dissimilar. 	
	8.2 Fulfills daily needs by investigating the surface area of various solids.	<ul style="list-style-type: none"> • Surface Area <ul style="list-style-type: none"> • Cube • Cuboid 	<ul style="list-style-type: none"> • States that the surface area of a cube is found by adding the surface areas of the six sides of the cube. • States that surface area of a cube is $6a^2$ when the length of a side of a cube is a. • Finds the surface area of a cube of known dimensions. • Solves problems related to the surface area of a cube. • States that surface area of a cuboid is found by adding the surface areas of six rectangular sides. • States that surface area of a cuboid is found by the formula $2(ab+bc+ca)$ where a, b and c are length, width and height respectively. • Calculates the surface area of a cuboid with given dimensions. 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> Solves problems related to the surface area of a cuboid. 	
<p>Competency – 9</p> <p>Works with an awareness of mass to fulfill daily requirements.</p>	9.1 Facilitates daily work by investigating large masses.	<ul style="list-style-type: none"> Mass <ul style="list-style-type: none"> Relationship between kilograms and metric tons Conversion (kg \Leftrightarrow metric ton) Problems related to mass (Including metric tons) 	<ul style="list-style-type: none"> Identifies the need of a unit to measure large masses. Identifies the metric ton as a unit of measuring large masses. States the relationship between the metric ton and the kilogram. Converts kg \Leftrightarrow metric ton Solves problems related to masses in metric tons. 	05
<p>Competency – 10</p> <p>Gets the maximum out of space by working critically with respect to volume.</p>	10.1 Determines for daily needs, the space that is taken up by various solids.	<ul style="list-style-type: none"> Formulae for the volume <ul style="list-style-type: none"> Cube Cuboid 	<ul style="list-style-type: none"> States that the volume of a cube with side length a can be found by a^3. Calculates the volume of a cube using the formula. Solves problems related to the volume of a cube. States that volume of a cuboid can be found by abc when length, width and height are a, b and c respectively. 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> • Calculates the volume of a cuboid using the formula. • Solves problems related to cuboids. • Solves problems related to the volume of cubes and cuboids. 	
<p>Competency – 11</p> <p>Works critically with the knowledge of liquid measures to fulfill daily needs.</p>	11.1 Facilitates daily work by investigating the capacity of liquid containers.	<ul style="list-style-type: none"> • Capacity <ul style="list-style-type: none"> • Introducing capacity • Relationship between volume and capacity • Estimating capacity • Problems on capacity 	<ul style="list-style-type: none"> • Identifies the capacity of a container as the total quantity of a liquid required to fill up that container. • Identifies the quantity of liquid in a container as its' volume of liquid. • States that capacity is the volume of the whole container. • Estimates the capacity of a container. • Solves problems relate to volume and capacity. 	03
<p>Competency – 12</p> <p>Fulfills the needs of the world of work by time management.</p>	12.1 Investigates the rotation of the earth and inquires into its results.	<ul style="list-style-type: none"> • Time Zones <ul style="list-style-type: none"> • Introducing time zones 	<ul style="list-style-type: none"> • Identifies equator, latitudes and longitudes. • Identifies longitude 0° as the Greenwich Mean Time (GMT) and longitude 180° as the International Date Line (IDL). 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> • Identifies a land strip demarcated by two longitudes with 15^0 gap as a time zone. • Identifies the region between $7\frac{1}{2}^0$ from the Greenwich Mean Time on both sides as the 0 Time Zone. • Identifies that the time zones are separated as -1 to -12 to left side and +1 to +12 to the right side. 	
	12.2 Investigates the difference in time between countries and finds their relative positions.	<ul style="list-style-type: none"> • Time at a location with respect to the standard time 	<ul style="list-style-type: none"> • Identifies that completion of 24 hours and passing the International Date Line are the events that change the date when setting up standard time of each country compared to Greenwich Mean Time (GMT). • Obtains the time, date and the day of other countries compared to the standard time given for any country according to its location. 	03

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
Competency – 13 Uses scale diagrams in practical situations by exploring various methods.	13.1 Indicates the location of a place using a direction.	<ul style="list-style-type: none"> • Location • With respect to a main direction 	<ul style="list-style-type: none"> • States that location of a place can be indicated based on North and South. • Describes the location of a place as from North to West, North to East, South to West and South to East etc. • Denotes the location of a place with first letters of the directions on both sides and the magnitude of the angle at the middle. • Draws a rough sketch for denoting a location of a place from fixed point using a direction and distance. 	03
	13.2 Describes various locations in the environment using scale drawings.	<ul style="list-style-type: none"> • Interpretation of scale diagrams • The scale as a ratio • Drawing scale diagrams (Various rectilinear plane figures) 	<ul style="list-style-type: none"> • Convertes a given scale as a discription \rightarrow as a numerical connection (1 cm represents x cm) \rightarrow (1 cm \rightarrow x cm) \rightarrow as a ratio (1:x) • Calculates the length of a scale diagram when the actual length and the scale of a rectilinear plane figure is 	05

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<p>given.</p> <ul style="list-style-type: none"> • Draws a scale diagram when the scale and actual dimensions of a rectilinear plane figure is given. • Calculates dimensions of the actual figure using a scale diagram. 	
<p>Competency – 14</p> <p>Simplifies algebraic expressions by systematically exploring various methods.</p>	<p>14.1 Simplifies algebraic expressions and finds the value by substitution.</p>	<ul style="list-style-type: none"> • Algebraic Expressions <ul style="list-style-type: none"> • Constructing Multiplication <ul style="list-style-type: none"> • An algebraic expression by a number • An algebraic binomial expression by an algebraic term • Simplifying(Adding, subtracting and with a bracket) • Substitution (Integers) 	<ul style="list-style-type: none"> • Develops algebraic expressions of up to three unknowns using several mathematical operations. • Develops algebraic expressions with parentheses and up to three unknowns. • Multiplies an algebraic expression without parentheses by a number. • Multiplies a binomial algebraic expression without parentheses by an algebraic term. • Simplifies algebraic expressions with addition, subtraction and with parentheses. • Accepts that for removal of parantheses, the terms within 	<p>05</p>

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<p>parentheses should be multiplied by the number or the algebraic term outside it.</p> <ul style="list-style-type: none"> Substitutes integers for unknowns in an algebraic expression with not more than three unknowns and finds the value. 	
<p>Competency – 15</p> <p>Factorizes algebraic expressions by systematically exploring various methods.</p>	15.1 Factorizes algebraic expressions.	<ul style="list-style-type: none"> Finding Highest Common Factor of the group of terms up to three algebraic terms Factors of algebraic expressions (Up to 3 terms) <ul style="list-style-type: none"> The common factor is a whole number The common factor is an algebraic term 	<ul style="list-style-type: none"> Finds the highest common factor of a group of terms with up to three algebraic terms. Factorizes an algebraic expression whose common factor of which is a whole number. Factorizes an algebraic expression whose common factor is an algebraic term. Checks the correctness of factorization of algebraic expression by multiplying with the common factor. 	05
<p>Competency – 17</p> <p>Manipulates the methods of solving equations to fulfill the</p>	17.1 Uses linear equations to solve problems.	<ul style="list-style-type: none"> Constructing simple equations <ul style="list-style-type: none"> The form $ax + b = c ; a, b, c \in \mathbb{Q}, a \neq 0$ Solving simple equations 	<ul style="list-style-type: none"> Develops simple equations of the form $ax + b = c$ where $a, b, c \in \mathbb{Q}$ and $a \neq 0$. Develops a simple equation with one pair of parentheses. Solves simple equations of 	05

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
needs of day to day life.		<ul style="list-style-type: none"> • With fractional coefficients as well and with one pair of brackets 	<p>the form $ax+b=c$.</p> <ul style="list-style-type: none"> • Solves simple equations with one pair of parentheses. • Checks the correctness of the solution by substituting the answer in the simple equation. • Solves problems using the knowledge of simple equations. 	
<p>Competency – 20</p> <p>Easily communicates the mutual relationships that exist between two variables by exploring various methods.</p>	20.1 Uses the number line to compare fractions and decimal numbers.	<ul style="list-style-type: none"> • Representation of points on a number line • Fractions • Decimals(with one decimal place) • Comparing fractions and decimal 	<ul style="list-style-type: none"> • Represents fractions on a number line. • Represents decimals with one decimal place on the number line. • Compares fractions and decimals using the number line. 	02
	20.2 Illustrates the behavior of a variable pictorially.	<ul style="list-style-type: none"> • Representation of intervals on the number line • $x > a, x < a$ • $x \geq a, x \leq a$ • Open and close intervals with the form $a \leq x \leq b$ 	<ul style="list-style-type: none"> • Represents inequalities of the form $x > a$ and $x < a$ on the number line. • Represents inequalities of the form $x \geq a$ and $x \leq a$ on the number line. • Represents inequalities of the form 	04

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			$a \leq x \leq b, a \leq x < b, a < x \leq b,$ $a < x < b, x < a \text{ or } x > b,$ <i>and</i> $x \leq a \text{ or } x \geq b$ $x < a \text{ or } x \geq b, x \leq a \text{ or } x > b$ on the number line. Writes the inequalities represented on number line in algebraic form.	
	20.3 Represents location on a Cartesian Plane.	<ul style="list-style-type: none"> • Representation on a Cartesian plane • Ordered pairs of integral values (In the four quadrants) • Graphs of equations of the form $x = a, y = b$ 	<ul style="list-style-type: none"> • Draws the Cartesian plane including all four quadrants. • Marks the points $x, y, \in Z(x, y)$ on the Cartesian plane. • Writes a marked point on the Cartesian plane as an ordered pair. • Draws graphs of the form $x=a, y=b$ on the Cartesian plane where $a, b \in Z$ • Writes the equation $x=a$ or $y=b$ for the line parallel to the x axis or y axis. 	03
Competency – 21 Makes decisions by	21.1 Performs calculations using the	<ul style="list-style-type: none"> • Introducing pairs of angles and doing simple calculations in relation to angles 	<ul style="list-style-type: none"> • Identifies complementary angles, supplementary angles, adjacent angles and vertically 	05

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
investigating the relationships between various angles.	relationships between various angles.	<ul style="list-style-type: none"> • Adjacent angles • Complementary angles • Supplementary angles • Vertically opposite angles <ul style="list-style-type: none"> • Calculating the magnitude of an angle <ul style="list-style-type: none"> • Angles on a straight line • Angles around a point 	<p>opposite angles using simple examples.</p> <ul style="list-style-type: none"> • Identifies that the sum of a pair of complementary adjacent angles is 90°. • Identifies that the sum of a pair of supplementary adjacent angles is 180°. • Identifies that opposite angles formed by intersection of two straight lines are equal in magnitude. • Performs simple calculations related to complementary angles, supplementary angles, adjacent angles and opposite angles. • Identifies that the sum of all the angles on a straight line is equal to 180°. • Identifies that the sum of all the angles around a point is equal to 360°. • Perform calculations related to angles on a straight line and angles around a point. 	
Competency – 22	22.1 Creates solids and	• Creation of models	• Creates models of the solid objects octahedron,	06

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
Creates new models by exploring various solids.	confirms the relationships between properties.	<ul style="list-style-type: none"> • Octahedron • Dodecahedron • Icosahedron <ul style="list-style-type: none"> • Vertices, edges and faces <ul style="list-style-type: none"> • Octahedron • Dodecahedron • Icosahedron • Verification of Euler's relationship <ul style="list-style-type: none"> • For solids with only straight edges such as Octahedrons, Dodecahedrons, Icosahedrons • Introducing Platonic solids 	<p>dodecahedron and icosahedron using given blocks.</p> <ul style="list-style-type: none"> • Verifies Euler relationship by checking the number of vertices, edges and faces of octahedron, dodecahedron and icosahedron. • Identifies the geometric shapes of faces of octahedron, dodecahedron and icosahedron and describes its characteristics. • Describes the characteristics of a platonic solid. • Differentiate platonic solids from other given solids. 	
<p>Competency – 23</p> <p>Makes decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.</p>	23.1 Inquires into the relationships between the various angles of rectilinear plane figures.	<ul style="list-style-type: none"> • Drawing and measuring the interior and exterior angles of plane figures <ul style="list-style-type: none"> • Triangle • Quadrilateral • Calculating the values of exterior angles using the interior angles <ul style="list-style-type: none"> • Triangle 	<ul style="list-style-type: none"> • Measures interior angles of a triangle to the nearest degree. • States that the sum of the three interior angles of a triangle is 180°. • Measures interior angles of a convex quadrilateral to the nearest one degree. • States that the sum the interior angles of a convex quadrilateral is 360°. 	06

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
		<ul style="list-style-type: none"> • Quadrilateral 	<ul style="list-style-type: none"> • Identifies correctly the exterior angles of a plane polygon using diagrams. • Draws exterior angles by extending the sides of triangles and convex quadrilaterals. • Measures the exterior angles of a triangle and a quadrilateral to the nearest degree. • States that the sum of exterior and interior angles of triangles and quadrilaterals at any vertex is 180°. • States that the sum of exterior angles of a triangle and a quadrilateral is 360° • Calculates the exterior angle relevant to a given interior angle of triangles and convex quadrilaterals. • Perform simple calculations related to interior angles of triangles and convex quadrilaterals correctly. 	

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
<p>Competency – 24</p> <p>Thinks logically to make decisions based on geometrical concepts related to circles.</p>	<p>24.1 Inquires into the special properties related to circles.</p>	<ul style="list-style-type: none"> • Circles • Chord • Sector • Segment • Symmetriness 	<ul style="list-style-type: none"> • Identifies a straight line connecting any two points marked on a circle as a chord. • Identifies a fragment of a circle in between two points marked on the circles as an arc. • Identifies the area surrounded by two radii and the respective arc as a sector. • Identifies the area of a circles surrounded by an arc and the chord which connects the two extremes of the arc as a segment. • Identifies that the axis of symmetry of a circle is the diameter of the circle and a circles has infinite number of diameters. 	<p>05</p>
<p>Competency – 25</p> <p>Studies the beauty of the environment by exploring the properties of various shapes.</p>	<p>25.1 Inquires into the results of a rotation that are based on symmetry.</p>	<ul style="list-style-type: none"> • Rotational symmetry • Concept • Centre of rotation • Order of symmetry (For geometric shapes only) 	<ul style="list-style-type: none"> • States rotational symmetry is the coincidence of a plane figure with its initial position when it is rotated through a circle. • Marks the centre of rotation of geometrical shapes. • States that the number of times the rotating plane figure 	<p>05</p>

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<p>coincides with its initial position is the order of symmetry.</p> <ul style="list-style-type: none"> Writes the order of rotational symmetry for geometrical shapes. Obtains a relationship between the order of rotational symmetry and the number of axes of symmetry. 	
<p>Competency – 26</p> <p>Investigates the methods of organizing various geometric shapes and uses them to enhance beauty.</p>	26.1 Studies shapes by creating various patterns that can be used to enhance beauty.	<ul style="list-style-type: none"> Tessellation <ul style="list-style-type: none"> Regular tessellation Semi-regular tessellation 	<ul style="list-style-type: none"> States that the tessellation using only one regular geometrical shape is the regular tessellation. Creates regular tessellation by identifying geometrical shapes that can create regular tessellation. States that tessellation using two or more regular shapes is the semi-regular tessellation. Creates semi-regular tessellations identifying geometrical shapes leading to semi-regular tessellations. Engages in creations using tessellation. 	05
<p>Competency – 27</p>	27.1 Constructs the	<ul style="list-style-type: none"> Necessary condition for a 	<ul style="list-style-type: none"> Identifies that the sum of lengths of two sides of a 	06

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
Analyzes according to geometric laws, the nature of the locations in the surroundings.	triangles using the awareness of necessary conditions for a triangle.	<p>triangle</p> <ul style="list-style-type: none"> • The sum of the lengths of any two sides $>$ the length of the remaining side • Construction of triangles (When the side lengths are given) 	<p>triangle is greater than the length of the remaining side.</p> <ul style="list-style-type: none"> • Solves problems related to necessary conditions for the existence of triangle. • Creates the relevant triangle when the lengths of the three sides are given. 	
<p>Competency – 28</p> <p>Facilitates daily work by investigating the various methods of representing data.</p>	28.1 Represents data using a stem and leaf diagram for facilitating the communication.	<ul style="list-style-type: none"> • Data representation • Stem and leaf diagram 	<ul style="list-style-type: none"> • Identifies the stem and leaf graph • Accepts that should be included a key for the stem and leaf graph. • Represents a data set with less than 30 pieces of data and value of the data are less than 1000 in a stem leaf graph. 	02
<p>Competency – 29</p> <p>Makes predictions after analyzing data by various methods to facilitate daily activities.</p>	29.1 Discusses the dispersion of data using stem and leaf diagram.	<ul style="list-style-type: none"> • Using a stem and leaf diagram for a data set <ul style="list-style-type: none"> • Minimum value • Maximum value • Range 	<ul style="list-style-type: none"> • Finds the minimum value of a data set using a stem leaf graph. • Finds the maximum value of a data set using the stem and leaf graph. • Calculates the range of a data set using maximum value and minimum value. 	04

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> Decides conclusions on data distribution based on the minimum value, maximum value and the range. 	
	29.2 Inquires into numerical representative values of a group of data.	<ul style="list-style-type: none"> Central tendency measurements (Of a string of raw data) <ul style="list-style-type: none"> Mode Median Mean Measure of the spread (Of a string of raw data) <ul style="list-style-type: none"> Range 	<ul style="list-style-type: none"> Finds the mode of a raw data set. Finds the median of a raw data set. Calculates the mean of data set which has less than thirty pieces of data. Draws conclusions about a raw data set based on the mode, median and mean. Finds the range of a raw data set. 	04
Competency – 30 Manipulates the principles related to sets to facilitate daily activities.	30.1 Analyzes the various relationships related to sets.	<ul style="list-style-type: none"> Set notation <ul style="list-style-type: none"> Is an element (\in) Is not an element (\notin) Empty set (\emptyset) Number of elements ($n(A)$) 	<ul style="list-style-type: none"> Uses \in symbol to indicate that the element is an element of a given set. Uses \notin symbol to indicate that an element is not an element of a given set. Describes the empty set with examples. 	04

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<ul style="list-style-type: none"> • Uses symbols \emptyset or $\{\}$ to indicate an empty set. • Uses $n(A)$ to indicate the number of elements of a set 'A'. • Solves problems related to set notation. 	
<p>Competency – 31</p> <p>Analyzes the likelihood of an event occurring to predict future events.</p>	<p>31.1 Determines the likelihood of an event occurring based on quantitative values.</p>	<ul style="list-style-type: none"> • Probability <ul style="list-style-type: none"> • 0 -1 scale 	<ul style="list-style-type: none"> • States that probability of a definitely occurring event is given mark 1. • States that the probability of an event definitely not occurring is given mark 0. • States that when the occurrence of an event is uncertain the probability is given a mark between 0 and 1. • States that when there are two possible occurrences with equal probabilities the probability of one event is awarded $\frac{1}{2}$. • States that when the likelihood of an event is very high the mark awarded to it is in between $\frac{1}{2}$ and 1 and if the likelihood of the event is very low the mark will be in 	<p>02</p>

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<p>between 0 and $\frac{1}{2}$.</p> <ul style="list-style-type: none"> • Awards marks for given events according to the 0-1 scale. 	
	<p>31.2 Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value.</p>	<ul style="list-style-type: none"> • Suitable values for the likelihood of an event occurring <ul style="list-style-type: none"> • Fraction of success • Experimental probability • Theoretical probability 	<ul style="list-style-type: none"> • States the success of fraction based on the number of successful events and total number of experimental events. • States that when the frequency of an experiment is increased the fraction of success is the more suitable for the likelihood of the incident. • Identifies fraction of success obtained after increasing the frequency of experiments as the experimental probability. • Identifies the probabilities based on the likelihood but without experiments as the 	<p>04</p>

Competency	Competency Level	Content	Learning Outcomes	Number of Periods
			<p>theoretical probability.</p> <ul style="list-style-type: none"> • Solves simple problems related to experimental and theoretical probabilities. <p>Total</p>	170

Lesson sequence

Content	Competency levels	Number of periods
1st term		
1. Number Patterns	2.1	05
2. Perimeter	7.1	05
3. Angles	21.1	05
4. Directed Numbers	1.2	05
5. Algebraic Expressions	14.1	05
6. Solids	22.1	06
7. Factors	15.1	06
8. Square Root	1.1	05
9. Mass	9.1	05
10. Indices	6.1,6.2	05
2nd term		
11. Symmetry	25.1	05
12. Triangles	23.1	06
13. Fractions - I	3.1	06
14. Fractions - II	3.2	06
15. Decimals	3.3	07
16. Ratios	4.1,4.2	06
17. Equations	17.1	05
18. Percentages	5.1,5.2	06
19. Sets	30.1	04
20. Area	8.1,8.2	06
21. Time	12.1,12.2	06
3rd term		
22. Volume and Capacity	10.1,11.1	06
23. Circle	24.1	05
24. Location of a place	13.1	03
25. Number line and Cartesian plane	20.1,20.2,20.3	09
26. Triangle Constructions	27.1	06
27. Data representation and Interpretation	18.1,29.1,29.2	10
28. Scale Drawings	13.2	05
29. Probability	31.1,31.2	06
30. Tessellation	26.1	05
	Total	170

Instructions for the Learning-Teaching Evaluation Process

1. Number Patterns

Competency 2: Makes decisions for future requirements by investigating various relationships in numbers.

Competency Level 2.1: Simplifies problems by analyzing different characteristics and observing relationships among terms of number patterns.

Number of Periods: 05

Introduction:

A row of numbers where a similar relationship exists between any two successive terms is a number pattern. Students have gained experiences by engaging in simple exercises related to number patterns from the primary grades. They have the ability to deduce the other terms by identifying the relationship between the terms of a number pattern. The number patterns such as these are known as number sequences.

The general term of a number pattern is decided by the value of each term, the place of the term and the relationship between the successive terms. Hence, the n^{th} term for natural numbers can be written in terms of n . The general term for even numbers starting with 2 is $2n$ and for odd numbers starting with 1 is $2n-1$. The general term for the multiplication pattern of 3 starting with 3 is $3n$. Accordingly, the general term of the multiplication pattern of a number a starting with a is an . Further, the general term for square number is n^2 and the general term for triangular numbers is $\frac{n}{2}(n+1)$. Therefore, the value of any term can be obtained from the general term. In all these, general terms n is a positive integer ($n \in \mathbb{Z}^+$)

Learning Outcomes for Competency Level 2.1:

1. Identifies n^{th} term of a number pattern as the general term.
2. Identifies that n^{th} term of the multiplication pattern of a number 'a' in a counting number set is 'an'.
3. Writes the general term of the multiplication pattern of a number of a set of counting numbers.
4. Writes the general term of the even number pattern of a counting number set.
5. Writes the general term of the odd number pattern of a counting number set.
6. Writes the general term of the square number pattern of a counting number set.
7. Solves problems related to number patterns.

Glossary of terms:

Number Patterns	- සංඛ්‍යා රටා	- எண்கோலம்
General Term	- සාධාරණ පදය	- பொது உறுப்பு
Multiples	- ගුණකර	- மடங்குகள்
Counting Numbers	- ගණිත සංඛ්‍යා	- எண்ணும் எண்கள்
Even Numbers	- ඉරට්ට සංඛ්‍යා	- இரட்டை எண்கள்
Odd Numbers	- ඔත්තේ සංඛ්‍යා	- ஒற்றை எண்கள்
Square Numbers	- සමරචතුරස්‍ර සංඛ්‍යා	- சதுர எண்கள்
Triangular Numbers	- ත්‍රිකෝණ සංඛ්‍යා	- முக்கோணி எண்கள்
Number Sequences	- සංඛ්‍යා අනුක්‍රම	- எண்தொடரி

Instruction to plan the lesson:

Given below is a specimen lesson prepared on the basis of a group activity performed in pairs to develop in students the subject concepts related to the learning outcomes 1,2 and 3 under the competency level 2.1

Time: 40 minutes

Quality Inputs:

- Copies of the activity sheet

Instructions for the teacher:**Approach:**

- Displaying a multiplication number pattern on the board, highlight the relationship between two successive terms and explain that this is a number pattern.
- State that, by identifying the relationship between the terms of the number pattern, the other terms can be obtained without writing all the terms. Start the lesson telling that the following activity is done to inquire into it.

Development of the lesson:

- Taking into consideration, the relationship between the successive terms of the multiplication pattern 3, 6, 9, 12, ..., explain how each term is formed.

$$1^{\text{st}} \text{ term} \quad 3 \times 1 = 3$$

$$2^{\text{nd}} \text{ term} \quad 3 \times 2 = 6$$

$$3^{\text{rd}} \text{ term} \quad 3 \times 3 = 9$$

$$8^{\text{th}} \text{ term} \quad 3 \times 8 = 24$$

$$10^{\text{th}} \text{ term} \quad 3 \times 10 = 30$$

$$n^{\text{th}} \text{ term} \quad 3 \times n = 3n$$

- Group the students in pairs and distribute the activity sheets.
- After completing the group work, make a review presenting essential facts.

Activity sheet for the students:



- Fill in the blanks to get the relationship between the terms of the following multiplication number patterns.

4, 8, 12, 16,

$$1^{\text{st}} \text{ term} \quad 4 \times 1 = 4$$

$$2^{\text{nd}} \text{ term} \quad 4 \times 2 = 8$$

$$3^{\text{rd}} \text{ term} \quad \dots \times \dots = \dots$$

$$4^{\text{th}} \text{ term} \quad \dots \times \dots = \dots$$

$$8^{\text{th}} \text{ term} \quad \dots \times \dots = \dots$$

$$10^{\text{th}} \text{ term} \quad \dots \times \dots = \dots$$

$$n^{\text{th}} \text{ term} \quad \dots \times \dots = \dots$$

- As was done above, write an expression for the n^{th} term of the following multiplication patterns while writing their relationships between the terms.

(1) 5, 10, 15, 20,

(2) 6, 12, 18, 24, ...

(3) 10, 20, 30, 40,

- Discuss the importance of obtaining an expression for the n^{th} term.

Assessment and Evaluation :

- Assessment criteria:
 - Identifies the relationship between the terms of the number pattern and writes general term.
 - Write the general factor of a multiplication pattern.
 - Accepts that any term of the pattern can be written using the general term.

- Investigates relationships referring to information.
- Makes decisions for future requirements going by the relationships.
- Direct the students to do the relevant exercises in lesson 1 of the textbook.

For your attention ...**Development of the lesson:**

- Plan and implement a suitable method to write the general term of the patterns of even numbers, odd numbers, square numbers and triangular numbers.

Assessment and Evaluation:

- Direct the students to work out the related exercises in lesson 1 of the textbook.

For further study:

- <http://www.youtube.com/watch?v=zIcxrhyJs6M>
- <http://www.youtube.com/watch?v=IEKU6tubTEw>

2. Perimeter

Competency 7: Investigates the various methods of finding the perimeter to carry out daily tasks effectively.

Competency Level 7.1: Satisfies various requirements by investigating the perimeter of rectilinear plane figures.

Number of Periods: 05

Introduction:

Students have already learnt how to find the perimeter of the plane figures square, rectangle and triangle. In this section, we discuss how to find the perimeter of compound plane figures. Compound plane figures are formed by the combination of two or more rectilinear plane figures. Here, our attention is focused on the perimeter of compound plane figures formed by the combination of the same type or different types of the rectilinear plane figures namely the square, rectangle, isosceles triangle and equilateral triangle. It is important to stress that either the side or the part that overlaps when two rectilinear plane figures combine do not add when the perimeter is calculated.

Learning Outcomes for Competency Level 7.1:

1. Accepts that attention has to be paid to the complete figure when finding the perimeter of a compound plane figure.
2. **Finds the perimeter of a compound plane figure consisting of either similar or different two plane figures of equilateral triangles, isosceles triangles, squares and rectangles.**
3. Solves problems related to compound plane figures consisting of two plane figures namely equilateral triangles, isosceles triangles, squares and rectangles.

Vocabulary:

Rectangle	- සෘජු කෝණාස්‍රය	- செவ்வகம்
Square	- සමචතුරස්‍රය	- சதுரம்
Isosceles Triangle	- සමද්විපාද ත්‍රිකෝණය	- இருசமபக்க முக்கோணி

Equilateral Triangle	- සමපාද ත්‍රිකෝණය	- சமபக்க முக்கோணி
Perimeter	- පරිමිතිය	- சுற்றளவு
Compound plane figures	- සංයුක්ත තලරූප	- கூட்டுத்தளவுரு

Instruction to plan the lesson:

Given below is a specimen lesson designed in the form of a group activity with inquiry for developing in student the subject concepts related to the second learning outcome under the competency level 7.1

Time: 40 minutes

Quality Inputs:

- Kits consisting of squares of side 4cm, equilateral triangles of side 4cm, 4cm X 3cm rectangles, isosceles triangles of sides 4cm and 3cm cut from Bristol board (one kit for each group)
- Ruler (one for each group)

Instructions for the teacher:**Approach:**

- Remind students what the perimeter of a plane figure is.
- Remind the characteristics of the plane figures, square, rectangle, equilateral, triangle and isosceles triangle and the method of finding their perimeter.
- Discuss the formation of a compound plane figure by uniting two equal sides of two plane figures.

Development of the lesson:

- Group the students appropriately and distribute a copy of the activity sheet, a set of plane figures and a ruler to each group.
- Engage the students in the activity.
- Allow the students to present the facts they have found to the entire class.
- Assess the students while they are involved in the activity.
- Explain the difference between the perimeter of the compound figure and the perimeters of the figures that contributed for its formation and the reason for this difference.
- Make a review about the perimeter of a compound figure, based on student's findings.

For your attention...**Development of the lesson:**

- Give figures of various compound plane figures and get the students to calculate their perimeters.

Assessment and Evaluation:

- Direct the students to work out the related exercises in lesson 2 of the textbook.

For further study:

- http://www.youtube.com/watch?v=sJmLjUj_h68
- <http://www.youtube.com/watch?v=5ZCKr4wTQvI>
- <http://www.youtube.com/watch?v=h0FFEBHBufo>
- <http://www.youtube.com/watch?v=1uWZNW5PF-s>

3. Angles

Competency 21: Makes decisions by investigating the relationships between various angles.

Competency Level 21.1: Performs calculations using the relationships between various angles.

Number of Periods: 05

Introduction:

Lines and angles are basic concepts essential to learn geometry. Students have learnt before that angles are defined according to their static and dynamic nature and are classified according to their magnitude. This lesson deals with the sum of the angles on a straight line and vertically opposite, adjacent, complementary, supplementary, complementary adjacent and supplementary adjacent angles. It is emphasized that these basic facts are essential in learning further geometry.

Learning Outcomes for Competency Level 21.1:

1. Identifies complementary angles, supplementary angles, adjacent angles and vertically opposite angles using simple examples.
2. **Identifies that the sum of a pair of complementary adjacent angles is 90° .**
3. **Identifies that the sum of a pair of supplementary adjacent angles is 180° .**
4. Identifies that opposite angles formed by intersection of two straight lines are equal in magnitude.
5. Performs simple calculations related to complementary angles, supplementary angles, adjacent angles and opposite angles.
6. Identifies that the sum of all the angles on a straight line is equal to 180° .
7. Identifies that the sum of all the angles around a point is equal to 360° .
8. Perform calculations related to angles on a straight line and angles around a point.

Vocabulary:

Point	-	புள்ளி	-	புள்ளி
Angle	-	கோணம்	-	கோணம்
Adjacent angles	-	அடுத்துள்ள கோணங்கள்	-	அடுத்துள்ள கோணங்கள்
Complementary angles	-	நிரப்பு கோணங்கள்	-	நிரப்பு கோணங்கள்
Supplementary angles	-	மிகை நிரப்பு கோணங்கள்	-	மிகை நிரப்பு கோணங்கள்
Vertically opposite angles	-	குத்தெதிர்க் கோணங்கள்	-	குத்தெதிர்க் கோணங்கள்

Instruction to plan the lesson:

Given below is a specimen lesson designed on the basis of an activity with a view to developing abilities relevant to the second learning outcome under the competency level 21.1.

Time: 40 minutes

Quality Inputs:

- Instrument given in Annex 1 (one for each group)
- Enlarged protractor made of Bristol board (one for each group)
- Twine.

Instructions for the teacher:**Approach:**

- Remind about angles and naming of angles.
- Remind about the value of a rightangle.
- Discuss about the acute angle, right angle, obtuse angle, reflex angle and adjacent angle

Development of the lesson:

- Point out that if the sum of two angles is 90 (i.e. a right angle) one angle is the complementary angle of the other.
- Divide class into groups as appropriate.
- Distribute the items stated under quality inputs to the groups.
- Discuss about the complementary angle. Make students aware about the instrument you have made and direct the students for the activity given below.
- Give an opportunity to present students' findings.
- Based on the students' findings, remind again that if the sum of two adjacent angles is equal to 90, those angles and complementary adjacent angles and complementary to the other.

Activity sheet for the students:



- Copy the following table in your exercise book

First angle	Second angle	Sum of the angles

- Keep the string stretched in the instrument given to you and complete the table taking the angle between the string and the horizontal line as the first and the angle between the string and the vertical line as the second angle.
- Change the position of the string and thereby the two angles to complete the table.
- Suggest a name for each pair of angles.
- Based on it, complete the following table.

Pair of complementary angles	
First angle	Second angle
60°
72°
.....	15°
.....	5°
.....	23°

- Discuss what is a complementary pair of angles within the group

Assessment and Evaluation:

- Assessment criteria:
 - Uses the instrument correctly.
 - Measures angles correctly.
 - Accepts that a pair of complementary angles is a pair of angles whose sum is 90°.
 - Discuss on the value of the other angle without using the instrument.
 - Works cooperatively within the group.
- Directs the students to do the relevant exercises in lesson 3 in the textbook.

For your attention...

Development of the lesson:

- Discuss about complementary angles with the students and direct them to make an instrument to obtain pairs of complementary angles.

Assessment and Evaluation:

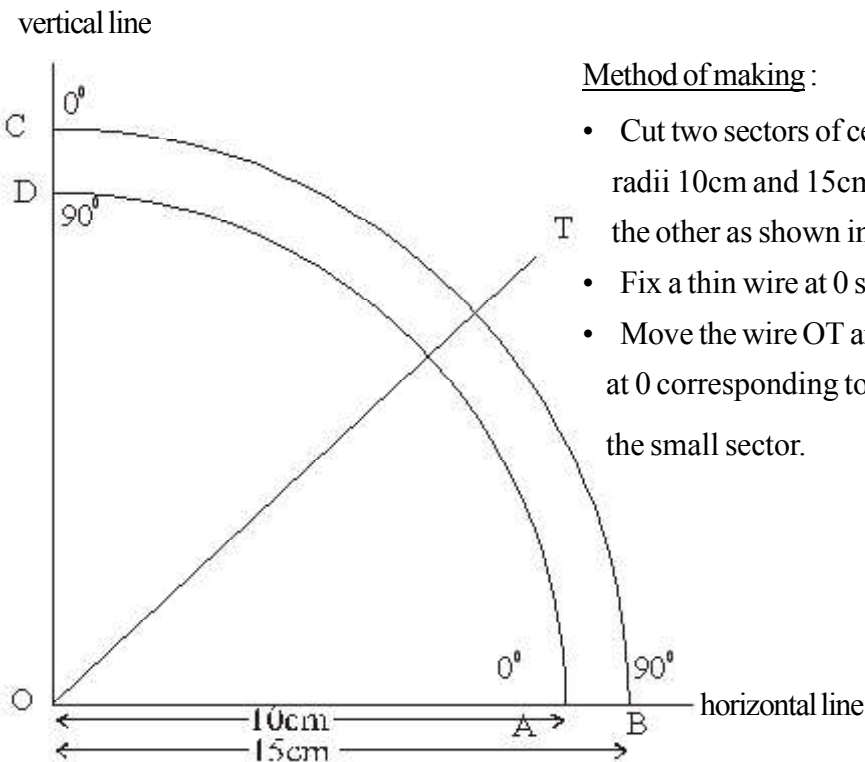
- Direct the students to do the relevant exercises in lesson 3 in the textbook.

For further study:



- <http://www.youtube.com/watch?v=BTnAINsGnsY>
- <http://www.youtube.com/watch?v=XDOH9UI2OOM>
- <http://www.youtube.com/watch?v=zNtbi4OJs9I>
- <http://www.youtube.com/watch?v=7aUxFzTG5w>
- <http://www.youtube.com/watch?v=zrqzG6xKa1A>
- <http://www.youtube.com/watch?v=vAlazPPFlyY>
- <http://www.youtube.com/watch?v=2439OIVBgPg>

Annex 1



Method of making :

- Cut two sectors of central angle 90° with radii 10cm and 15cm. Paste them one over the other as shown in the diagram.
- Fix a thin wire at O so that it can be rotated.
- Move the wire OT and measure the angles at O corresponding to the large sector and the small sector.

4. Directed Numbers

Competency 21: Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life

Competency Level 1.2: Manipulates directed numbers under the basic mathematical operations.

Number of Periods: 05

Introduction:

Students have already learnt that the numbers written with positive or negative signs (i.e. with direction) are directed numbers and positive and negative whole numbers including zero are integers.

They also have learnt in a previous lesson how to add directed number using or without using the numbers line.

In this lesson, we discuss about the subtraction of integers using the number line and subtraction of directional numbers considering subtraction as addition.

Also discussed in this lesson are the facts that when numbers with like signs are multiplied the answer is a positive number whereas when numbers with unlike signs are multiplied the answer is a negative number. It is also expected to discuss that in case of division of directional numbers, a positive number is obtained in the division of numbers with like signs whereas a negative numbers is obtained during the division of numbers with unlike signs.

Learning Outcomes for Competency Level 1.2:

1. Subtracts integers using the number line.
2. States that addition can be used for the subtraction of integers.
3. Subtracts integers.
4. Multiplies integers.
5. Divides integers.
6. Subtract integers using directed numbers.
7. Multiplies directed numbers.
8. Divides directed numbers.

Glossory of terms:

Directed numbers	-	සදිශ සංඛ්‍යා	-	திசைகொண்ட எண்கள்
Integers	-	නිඛිල	-	நிறை எண்கள்
Number Line	-	සංඛ්‍යා රේඛාව	-	எண்கோடு

Instructions to plan the lesson:

Given below is an activity - based specimen lesson plan designed to develop in students the subject concepts relevant to the learning outcomes 2, 3 and 6 after the development of subject concepts relating to the first learning outcome under the competency level 1.2.

Time: 40 minutes

Quality Inputs:

- Circular cards of two colors with +1 and -1 written on them (fairly large ones for teacher demonstration)
- Plannel board
- Drawing pains

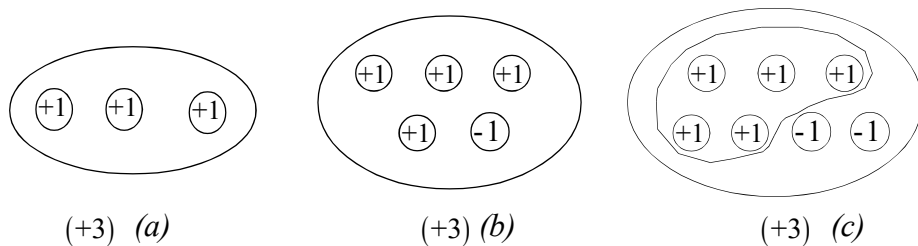
Instructions for the teachers:

Approach:

- Discuss with students how integers were subtracted using the number line.
- Engage the students in the following activity to see whether addition can be used to subtract integers

Development of the lesson:

- Use circular cards to represent plus (positive) numbers and minus (negative) numbers. Prepare cards with $\oplus 1$ to represent positive numbers and cards with $\ominus 1$ to represent negative numbers. Remind when a $\oplus 1$ card is added to a $\ominus 1$ card the answer is zero (0).
- Discuss with students how (+3) is shown in the following figures

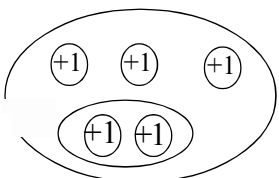


- Discuss that in (b), $\oplus 1$ is added to $\ominus 1$ giving zero and the answer again is $(+3)$ while in (c), $\oplus 2$ is added to $\ominus 2$ giving zero and the answer is $(+3)$.
- In the light of the above, discuss an below on the occasions of subtracting integers.

(i) $(+5)-(+2)$ (ii) $(+3)-(+5)$ (iii) $(-3)-(+5)$ (iv) $(+3)-(+5)$ (v) $(-3)-(-5)$

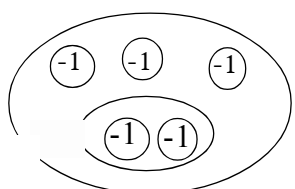
(i) $(+5)-(+2)$

removal of $(+2)$



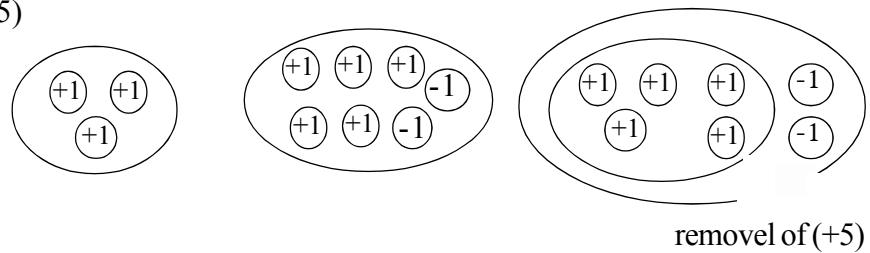
$$(+5) - (+2) = \underline{\underline{+3}}$$

removal of (-2)



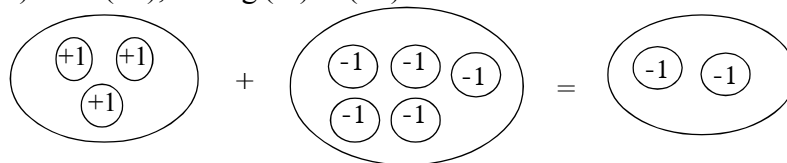
$$(-5) - (-2) = \underline{\underline{-3}}$$

(ii) $(+3) - (+5)$



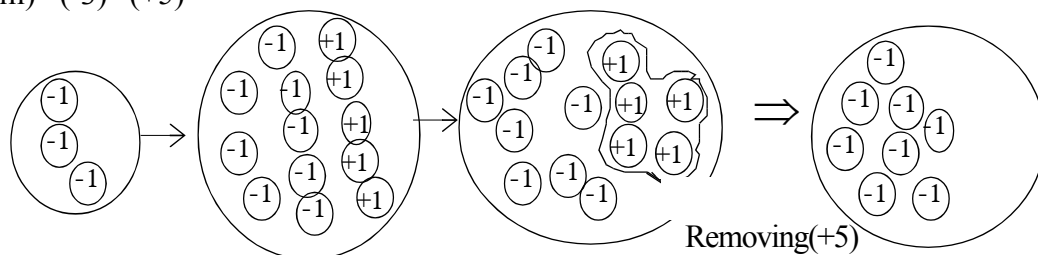
removal of $(+5)$

- Discuss in a subtraction like this, the same answer can be obtained by adding the number with the sign changed. That is, instead of subtracting $(+5)$ from $(+3)$, adding (-5) to $(+3)$.



That is $(+3) - (+5) = (+3) + (-5) = (-2)$

(iii) $(-3) - (+5)$

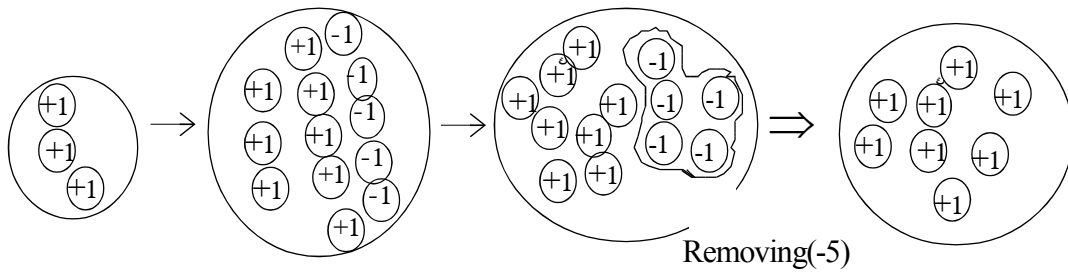


Removing $(+5)$

$$(-3) - (+5) = (-8)$$

Taking as a sum, $(+3) - (+5) = (-3) + (-5) = (-8)$

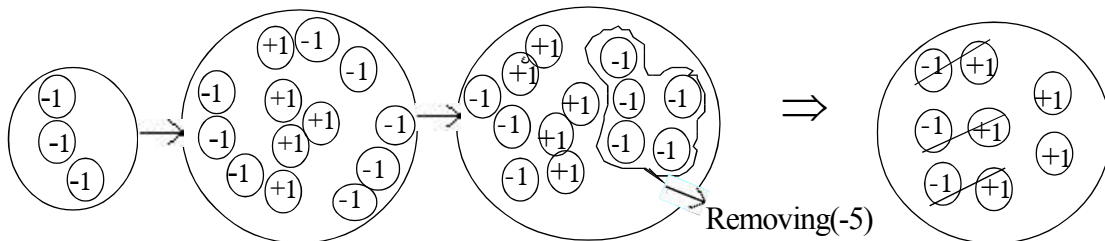
(iv.) $(+3) - (-5)$



$$(+3) - (-5) = (+8)$$

Taking as a sum $(+3) - (-5) = (+3) + (+5) = (+8)$

(v.) $(-3) - (-5)$



$$(-3) - (-5) = (+2)$$

Taking as a sum $(-3) - (-5) = (-3) + (+5) = (+2)$

- Discuss with students the above examples of integer subtractions and also the fact that integer subtraction can be written as an addition and simplified.
 $a - (+b) = a + (-b)$

Activity :

- Group the students as appropriate and distribute among them the card with +1 and -1 written on them.
- Showing some problems such as $(+3) - (-2)$ / $(+2) - (+5)$ / $(-3) - (-2)$ / $(-2) - (+5)$ by cards. Instruct to get the answer by writing as an addition.
- Confirm further that, in students presentations the answers obtained by cards and addition are equal and it is easier to get the answer by addition.

Assessment and Evaluation:

- Assessment criteria:
 - Handles cards correctly according to the problem given.
 - solves the problem correctly using cards.
 - Accepts that integers can be subtracted by addition.
 - Responds correctly and clearly.
 - Works cooperatively within the group.
- Directs the students to do the relevant exercises in lesson 4 in the textbook.

Practical Applications:

- Discuss that this concept is employed in transactions, when finding temperature differences and in auditing

For your attention...**Development of the lesson:**

- Discuss that solving this type of problems, the sign in front of the two numbers are called plus and minus (positive and negative) because they indicate direction and the mathematical operation between those two is called addition and subtraction.
- Plan and implement suitable learning methods to achieve the other learning outcomes relating to the competency level 1.2

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 4 in the textbook

For further study:.

- <http://www.youtube.com/watch?v=IBscLuttQq0>
- <http://www.youtube.com/watch?v=Oo2vGhVkvDo>
- <http://www.youtube.com/watch?v=fFdOr8U4mnl>
- <http://www.youtube.com/watch?v=NQSN00zL5gg>
- <http://www.youtube.com/watch?v=C38B33ZywWs>
- <http://www.youtube.com/watch?v=47wjld9k2Hs>
- <http://www.youtube.com/watch?v=pzQY-9Nmtws>
- <http://www.youtube.com/watch?v=4ve7OaCnDLs>
- <http://www.youtube.com/watch?v=d8IP5tR2R3Q>
- http://www.youtube.com/watch?v=rK4sXm_MPWo
- <http://www.youtube.com/watch?v=bQ-KR3clFgs>

5. Algebraic Expressions

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

Competency Level 14.1: Simplifies algebraic expressions and finds the value by substitution.

Number of Periods: 05

Introduction:

Students have learnt before how to construct algebraic expressions when several mathematical operations combine with an unknown. This section deals with constructing algebraic Expressions with up to three unknowns along with several mathematical operations. This lesson also aims to show the need of parentheses in the building up of algebraic expressions and develop the skill of simplifying algebraic expressions with parentheses. This also includes finding out the value of an algebraic expressions substituting integers in an algebraic expressions with three unknowns. As it is important to derive algebraic expressions to solve problems in further learning, paying attention to this aspect is necessary.

Learning Outcomes for Competency Level 14.2:

1. Develops algebraic expressions of up to three unknowns using several mathematical operations.
2. Develops algebraic expressions with parentheses and up to three unknowns.
3. Multiplies an algebraic expression without parentheses by a number.
4. Multiplies a binomial algebraic expression without parentheses by an algebraic term.
5. Simplifies algebraic expressions with addition, subtraction and with parentheses.
6. Accepts that for removal of parentheses, the terms within parentheses should be multiplied by the number or the algebraic term outside it.
7. Substitutes integers for unknowns in an algebraic expression with not more than three unknowns and finds the value.

Glossary of terms:

ගණිත கணிதச் செய்கைகள்	-	கணிதச் செய்கைகள்	-	Mathematical Operations
වීජීය පද	-	அட்சரகணித உறுப்பு	-	Algebraic terms
වීජීය ප්‍රකාශන	-	அட்சரகணிதக் கோவை	-	Algebraic expressions
ප්‍රකාශ	-	கூற்று	-	Statements
වරහන	-	அடைப்பு	-	Bracket
අඥානය	-	தெரியாக்கணியம்	-	Unknown

Instruction to plan the lesson:

Given below is a specimen lesson plan with a group activity and a teacher discussion designed to develop in students the learning outcomes 1 and 2 and the subject concepts related to them under the competency level 14.1

Time: 40 minutes

Quality Inputs:

- Four copies of the activity sheet
- Cards with the numbers, algebraic terms and symbols $a, b, c, +, -, 2, 3, \times, \div, ()$ pasted on them, flannel boards with cards containing the last light algebraic expressions, demy papers, markers.

Instructions for the teachers:**Approach:**

- Show cards such as $x+2, 2x, 3x-5$ and discuss how such algebraic expressions are made.
- Discuss with students how verbal expressions with a single unknown are converted to algebraic expressions.

Development of the lesson:

- Divide the class in to small groups an appropriate.
- Distribute activity sheets among the groups. Assign to each group an A, B, C, D the verbal expressions relevant to them.
- Instruct to each groups to make algebraic expressions relevant to the two verbal statements written in the two relevant boxes using the algebraic terms, numbers and symbols given and panel in the demy paper provided.
- After finishing the tank, present the flannel board containing the final algebraic expressions prepared by the teacher for the verbal statement.
- Allow each group to select form the flannel board the algebraic expression that matches the one formulated by them.
- Discuss about writing $2 \times a$ as $2a$ and $b \div 3$ as $b/3$ with students.
- Discuss the importance of using parentheses when they are required. Examine whether the second statement for which parentheses is a must have been correctly converted in to the algebraic expression and draw attention to it.
- Present verbal statements such as “If the amounts of money Kamala, Nimala and Sugala had were x, y and z , add half of Sugala’s amount to thrice the amount of Kamala and subtract Sugala’s amount from the answer” and convert it in to an algebraic expression discussing with students

Activity sheet for the students:

- Examine well the cards given to you.
- Select the two verbal statements assigned to your group.
- Using the cards with numbers, algebraic terms and mathematical operations make algebraic expressions for the verbal statements given.
- When converting the second statement to an algebraic expression, find what you need in addition to the numbers, algebraic terms and mathematical operations.
- Paste the algebraic expressions you have made on the demy paper separately.
- Display your work to the class. Compare your expressions with those of the teacher and select the matching ones. Paste those in front.

A

1. Divide b by 2, add to a and subtract three times c .

2. Divide a by 2, add to b and subtract the answer by c

C

1. Multiply a by 2 and subtract c . Then divide b by 3 and add the answer.

2. Multiply a by 3 and add b . Subtract the answer from the answer obtained by multiplying c by 2.

B

1. Multiply a by 3, subtract b and add twice c .

2. Multiply a by 2, subtract the answer by b .

D

1. Divide a by 3. Then multiply b by 2. Add the answer and subtract c .

2. Divide a by 3, subtract b and subtract the answer from three times c .

Assessment and Evaluation :

- Assessment criteria:
 - Constructs algebraic expressions according to the statement given.
 - Shows that a given verbal statement can be represented in a shortened form using algebraic term and mathematical operations.
 - Gives reasons for the importance of using parentheses at required points when constructing algebraic expressions.
 - Acts cooperatively within the groups
- Directs the students to do the relevant exercises in lesson 5 in the textbook.

Practical Applications:

- Various problems met in day-to-day life can be translated in to algebraic expressions and they can be solved by equation and inequalities.

For your attention...**Development of the lesson:**

- Plan the lesson using a suitable method to develop the subject concepts relevant to the learning outcomes 3, 4, 5, 6 and 7. Discuss the importance of taking care about the sign when multiplying an algebraic expression with parentheses by a number.
- Plan a lesson with an activity for substitution of integers for unknowns.
- Recall directed numbers when obtaining the answers by the substitution of negative integers.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 5 in the textbook

For further study:.

6. Solid Objects

Competency 22: Creates new models by exploring various solids.

Competency Level 22.1: Creates solids and confirms the relationships between properties.

Number of Periods: 06

Introduction:-

The student have already learnt about the cube, cuboid, regular tetrahedron and square pyramid and have derived the Euler relationship. In this grade it is expected to discuss the feature of regular solids, create models for the octahedron, dodecahedron and icosahedron and verify Euler relationship for those solid objects. There are only five such regular solids. They are regular tetrahedron, cube, octahedron, dodecahedron and icosahedron. Since they were discovered by the mathematician Plato, they are referred to as Platonic solids.

Hence it is expected to identify the characteristics of Platonic solids and differentiate Platonic solids from the solid objects given.

Learning Outcomes for Competency Level 22.1:

1. Creates models of the solid objects octahedron, dodecahedron and icosahedron using given blocks.
2. Verifies Euler relationship by checking the number of vertices, edges and faces of octahedron, dodecahedron and icosahedron.
3. Identifies the geometric shapes of faces of octahedron, dodecahedron and icosahedron and describes its characteristics.
4. Describes the characteristics of a platonic solid.
5. Differentiate platonic solids from other given solids.

Glossary of terms:

Solida	-	ஊதலிசீது	-	எண்முதி
Octahedron	-	அசீயிலலச	-	எண்முதி
Dodecahedron	-	டீலிடசலலச	-	பன்னிருமுதி
Icosahedron	-	லிசகிலலச	-	இருபதுமுதி
Geometric Shapes	-	சயாலீதிக ஂடுலல	-	கேத்திரகணித வடிவங்கள்

Instructions to plan the lesson:

Given below is a specimen lesson designed on the basis of a group activity with guided inquiry method to develop in students the concepts related to the learning outcomes 4 and 5 under the competency level 22.1

Time : 40 minutes

Quality Inputs:

- Copies of the activity sheet
- Cube, cuboids, regular tetrahedron, square pyramid, octahedron, decahedron, dodecahedron and kits with compound solids
- Copy of the table given in annexe 1

Instructions for the teacher :**Approach :**

- Give introduction to the lesson displaying the solid objects octahedron, decahedron and dodecahedron prepared to the class and discussing about their faces, edges and vertices.

Development of the lesson:

- Display a cube and discuss about its characteristics with the students. Stress the following characteristics.
 1. All the faces of the cube are identical.
 2. Each face is a regular polygon.
 3. Number of polygons meeting at any vertex are equal.
- A solid object meeting all these requirements is a regular solid. Introduce such solids as Platonic solids.
- Divide the class into groups as appropriate and distribute to each group a kit of solid objects, an activity sheet and a table given in Annex I.
- Engage the students in the activity according to the activity sheet getting them to examine the characteristics of each of the solid in the kit provided.
- Pool facts after giving an opportunity to present the students' findings.

Activity sheet for the students:

- Complete the table using the solids given to you.
- Follow teachers' Instructions.
- Inquire the platonic solids you have picked up from the solids provided to you on the basis of the characteristics of a Platonic solid.
- Present the findings of the groups to the class.

Assessment and Evaluation:-

- Assesment criteria:
 - complete the table correctly using the solid objects given.
 - describe the common characteristics of a Platonic solid.
 - Distinguishes the Platonic solids from the solid objects given.
 - Accepts that there five Platonic solids
 - Presents the findings creatively to the class.
- Direct the students to do the relevant exercises in lesson 6 of the text book.

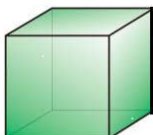
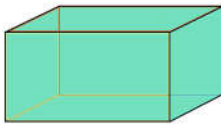


For further study:

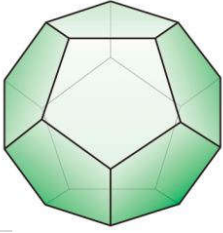

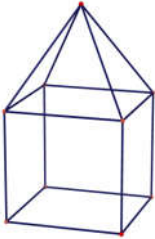
<https://www.youtube.com/watch?v=CCaX5eTteEg>

• <http://mathworld.wolfram.com/Octahedron.html>

• <http://mathworld.wolfram.com/Dodecahedron.html>

• <https://www.youtube.com/watch?v=voUVDagFtho>

Solid object	Shape of the faces	Whether all the faces are regular or not	Whether the edges meeting at a vertex are equal or not	Number of edges meeting at a vertex	Whether the solid object is a Platonic solid or not
Cube 	Square	regular	equal	3	Yes
Cuboid 	Square, Rectangle	Not regular	equal	3	No
Tetrahedron 					
Octahedron 					

<p>Decahedron</p> 					
<p>Dodecahedron</p> 					
<p>Compound solid that are included cuboid and pyramid</p> 					

7. Factors

Competency 15: Factorizes algebraic expressions by systematically exploring various methods.

Competency Level 15.1: Factorizes algebraic expressions.

Number of Periods: 06

Introduction:-

In the previous grades the students have learnt how the highest common factor of a set of numbers is found. This lesson aims in writing the highest common factor of a set of terms consisting of up to three algebraic terms and writing separately the common factors of an algebraic expression.

Learning Outcomes for Competency Level 15.1:

1. Finds the highest common factor of a group of terms with up to three algebraic terms.
2. Factorizes an algebraic expression whose common factor of which is a whole number.
3. Factorizes an algebraic expression whose common factor is an algebraic term.
4. Checks the correctness of factorization of algebraic expression by multiplying with the common factor.

Glossary of terms:

Highest common factor	- மிக உயர்வு பொதுக் காரணி	- பொதுக்காரணிகளுடன் பெரியது
Algebraic expression	- விகித சூத்திரம்	- அட்சரகணிதக் கோவை
Common factor	- பொதுக் காரணி	- பொதுக்காரணி

Instructions to plan the lesson:

Given below is a specimen lesson plan involving a paired activity coupled with the lecture - discussion method to realize the learning outcome 1 under competency level 15.1.

Time : 40 minutes

Quality Inputs:

- Activity sheets for all the students in the class.

Instructions for the teacher:**Approach:**

- Recall students several instances where the highest common factor of several sets of numbers is found using prime factors.

e.g. 12, 18, 30

$$12 = 2 \times 2 \times 3$$

$$18 = 2 \times 3 \times 3$$

$$30 = 2 \times 3 \times 5$$

(Circle the common factors.)

Highest common factor = $2 \times 3 = 6$

- Explain how an algebraic expression is expanded as a product of prime factors.

$$8xy = 2 \times 2 \times 2 \times x \times y$$

$$36a^2b = 2 \times 2 \times 3 \times 3 \times a \times a \times b$$

$$63pq^2 = 3 \times 3 \times 7 \times p \times q \times q$$

Development of the lesson:

- Pair the students in the class, distribute copies of the activity sheets to them and engage them in the activity.
- After the completion of the activity, discuss with students how the highest common factor of a set of algebraic terms can be found using the activity sheets.

Activity sheet for the students:

Study the examples well and fill in the following blanks in order to find highest common factor of several algebraic terms.

Example 1

- Let's find the highest common factor of $2x$ and $4y$.

- Circle the common factors.

$$2x = \textcircled{2} \times x$$

$$4y = \textcircled{2} \times 2 \times y$$

So, highest common factor is 2.

Example 2

- Let's find the highest common factor of ab and bc . Circle the common factors. Find the highest common factor using the common factors.

$$ab = a \times \textcircled{b}$$

$$bc = \textcircled{b} \times c$$

Highest common factor is b .

- Complete the blanks to find the highest common factor of $6a$ and $18b$.

$$6a = 2 \times \dots \times a$$

$$18b = \dots \times 3 \dots \times b$$

Circle the common factors.

From the common factors, highest common factor = $\dots \times \dots = 6$

- Complete the blanks to find the highest common factor of $5x^2$, $5xy^2$ and $10xz$.

$$5x^2 = \dots \times x \times \dots$$

$$15xy^2 = \dots \times 3 \times \dots \times \dots y$$

$$10xz = \dots \times 5 \times \dots \times z$$

Circle the common factor.

From the common factor, highest common factor = $\dots \times \dots$

=

- Find the highest common factor of the following groups of terms by expanding each term in them.

(i) $6pqr$, $9p^2q$, $15pq^2$

(ii) $4ab^2$, $8a^2b^2c$, $12ab^2c$

(iii) $12xy$, $4x^2$, $6y^2$

Assessment and Evaluation:

- Assessment criteria:
 - Expand an algebraic term with a coefficient using prime factors.
 - Writes common factors of some algebraic terms.
 - Accepts that the highest common factor of several algebraic terms that include several common factors is the product of those common factors.
 - Finds the highest common factor of a set of algebraic terms given using common factors.
 - Engages in the activity with mutual cooperation.
- Direct the students to do the relevant exercises in lesson 7 of the text book.

For your attention...**Development of the lesson:**

- Make students achieve the remaining three learning outcomes by using activity sheets or any other methodologies.
- Emphasize that when separating an algebraic expression in to common factors, finding the highest common factor is vital.
- Explain about the positive common factor as well as the negative common factor when taking the common factor out.
- Explain to students that the accuracy of the separation of an algebraic expression in to common factor can be tested by multiplying by the common factor.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 7 of the textbook.

For further study:

- <http://www.youtube.com/watch?v=mbb3msmX2xs>
- http://www.youtube.com/watch?v=_sluZHYrdWM
- <http://www.youtube.com/watch?v=OLVhZxHU38Q>
- <http://www.youtube.com/watch?v=499MvHFrgUU>

8. Square Root

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

Competency Level 1.1: Inquires into the relationships between whole numbers.

Number of Periods: 05

Introduction:-

When a whole number is multiplied by same, a perfect square number is obtained. That whole number is the square root of the perfect square number. There is a relationship between the last digits of the perfect square number and its square root.

When the last digit of the perfect square number is,

0, the last digit of the square root is 0;

5, the last digit of the square root is 5;

1, the last digit of the square root is 1 or 9;

4, the last digit of the square root is 2 or 8;

6, the last digit of the square root is 4 or 6;

9, the last digit of the square root is 3 or 7.

But the last digit of a perfect number cannot be 2, 3, 7 or 8. By using these features, the square root of a perfect square number can be obtained by inspection. Moreover, the square root of a perfect square number is obtained by writing it as a product of prime factors. This lesson comprehensively deals with these aspects.

Learning Outcomes for Competency Level 1.1:

1. Finds the square of whole numbers between 1 and 20.
2. Inquires into the last digit of a whole and its square.
3. Represents square root of a number by “ $\sqrt{\quad}$ ”.
4. Finds the square root of whole square numbers between 1 and 1000 by inspection.
5. Finds the square root of whole square numbers between 1 and 1000 using prime factors

Glossary of terms:

Perfect Square Number	- පුර්ණ වර්ග සංඛ්‍යා	- நிறைவர்க்க எண்கள்
Square root	- වර්ග මූලය	- வர்க்கமூலம்
Triangle	- ත්‍රිකෝණය	- முக்கோணி

Instructions to plan the lesson:

Given below is a specimen lesson plan designed with guided inquiry for developing in students the learning outcome 4 after establishing in them the learning outcomes 1,2 and 3 under the competency level 1.1.

Time : 40 minutes

Quality Inputs:

- Activity sheets for all the students in the class.

Instruction for the teacher:**Approach:**

- Draw students' attention to the table they prepared for the previous lesson which contains whole numbers from 1 to 20 and their squares.
- Conduct a discussion surfacing the relationship between the last digit of the square root of the perfect square number and the last digit of the whole number.
- Reminds the students the square of 10, 20 and 30, the multiples of 10 and the square roots 10, 20 and 30 of those perfect square numbers.
- In the light of the facts recalled by the students, give direction for them to go through the students' activity sheet containing instructions for finding out the square root of a whole number by inspections.

Development of the lesson:

- Tell that students should engage in work according to teacher's guidance and the instructions in the activity sheet.
- Display the students' activity on the blackboard with instructions and ask students to write down only the 'students' work part' in their exercise books
- In order to find the value of $\sqrt{169}$, instruct students to proceed with the teacher step by step while discussing.
- Let the students work out the square roots of the whole numbers given in the activity sheet.
- At end of the activity give an opportunity to present the experiences of the students to the whole class.

- Using the results of the students' work, make a review about getting the square root of a perfect square number by inspection.

Activity sheet for the students:



Following the instructions displayed on the blackboard and teacher's guidance, forward step by step in the following work sheet filling the blanks to obtain a value for $\sqrt{169}$

Instructions	students work
1. In the blank write perfect square number whose square root has to be find.	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> $\sqrt{\dots\dots}$ </div>
2. Write the same number inside the box without the square root sign. of the three multiples of 10, 100, 400, and 900, write on either side of the box the two square numbers that are closest to the number within the box but lesser and greater.	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> $\dots\dots$ $\dots\dots$ $\dots\dots$ </div>
3. Place square root sign for all the three numbers.	$\sqrt{\dots\dots}$ $\sqrt{\dots\dots}$ $\sqrt{\dots\dots}$
4. On either side, write the two multiples of 10 obtained as square roots.	$\dots\dots$ $\sqrt{\dots\dots}$ $\dots\dots$
<p>5. Circles the numbers that can be the square roots according to the last digit.</p> <p>6. Take the number within the circle that closest to the number underlined in the second steo as the answer.</p> <p>7. Test the accuracy of the answer by multiplying.</p>	<p>According to above steps:</p> <p>$\sqrt{\dots\dots}$ lies between the two multiples of ten namely $\dots\dots$ and $\dots\dots$. So the value of $\sqrt{\dots\dots}$ shold be a whole number between $\dots\dots$ and $\dots\dots$. The whole numbers between $\dots\dots$ and $\dots\dots$ are $\dots\dots$, $\dots\dots$, $\dots\dots$, $\dots\dots$, $\dots\dots$, $\dots\dots$.</p> <p>$\therefore \sqrt{\dots\dots} = \underline{\hspace{2cm}}$</p>

- Writing steps according to above instructions, obtained the value for $\sqrt{256}$, $\sqrt{324}$ and $\sqrt{625}$ by inspections.
- Get ready to present your results to the whole class.

Assessment and Evaluation:

- Assessment criteria:
 - Write the square root of a perfect square number as the two multiples of 10 on either sides.
 - Finds its square root of a perfect square number by observing its last digit.
 - Accepts that the square root of a perfect square number is one of the nine consecutive whole numbers.
 - Decide the square root of a perfect square number by following the given method.
 - Acquires successful results by correct observation.
- Direct the students to do the relevant exercises in lesson 8 of the text book.

Practical applications:

- In problems related to the area of squares, the square root is essential to obtain the length of its side.

For your attention...

Development of the lesson:

- Plan and implement a suitable lesson to obtain the square root of a perfect square number by prime factors in relation to the learning outcome 5 under the competency level 1.1

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 8 of the textbook.

For further study:



- <http://www.math.com/school/subject1/lessons/S1U1L9DP.html>
- <http://www.khanacademy.org/math/pre-algebra/exponents-radicals/radical-radicals/v/understanding-square-roots>

For your special attention:

- The square of a number whose last digit is 5:

$$\begin{array}{l}
 \bullet \begin{array}{ccc} 45^2 = & 20 & 25 \\ \text{---} & \text{---} & \text{---} \\ 4 \times 5 & & 5 \times 5 \end{array} \text{ accordingly} & \sqrt{2025} = 45 \\
 \bullet \begin{array}{ccc} 85^2 = & 72 & 25 \\ \text{---} & \text{---} & \text{---} \\ 8 \times 9 & & 5 \times 5 \end{array} & \sqrt{7225} = 85
 \end{array}$$

9.Mass

Competency 9: Works with an awareness of mass to fulfill daily requirements.

Competency Level 9.1: Facilitates daily work by investigating large masses.

Number of Periods: 05

Introduction:

In the previous grades the student have learnt about the units of measuring mass, i.e. gram (g) milligram (mg) and kilogram (kg), the relationships among them and conversion of those units. Metric ton (t) can be introduced as a unit for measuring large masses easily. 1000 kg is equal to 1t. Therefore

1kg is $\frac{1}{1000}t$ That means one the kilogram is equal to $\frac{1}{1000}th$ the metric ton. In this lesson, it is expected to solve problems related to mass using mathematical operations on masses given in kg and t.

Learning Outcomes for Competency Level 9.1:

1. Identifies the need of a unit to measure large masses.
2. Identifies the metric ton as a unit of measuring large masses.
3. States the relationship between the metric ton (t) and the kilogram(kg).
4. Converts kg \leftrightarrow metric ton
5. Solves problems related to masses in metric tons.

Glossary of terms:

Metric ton	- மெட்ரிக் டொன்	- மெற்றிக் தொன்
Mass	- கனம்	- திணிவு
Kilogram	- கிலோகிராம்	- கிலோகிராம்

Instructions to pan the lesson:

Given below is a specimen lesson prepared on the basis of activity and discussion method to develop in students the 4th learning outcome after reinforcing the subject content relevant to the learning outcomes 1, 2 and 3 under the competency level 9.1

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet

Instructions for the teacher:**Approach :**

- Start the discussion asking students about the units measuring mass Recall that those units are mg, g, kg and t.
- Asking the relationships between mg and g, g and kg, and kg and t, write them on the board.
- Direct students to the activity sheet recalling the simplifications involving the powers of 10 through four examples such as

$$(i) \quad 4 \times 1\,000 = 4\,000 \quad (ii) \quad 3.5 \times 1\,000 = 3\,500.0$$

$$(iii) \quad \frac{8\,000}{1\,000} = 8 \quad (iv) \quad \frac{7\,500}{1\,000} = 7.5$$

Development of the lesson :

- Group the students, distribute the activity sheets one group each and engage the students in the activity.
- Draw students' attention to part A.
- Discussing the students' answers, explain the masses given in metric tons should be multiplied by 1000 when converting them to kilograms.
- Discussing the students' answers to part B of the activity sheet, explain that the masses given in kilograms should be divided by 1000 when converting them to metric tons.
- After completing the activity sheet, write some more examples on the blackboard.

Activity sheet for students:

$$1\,000\text{kg} = 1\text{t}$$

Fill in the blanks in the following

$$(A) \quad (i) \quad 2\text{t} = \dots \times 1000\text{kg} \\ = 2000\text{kg}$$

$$(vi) \quad 17\text{t} = \dots \times \dots \text{kg} \\ = \dots \text{kg}$$

$$(ii) \quad 5\text{t} = 5 \times \dots \text{kg} \\ = \dots \text{kg}$$

$$(v) \quad 4.5\text{t} = \dots \times \dots \text{kg} \\ = \dots \text{kg}$$

$$(iii) \quad 8\text{t} = \dots \times \dots \text{kg} \\ = \dots \text{kg}$$

$$(vi) \quad 12.5\text{t} = \dots \times \dots \text{kg} \\ = \dots \text{kg}$$

(B) (i) $3000 \text{ kg} = \frac{\dots}{1000} t$ $= 3 t$	(iv) $7500 \text{ kg} = \frac{\dots}{\dots} t$ $= \dots t$
(ii) $9000 \text{ kg} = \frac{9000}{\dots} t$ $= \dots t$	(v) $10500 \text{ kg} = \frac{\dots}{\dots} t$ $= \dots t$
(iii) $12000 \text{ kg} = \frac{\dots}{\dots} t$ $= \dots t$	

Practical Applications:

- Discuss with students the instances where the maximum tare of vehicles is indicated on some bridges.

Assessment and Evaluation:

- Assessment criteria:
 - State that one metric ton is equivalent to 1000 kilograms.
 - Express the masses given in ton in kilograms.
 - Express the masses given in kilograms in tons.
 - Accepts that metric ton can be used as a unit to measure large masses.
 - Works cooperatively in the group.
- Direct the students to do the relevant exercises in lesson 9 of the textbook.

For your attention ...

- Conduct an activity in which a mass given in kilograms is expressed as a decimal of a metric ton.
- In problems involving masses expressed in metric tons, use practical applications whenever possible.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 9 of the textbook.

For further study:

- <http://www.metric-conversions.org/weight/kilograms-to-metric-tons.htm>
- <http://www.mathsisfun.com/definitions/mass.html>

10.Indices

Competency 6: Uses logarithms and calculators to easily solve problems in day to day life.

Competency Level 6.1: Simplifies powers of a product using expansion.

Competency Level 6.2: Expands a power of a negative integer and finds the value.

Number of Periods: 05

Introduction:

Logarithms and calculators are used to facilitate the solution of mathematical problems we encounter in day to day life. Indices of numbers is the principle underlying the logarithms. Hence we need to have a practice in manipulating numbers in the form indices. In this lesson it is expected to develop in students the ability of expanding natural numbers powers with an index not greater than three of the product of two numbers. Attention is drawn for the following in this regard.

- The power of a product can be represented as a product of two powers.

$$(ab)^n \Rightarrow a^n \times b^n \quad (n \leq 3 \text{ and } n \in \mathbb{N})$$

- Depending on the index of the power of a negative integer, the value changes.

Learning Outcomes for Competency Level 6.1:

1. Expands powers with natural numbers when the index of a product of two natural numbers or algebraic terms is not more than three.

$$(ab)^n \Rightarrow a^n \times b^n \quad (n \leq 3; n \in \mathbb{N})$$

Glossary of terms:

Natural numbers	-	பூகணி சமவெண்	-	இயற்கை எண்கள்
Index	-	தரகூறு	-	சுட்டி
Power	-	வலு	-	வலு
Negative integers	-	எதிர்ம எண்கள்	-	மறை நிறைவெண்கள்

Instructions to pan the lesson:

Given below is a specimen lesson plan that paves way to inquiry through an activity done in pairs and helps develop in students the subject concepts related to the learning outcomes under the competency level 6.1

Time: 40 minutes

Quality inputs:

- Table given in annex- 1 for displaying to students
- Copies of the activity given in annex -2 for the students groups

Instruction for the teacher:**Approach:**

- Display the table in annex-1 on the blackboard and conduct a discussion to surface the facts learnt under the indices and the value of a power.

Development of the lesson:

- Discuss with the students about what they have learnt about getting the value of a power by its expansion.
- Divide the class into pairs and distribute the activity sheets.
- Give instructions to complete the table while discussing within the group.
- Move around the groups, help the students in case of need when they are engaged in the task and assess.
- Give students an opportunity to present the findings of the groups.
- Make a review highlighting how a power of a product is written as a product of powers.

Activity sheet for the students:



- Fill in the blanks in the box below.

(i) $2^2 = \boxed{\dots\dots}$

(ii) $3^2 = \boxed{\dots\dots}$

(iii) $2^2 \times 3^2 = \boxed{\dots\dots} \times 9 = \boxed{\dots\dots}$

(iv) $(2 \times 3)^2 = \boxed{(6)\dots\dots} \quad \boxed{\dots\dots}$

A

- According to the answer you get for part (iii) and (iv) in the box A write the relationship between $2^2 \times 3^2$ in the box below.

- Based on the relationship you identified above fill in the blanks below.

(i) $2^3 \times 3^3 = \dots\dots \times \dots\dots = \boxed{\dots\dots}$

(ii) $(2 \times 3)^3 = \boxed{\dots\dots} = \boxed{\dots\dots}$

- Also, write the relationship between $2^2 \times 3^2$ and $(2 \times 3)^2$ in the box below.

- Based on the relationship you identified, fill in the blanks below.

(i) $5^3 \times 2^3 = (\dots\dots)^{\dots\dots}$

(ii) $\dots\dots \times \dots\dots = (7 \times 5)^3$

(iii) $a^2 \times b^2 = (\dots\dots \times \dots\dots)^2$

(iv) $\dots\dots \times \dots\dots = (x \times y)^3$

(v) $(2 \times a)^3 = \dots\dots \times \dots\dots$

Assessment and Evaluation:

- Assessment criteria:
 - Writes the power of a product which is equal to the product of two powers of index two.
 - Accept the requirement that indices should be equal when writing the product of two powers as a power of a product.
 - Writes the power of a product of index two, as a product of two powers.
 - Write the power of a product of index not less than three on a product of two powers.
 - Comes to conclusions on the results of the activity.
- Direct the students to do the relevant exercises in lesson 10 of the textbook.

For your attention....

Development of the lesson:

- Develop learning outcome 6.2 explaining that when multiplying negative numbers, the answer can be negative or positive depending on the number of times the negative number repeated is odd or even.
- Direct the students to do the relevant exercises in lesson 10 of the textbook.

For further study:



- <http://www.youtube.com/watch?v=dAvosUEUH6I>
- <http://www.youtube.com/watch?v=pD2-H15ucNE>
- <http://www.youtube.com/watch?v=8htcZca0JIA>

For the teacher only: Study the pattern



$$1^2 + 1^2 = 1 \times 2$$

$$1^2 + 1^2 + 2^2 = 2 \times 3$$

$$1^2 + 1^2 + 2^2 + 3^2 = 3 \times 5$$

$$1^2 + 1^2 + 2^2 + 3^2 + 5^2 = \dots\dots\dots$$

$2^1 = 2$	$3^1 = 3$	$6^1 = 6$
$2^2 = 4$	$3^2 = 9$	$6^2 = 36$
$2^3 = 8$	$3^3 = 27$	$6^3 = 216$

Annex 1

11.Symmetry

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

Competency level 25.1 : Inquires into the results of a rotation that are based on symmetry.

Number of periods : 05

Introduction :

Many things in the natural environment as well as the created environment are organised conserving the property of symmetry. This improves their beauty and make them balanced and stable. Observing plants and plants parts, animals as well as the buildings and various equipment in the built environment confirms this. When something rotates it accompanies a symmetry. A plane figure is said to have a **rotational symmetry** if it coincides with its initial position before completing one round or 360° when it rotates around a specific point in it. The **order of rotational symmetry** is the number of times it coincides when the plane figure completes a full round or 360° . The order of rotational symmetry can also be expressed in terms of the fraction of rotation the figure has to complete for its first coincidence during its rotation around the centre of symmetry. That means, if the first coincidence is observed when it completes $\frac{1}{6}$ th a round, its order of rotational symmetry is 6. The specific point within the plane figure is the **centre of rotation**.

If any plane figure is rotated around any point within it, compulsorily coincides with its initial position once (at the end of the rotation). Therefore the order of rotational symmetry is always greater than one. In plane figures with bilateral symmetry, the order of rotational symmetry and the number of axes of symmetry are equal. But there are bilaterally symmetrical plane figures without rotational symmetry. Similarly, there are rotationally symmetrical figures without bilateral symmetry. This lesson studies these facts about symmetry.

Learning outcomes relevant to the competency level 25.1 :

1. States rotational symmetry is the coincidence of a plane figure with its initial position when it is rotated through a circle.
2. Marks the centre of rotation of geometrical shapes.
3. States that the number of times the rotating plane figure coincides with its initial position is the order of symmetry.

4. Writes the order of rotational symmetry for geometrical shapes.
5. Obtains a relationship between the order of rotational symmetry and the number of axes of symmetry.

Glossary of terms:

Rotational Symmetry	-	භ්‍රමක සමමිතිය	-	ආපසු ආරම්භක
Order of rotational Symmetry	-	භ්‍රමක සමමිතිය ගණය	-	ආපසු ආරම්භක වැරදි
Centre of rotation	-	භ්‍රමණ කේන්ද්‍රය	-	ආපසු ආරම්භක මධ්‍යය

Instructions to plane the lesson :

The sequel gives an activity in which the students is supposed to engage individually under the teachers guidance and demonstration. This aims to develop in students the learning outcomes 1, 2 and 3.

Time : 40 minutes

Quality inputs :

- A transparency
- A piece of cardboard, A4 size
- A piece of styrofoam, A4 size
- Pieces of tissue paper ($\frac{1}{4}$ th of A4 size)
- Pins

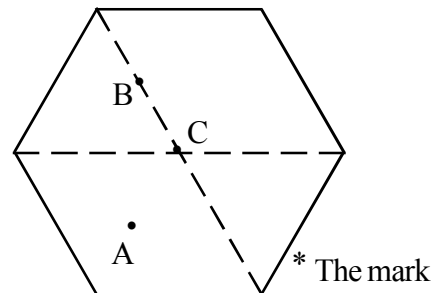
Instructions for the teacher :

Approach :

- Draw a few bilaterally symmetrical plane figures learnt in grade 7 on the blackboard. Draw their axes of symmetry asking about their numbers.
- Emphasize that in case of figure with several axes of symmetry, all those axes intersect at a point inside the plane figure.
- Introduce the lesson by reminding that the bilateral symmetry was investigated by folding the plane figure so that its parts coincide and telling that here, the consequences of rotating the plane figure will be explored.

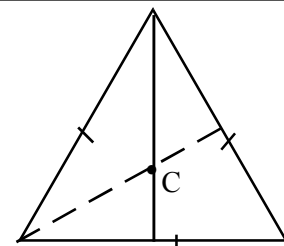
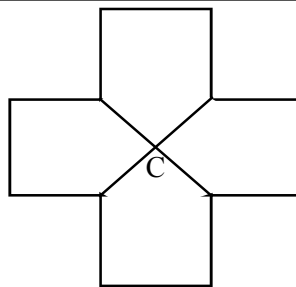
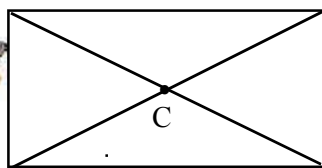
Development of the lesson :

- Draw a regular hexagon as shown in the figure on the piece of cardboard and mark the points A, B and C on it.
- Place of piece of cardboard with the figure on the piece of styrofoam.
- Copy the above figure on the transparency (keep these ready before the lesson).



- Show the above two figures to students coincide them and place it on the tip of the pin at point A.
- Rotate the transparency one round around the point A and get the students to observe the number of times the two figures coincide (It is suitable to make a mark on the two figures to find that a round is completed on rotation).
- Repeat same with points B and C.
- During this demonstration, let the students observe that the number of times coinciding is 1 when rotated around A and B and 6 when rotated around C.
- Explain that if a plane figure coincides with its initial position when it is rotated a full round or 360° around a specific point within it, the figure has rotational symmetry. Also explain that the point around which it is rotated for coincidence is called the centre of rotation and the number of times it coincides is known as the order of rotational symmetry. Discuss that the order of rotational symmetry is always greater than one.
- State that the center of rotation is the point at which two or more bilateral symmetry axes intersect.
- Asking students explain that in the plane figure shown above, the centre of rotation is C and the order of rotational symmetry is 6.
- Give students tissue papers and pins, draw the figures in the students activity sheet on the blackboard and engage students in the activity giving them the instruction in it verbally.
- Discuss the students answers after the completion of the activity.

Students activity sheet:



- Draw a rectangle as in figure 1 in the exercise book.
- Copy the figure you draw on the tissue paper.
- Mark point C in the figure.
- Coincide the two figures, rotate the tissue paper once around point C as was done in the teacher demonstration and examine how many times the two figures coincide.
- Under the figure write whether it has rotational symmetry or not.
- If it has rotational symmetry write (i) the center of symmetry and (ii) order of rotational symmetry underneath the figure.
- Repeat same for figures 2 and 3.
- Present your answer when discussing with the teacher.

Assessment and Evaluation:

- Assessment criteria :
 - Rotates a given plane figure around a point within it and finds the number of times it coincides with its initial position.
 - Marks the center of symmetry in a plane figure with rotational symmetry.
 - Identified plane figure with rotational symmetry.
 - Listens to verbal instruction with understanding and engages correctly in the activity.
 - Accepts that there are plane figures without rotational symmetry
- Engage the students in the following activity.
 - Draw any these figure with bilateral symmetry of your choice.
 - Examine whether the above figure have rotational symmetry and write your inference by the side of the figure.
 - If the figure(s) have rotational symmetry, indicate their center of rotation as C.
 - Direct the students to do the relevant exercises in lesson 11 in the textbook.

For your attention...**Development of the lesson :**

- Engage students in the above activity with geometrical shapes such as square, equilateral triangle, parallelogram, rhombus and circle and let them find whether they have rotational symmetry. Get them to mark the center of rotation.
- Direct them to find and write the order of rotational symmetry.
- Give them a set of plane figures that includes figures with 1, 2 and 3 axes of bilateral symmetry. In case of figures with rotational symmetry, let them find the order of symmetry and the number of axes of symmetry and ascertain a relationship between them. Through this, let them have an opportunity to acquire the learning outcomes 4 and 5.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 11 in the textbook.

For further study :

- <https://www.youtube.com/watch?v=UzMa6GnMnzg>
- <https://www.youtube.com/watch?v=xVYa9orJv08>

12. Triangles

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

Competency Level 23.1: Inquires into the relationships between the various angles of rectilinear plane figures.

Number of Periods: 06

Introduction:

This section intends to show that the sum of interior angles of a triangle is 180° and the sum of four interior angles of a quadrilateral is 360° . This lesson also seeks to develop the ability of identifying and drawing the exterior angles of a polygon and convincing through it the fact that the sum of the exterior angle and the interior angle of a polygon is equal to 180° . This lesson also includes the calculations related to interior and exterior angles of convex polygons. Since the theorem 'The sum of the three interior angles of a triangle is 180° ' is used in many geometry lessons that are come across in future, it is important to establish this section well in students.

Learning Outcomes for Competency Level 23.1:

1. Measures interior angles of a triangle to the nearest degree.
2. States that the sum of the three interior angles of a triangle is 180° .
3. Measures interior angles of a convex quadrilateral to the nearest one degree.
4. States that the sum the interior angles of a convex quadrilateral is 360° .
5. Identifies correctly the exterior angles of a plane polygon using diagrams.
6. Draws exterior angles by extending the sides of triangles and convex quadrilaterals.
7. Measures the exterior angles of a triangle and a quadrilateral to the nearest degree.
8. States that the sum of exterior and interior angles of triangles and quadrilaterals at any vertex is 180° .
9. States that the sum the exterior angles of a triangle and a convex quadrilateral are 360° .
10. Calculates the exterior angle relevant to a given interior angle of triangles and convex quadrilaterals.
11. Perform simple calculations related to interior angles of triangles and convex quadrilaterals correctly.

Glossary of terms:

Triangle -	ത്രികോණം	-	முக்கோணி
Polygon -	பெட்டி அளவு	-	பல்கோணி

Convex Polygon	-	උත්තල බහු අස්‍රය	-	குவி பல்கோணி
Interior angle	-	අභ්‍යන්තර කෝණය	-	அகக்கோணம்
Quadrilateral	-	චතුරස්‍රය	-	நாற்பக்கல்
Exterior angle	-	බාහිර කෝණය	-	புறக்கோணம்

Instructions to pan the lesson:

Given below is a specimen lesson plan proposed to be implemented through an activity and the lecture-discussion method to achieve the learning outcomes 1 and 2 under the competency level 23.1.

Time: 40 minutes

Quality inputs:

- Papers with the figure of acute-angled, right-angled and obtuse-angled triangles drawn on it(two copies)
- Two demy papers with enlarged figure of a triangle
- Copies of the activity sheet

Instruction for the teacher:

Approach:

- Recall that the sum of the angles of a point located on a straight line is 180° .
- Present a figure of a triangle to the students and remind students the naming of its interior angles.
- Discuss with students how the protractor is used to measure an angle.

Development of the lesson:

- Show an enlarged figure of a triangle and discuss about the sum of its three interior angles. State that it is 180° and tell that an activity is done to examine it.
- Give a copy of a activity sheet to each group.
- Divide students into six groups..
- Give a paper with the figure of an acute-angled triangle, right-angled triangle and obtuse-angled triangle to each group.
- When students are engaged in the activity help them use the protractor correctly.
- Paste the two demy papers with triangles on the blackboard.
- Let the students paste the information collected by the six groups on the demy papers centering the triangle.
- Showing the notes, conduct a discussion.
- Confirm that the sum of the three interior angles of a triangle is 180° . If the students haven't got 180° tell them that the reason for it is the errors of measurements and correct them.
- Discuss other features of the triangle too and propose a name for the triangle.
- Discuss with students the exercises such as finding the remaining angle of a triangle when the magnitude of two angles are known.

Activity sheet for the students:



- Examine well the triangle in the paper provided to you.
- Name that triangle. Measure each angle of that triangle and write their values.
- What is the sum of the three angles?
- Write all the special features of the triangle provided to your group.
- Taking the angles of the triangle given into consideration, write a special name for the triangle if possible.

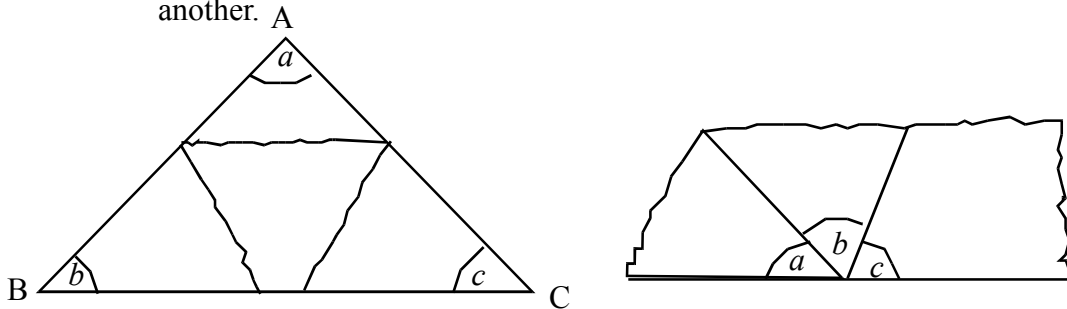
Assessment and Evaluation:

- Assessment criteria:
 - Identifies the interior angles of a triangle.
 - Accepts that the sum of the three interior angles of a triangle is 180° .
 - Measures the magnitude of an angle using the protractor correctly.
 - Names a triangle according to its angles.
 - Works cooperatively within the group.
- Direct the students to do the relevant exercises in lesson 12 of the textbook.

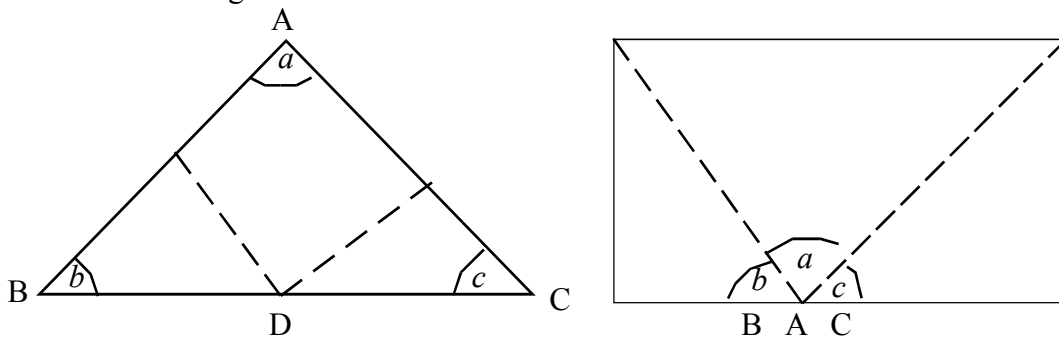
For your attention...

Development of the lesson:

- Discuss with students about the various methods which can be used to show that the sum of the three angles of a triangle is 180° without measuring the angle.
- By separating the angles and pasting them so that their arms touch one another.



- By folding so that all the three angles converge to a point on a side of a triangle.



- By a demonstration show that the above relationship is correct.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 12 in the textbook.

For further study:

- <http://www.youtube.com/watch?v=Ka82QC4QvGA>
- <http://www.youtube.com/watch?v=5CeBlu260Rw>
- <http://www.youtube.com/watch?v=inlMrf2d-k4>
- <http://www.youtube.com/watch?v=wPZla3SjPF0>
- <http://www.youtube.com/watch?v=Ncg1HB5uVLc>
- <http://www.youtube.com/watch?v=jRrRqMJbHKc>

13.Fractions I

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

Competency Level 3.1: Manipulates units and parts of units under multiplication.

Number of Periods: 06

Introduction:

In grade 6 and 7 students have identified proper fractions, improper fractions and mixed numbers and have learnt to add and subtract them. Multiplication of a fraction by a whole number can be described as a repeated addition. When two fractions are multiplied, their numerators and denominators should be multiplied separately. When a mixed number is multiplied by a whole number or another mixed number, that mixed number is converted to an improper fraction and multiplied.

Learning Outcomes for Competency Level 3.1:

1. Describes the method of multiplying a fraction by a whole number by repeated addition.
2. Multiplies a fraction by a whole number.
3. States that numerator and denominator have to be multiplied separately when two fractions are multiplied.
4. Multiplies a fraction by another fraction.
5. Multiplies a mixed number by a fraction.
6. Multiplies a mixed number by a mixed number.

Glossary of terms:

Fraction	-	பாரச	-	பின்னம்
Improper fraction	-	வீசம பாரச	-	முறைமையில்லாப் பின்னம்
Mixed number	-	மீசு சண்டல	-	கலப்பு எண்
Whole number	-	பூர்ண சண்டல	-	முழுஎண்
Denominator	-	பரச	-	பகுதி எண்
Numerator	-	லரச	-	தொகுதி எண்

Instructions to pan the lesson:

A specimen lesson plan designed to be implemented through a group activity and guided inquiry method for developing in students the subject concepts relating to the learning outcome 1 under the competency level 3.1 is given below.

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet

Instruction for the teacher:

Approach:

- Recall students the following simplifications they have learnt in grade 6 and 7

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

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

$$\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{4}{5}$$

- Using the example such as the following remind that

2 times 1 is 1×2 and

3 times 2 is 2×3

Development of the lesson:

- Group the students as appropriate and give each group a copy of the activity sheet.
- Draw students attention to the first part of the activity sheet.
- In the light of the first part, get them to complete the second part.
- After completion of the task , explain that multiplication of a fraction by a whole number is the repeated addition of that fraction a number of times equal to the multiplier.
- Use example such as

$$\frac{2}{3} \times 2 = \frac{2}{3} + \frac{2}{3} \text{ and}$$

$$\frac{3}{5} \times 4 = \frac{3}{5} + \frac{3}{5} + \frac{3}{5} + \frac{3}{5} \text{ for this}$$

Activity sheet for the students:

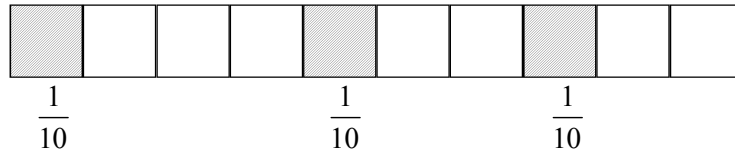


$$5 + 5 + 5 = \text{three times } 5$$

$$\text{three times } 5 = 5 \times 3$$

$$\text{Therefore } 5 + 5 + 5 = 5 \times 3$$

Examining this well, fill in the blanks of the following



According to the figure $\frac{1}{10} + \frac{1}{10} + \dots = \text{three } \frac{1}{10}$

$$\frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{1 + \dots + \dots}{10} = \frac{\dots}{10}$$

$$\therefore \text{Three } \frac{1}{10} = \frac{\dots}{10}$$

Further, three $\frac{1}{10} = \frac{1}{10} \times \dots$

$$\text{Therefore } \frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{1}{10} \times \dots$$

$$\cdot \quad \frac{1}{5} + \frac{1}{5} = \frac{1}{5} \times \dots$$

$$\cdot \quad \frac{2}{7} + \frac{2}{7} + \frac{2}{7} = \frac{2}{7} \times \dots$$

$$\cdot \quad \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \dots \times 5$$

Assessment and Evaluation:

- Assessment criteria:
 - Add a fraction repeatedly a given number of times.
 - Shows that the answer obtained by multiplying a fraction by a whole number and the answer obtained by adding the same fraction repeatedly a number of times equal to the multiplier are equal.
 - Accepts that multiplying a fraction by a whole number is adding that fraction repeatedly a number of times equal to the multiplier.
 - Gives reasons for the fact that the answer obtained by multiplying a fraction by a whole number is a fraction or a mixed number.
 - Works cooperatively within the group.
 - Direct the students to do the relevant exercises in lesson 13 of the textbook.

For your attention...**Development of the lesson:**

- Plan and implement a suitable activity to show that when multiplying two fractions, their numerators and denominators should be multiplied separately.
- Follow a suitable method to develop the subject concept relating to the multiplication of a fraction by a fraction.
- Also, follow a suitable method to develop the subject concept relating to the multiplication of a mixed number by a mixed number.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 13 of the text book.

For further study:

- <http://www.youtube.com/watch?v=4PlkCiEXBQI>
- <http://www.youtube.com/watch?v=XDjbNykJ28E>
- <http://www.youtube.com/watch?v=Yq9W6B7XnmU>
- <http://www.youtube.com/watch?v=CTKMK1ZGLuk>
- <http://www.youtube.com/watch?v=x6xtezhuCZ4>
- http://www.youtube.com/watch?v=KCehC_3CBBY
- <http://www.youtube.com/watch?v=yUYDhmQsiXY>
- <http://www.youtube.com/watch?v=YJgIGwTysk0>
- <http://www.youtube.com/watch?v=p729tFmpOXg>
- <http://www.youtube.com/watch?v=tfjQVtOyoaQ>
- <http://www.youtube.com/watch?v=RPhaidW0dmY>

14.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: Simplifies powers of a product using expansion.

Number of Periods: 06

Introduction:

Students have already learnt the manipulation of fractions under the mathematical operations addition, subtraction and multiplication. Here, a method is identified as to how fractions can be manipulated under the mathematical operation of division. For this, a method is developed taking into consideration the instances where the product becomes 1 when a number multiplied by another.

If the product is 1 when a number is multiplied by another, one number is the reciprocal of the other. The reciprocal of a fraction can be obtained by changing its numerator and denominator.

(e.g. $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$)

To get the reciprocal of a mixed number, first it is expressed as an improper fraction and then the reciprocal is obtained. Dividing a fraction by another is equivalent to multiplying the first by the reciprocal of the second. In this section division of proper fractions, improper fractions and mixed numbers is discussed using this method.

Learning Outcomes for Competency Level 3.2:

1. Identifies that the number by which another number should be multiplied to get 1 is its reciprocal.
2. Writes the reciprocal of a fraction.
3. Writes the reciprocal of a whole number.
4. Describes a method to divide fraction by using the property that the value obtained by dividing a number by it and the value obtained by multiplying that number by its reciprocal are equal.
5. Divides a fraction by a fraction.
6. Divides a fraction by a whole number.
7. Divides a whole number by a fraction.
8. Divides a fraction by a mixed number.
9. Divides a mixed number by a mixed number.

Glossary of terms:

Mixed Numbers	-	மீளும் எண்கள்	-	கலப்பு எண்
Reciprocal	-	புரக்கீழ்	-	நிகர்மாறு
Division	-	வகுத்தல்	-	வகுத்தல்
Multiplication	-	பெருக்கல்	-	பெருக்கல்
Numerator	-	உலக	-	தொகுதி
Denominator	-	பகுதி	-	பகுதி

Instructions to pan the lesson:

A specimen lesson plan designed with a group activity and discussion method to develop in students the subject concepts relevant to learning outcomes 1, 2, 3 and 4 under the competency level 3.2 is given below.

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet

Instruction for the teacher:**Approach:**

- By way of an example, remind how a fraction is multiplied by another fraction using previous knowledge. e.g. $\frac{3}{5} \times \frac{1}{3}$
- Recall, when multiplying fractions numerators and denominators are multiplied separately.
- Explain that a whole number can be written as a fraction whose denominator is 1. e.g. $5 = \frac{5}{1}, 7 = \frac{7}{1}$

Development of the lesson:

- Give one activity sheet to two students.
- Draw students attention to part I of the activity sheet.
- After completion of the task, put the answers on the board and show that they all are equal to 1. Ask about the positions of the numerator and denominator of the fractions multiplied to make the product 1.
- Show that the product becomes 1 when a fraction is multiplied by another fraction obtained by interchanging the positions of the numerator and the denominator of the first.
- Draw students' attention to part II of the activity sheet.

- After completion of the part II , write the answers on the board. Discuss with students that the answer when a number is divided by another can be obtained by multiplying that number by the reciprocal of the other. Confirm that, multiplying by the reciprocal can be used in place of division.
- Ask students, by what fraction , a fraction such as $\frac{5}{3}$ has to be multiplied to make the product 1. Write the answers on the board.
- Accordingly explain that if the product is 1 when a number is multiplied by another, one of them is the reciprocal of the other.

(e.g.Explain that $\frac{5}{3}$ is the reciprocal of $\frac{3}{5}$ and $\frac{3}{5}$ is the reciprocal of $\frac{5}{3}$)

- Explain that $\frac{1}{4}$ is the reciprocal of 4 and 4 is the reciprocal of $\frac{1}{4}$
- Considering the above facts, discuss and confirm that a reciprocal of a fraction can be obtained by changing its numerator and denominator.
- Hence, $10 \div 2$ is $10 \times \frac{1}{2}$. Show that this is multiplying 10 by the reciprocal of 2, which is $\frac{1}{2}$. Tell that this is used in future for the divisions of fractions.

Activity sheet for the students:



Part I

Find the value by filling the blanks.

- $\frac{2}{5} \times \frac{5}{2} = 1$
- $\frac{3}{4} \times \frac{4}{3} = \square$
- $\frac{6}{7} \times \frac{7}{6} = \square$
- $\frac{6}{1} \times \frac{1}{6} = \square$
- $\frac{2}{3} \times \frac{\square}{2} = 1$

Part II

Fill in the blanks.

- $10 \div 2 = \square$
- $10 \times \frac{1}{2} = \square$
- $6 \div 2 = \square$
- $6 \times \frac{1}{2} = \square$
- $8 \div \square = 2$
- $8 \times \square = 2$

vi. $\frac{3}{5} \times \frac{5}{\square} = 1$	vii. $10 \div 2 = 10 \times \square$
vii. $\frac{5}{9} \times \frac{\square}{\square} = 1$	viii. $12 \div 3 = 12 \times \square$
viii. $\frac{7}{10} \times \frac{\square}{\square} = 1$	ix. $24 \div 6 = 24 \times \square$
ix. $\frac{7}{1} \times \frac{\square}{\square} = 1$	

Assessment and Evaluation:

- Assessment criteria:
 - Writes a fraction relating to another so that the product is 1.
 - Accept that a number is the reciprocal of another if their product is equal to 1.
 - Accepts that the reciprocal of a fraction can be obtained by interchanging its numerator and denominator.
 - Writes the reciprocal of a given whole number.
 - Decide that a number can be multiplied by its reciprocal instead of dividing that number by other.
- Direct the students to do the relevant exercises in lesson 14 of the textbook.

For your attention...**Development of the lesson:**

- Plan and implement a suitable activity to show that division of a fraction by another fraction is equivalent to multiplying the first by the reciprocal of the other.
- Plan and implement activities relevant to division of a fraction by another fraction, division of a fraction by a whole number and division of a fraction by a mixed number.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 14 of the text book.

For further study:

- <http://www.youtube.com/watch?v=PQsgXNggV7Q>
- <http://www.youtube.com/watch?v=xoXYirs2Mzw>
- http://www.youtube.com/watch?v=yb7lVnY_VCY
- <http://www.youtube.com/watch?v=aNeCGxJVG7w>
- <http://www.youtube.com/watch?v=Mcm0Q3wGhMo>
- <http://www.youtube.com/watch?v=tnkPY4UqJ44>



15.Decimals

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

Competency Level 3.3: Manipulates decimal numbers under the mathematical operations of multiplication and division.

Number of Periods: 07

Introduction:

Decimals are used to indicate numerically a value between two consecutive whole numbers. A fractional number can be expressed as a decimal number and vice versa and equivalent fractions can be used for this.

This section aims to develop the ability of converting fractional numbers to decimals and vice versa, multiplying a whole number by a decimal number and vice versa, dividing a whole number by a decimal number and dividing decimal number by a decimal number.

When multiplying decimal numbers, the decimal number is converted to a proper fraction whose denominator is a number with powers of ten. Then the final answer can be obtained by converting to a decimal number the fractional answer obtained by multiplying fractions.

When dividing decimals, denominator and numerator are multiplied a number with powers of 10 as appropriate according to the number of decimal places in the decimal number. The required answer can then be obtained removing the decimal places in the denominator and simplifying.

In another method of dividing a decimal number by a decimal number, the two decimal numbers are written as a fraction with a denominator with a power of 10 followed by the method of dividing two proper fractions.

Learning Outcomes for Competency Level 3.2:

1. Converts decimals to fractions and fractions to decimals.
2. Describes multiplication of two decimals through multiplication of two fractions whose denominators are powers of ten.
3. Multiplies whole number by a decimal.
4. **Multiplies a decimal by a decimal.**
5. Describes the division of decimals using division of two fractions with denominators of powers of 10.
6. Divides a whole number by a decimal.
7. Divides a decimal by a decimal.

Glossary of terms:

Decimal numbers	- දශම සංඛ්‍යා	- தசம எண்கள்
Denominator	- හරය	- பகுதி
Numerator	- ලවය	- தொகுதி
Fraction	- භාගය	- பின்னம்
Conversion	- පරිවර්තනය	- வகுப்பு எல்லை

Instructions to pan the lesson:

Given below is a specimen lesson plan designed with a group activity design to develop in students the learning outcome 4 after the establishment of subject concepts relevant to learning outcomes 1, 2 and 3 under the competency level 3.3 .

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet
- Demy papers
- Markers

Instruction for the teacher:**Approach:**

- Write two decimal numbers such as 0.3 and 0.4 on the blackboard. Call two students and get them to write those numbers as fractions with a denominator of powers 10.
- Write an example such as 7×0.5 on the board and let another student work it.
- Involve other students in the discussion.
- Have the approach to the lesson asking students how to obtain the answer for a question such as 7×0.5

Development of the lesson:

- Group the students and distribute the copies of the activity sheet and other requirements.
- Direct them to work according to the instructions.
- After completion of the activity, let each group present the findings.
- Finally review how a decimal number can be multiplied by another decimal number and the answer is obtained.

Activity sheet for the students:

Example: $0.5 \times 0.25 = \frac{5}{10} \times \frac{25}{100} = \frac{125}{1000} = \dots\dots$

Get the answer for 0.5×0.25 by filling the blank of the above example.

- Examine well the four questions on multiplying decimals given to your group.
- Discussing within the group, write the given decimal number as fractions, simplify and write the answer as a decimal number.
- Write how the simplification was done separately in a demy paper.
- Except the way your group arrived at the answer, suggest another method to obtained the answer.
- Present the note of your group to the other students in the class.

Group 1	Group 2	Group 3	Group 4	Group 5
0.3×0.4	0.3×0.2	0.8×0.7	0.5×0.6	0.4×0.4
0.24×0.6	0.08×0.6	0.5×0.05	0.7×0.15	0.6×0.08
0.56×0.12	0.43×0.07	0.06×0.02	0.14×0.01	0.02×0.11
1.5×0.3	0.47×0.6	0.7×0.05	9.4×1.5	6.5×2.5

Assessment and Evaluation:

- Assessment criteria:
 - Writes decimal numbers as fractions correctly.
 - Obtained the correct fraction by multiplying fractional numbers.
 - Obtained the correct answer by multiplying two decimal numbers.
 - Test various methods of multiplying decimals and selects easy methods.
 - Present facts to validate the correctness of the solution.
 - Works cooperatively within the group.
- Direct the students to do the relevant exercises in lesson 15 of the textbook.

For your attention...**Development of the lesson:**

- Plan and implement a suitable activity or any other methods to reinforce the learning outcomes 4, 5, 6 and 7 in students.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 15 of the text book.

For further study:

- http://www.youtube.com/watch?v=GvgJ2_7P9SA
- <http://www.youtube.com/watch?v=cfr-yZxTH8Y>
- <http://www.youtube.com/watch?v=S0uuK7SQcA8>
- <http://www.youtube.com/watch?v=Nqts8zW8RxM>

16. Ratios

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

Competency Level 4.1: Uses ratios in day to day activities.

Competency Level 4.2: Solves problems constructing relationships between two ratios.

Number of Periods: 06

Introduction:

In many day to day activities we have to use our knowledge about ratios. The knowledge in ratios is applied in activities such as preparation of medicines and food stuffs, agriculture-related works, investment of money in business and distribution of profits. It keeps secure the quality of the products and fairness in business. In shared business affairs, problems of equity may arise when dividing dividends especially when the money contributed by the share holders and the periods of investment are different. As a solution for them, the amount of money and time are compounded. That means, the ratio according to which the dividends should be distributed among the share holders is decided by taking the product of the amount and time into consideration. In the manufacture of various products, their quality is ensured by mixing the ingredients according to a fixed ratio decided before. When solving problems related to ratios there instances where they should be written in the form of fractions. Though it is written like that it is not interpreted as a part of a unit. The ratio $a : b$ is written as $\frac{a}{b}$.

In this lesson we study the calculation of the whole amount and other quantities when the ratio among several quantities and amount of one of them is known. Also, we learn here that when the ratio between two quantities out of three are known how to get the compound ratio and solve problems related to it.

Learning Outcomes for Competency Level 4.1:

1. Denotes a ratio as a fraction and describes its definition..
2. Divides according to a ratio developed by compounding into two quantities.

Glossary of terms:

Compound ratios - සංයුක්ත අනුපාත - கூட்டுவிசிதம்

Instructions to pan the lesson:

Given below is a specimen lesson plan based on the guided inquiry method and design to develop in students the understanding and skills related to the subject concepts of the second learning outcome after reinforcing in them the subject concepts relating to the first learning outcome under the competency level 4.1.

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet (one for each group)

Instruction for the teacher:**Approach:**

- Display the following problem on the blackboard to revise division according to a ratio
- Find the amounts of money A, B and C receive when Rs.1500 is divided in the ratio A:B:C = 2:3:5
- Copy following table on the blackboard. Then complete the table inquiring into the previous knowledge of students.

Amount received by A (Rs)	Amount received by B (Rs)	Amount received by C (Rs)	Total sum divided (Rs)
2	3	5
2×.....	3×	5×	10×
.....	1500

- Explain how the constant value for multiplication is obtained by $\frac{1500}{10}$
- Discuss how the above problem is solved by writing as fractions.
- Explain that the amount received by A as a fraction is $\frac{2}{10}$ and how it is obtained.

Show that A receives a sum equal to $1500 \times \frac{2}{10}$. Compare with the answers obtained

by completing the above table and explain.

- State that the knowledge of ratios is used in partnerships to divide dividends. Approach the lesson by telling that this lesson inquires into how the dividends are divided.

Development of the lesson:

- Divided the students into three groups as appropriate and distribute a copy of the activity sheet of exercises among the groups.
- Say that all the groups should answer Part A of the exercise sheet and give an opportunity for the groups to answer part B
- Give guidance to students and assess them while they are engage in work.
- After completing the task, get each group to present the findings and conduct a discussion.
- Explain that in part A the amounts of money invested by the entrepreneurs and the periods of investment are equal, so it is fair to divide the profits equally.
- Explain that in the occasion B-1 , the amounts of money invested by the entrepreneurs are not equal, so it is unfair to divide the profits equally though the time is the same. Hence the profits are divided according to the ratio of the amounts invested.
- Explain that in the occasion B-2, the periods of investments are not equal through the amounts of money invested are equal, so it is unfair to divide the profits equally. Hence the profits are divided according to the ratio of the periods of investment.
- In the case of B-3, both the amount and period are not equal. So, explain how a ratio is created by multiplying the invested amount and the period of amount.

Activity sheet for the students:

- Pay your attention to part A of the exercise sheet provided to you and answer it discussing within the group.
- in part B pay attentions to the instances (1 and 2) given by the teacher and divide the profits between the two entrepreneurs answering the following questions.
 1. Are the amounts of money invested by the entrepreneurs are equal?
 2. Are the periods during which the monies contributed by the monies were utilized in the business equal?
 3. What is the period in month during which the amounts invested by the entrepreneurs were used for the business?
 4. Divide the profit between the two accordingly.
 5. Is it fair or unfair to divide the profit equally between the two in the case of b-3?
 6. If unfair,
 - What are the reasons for it?
 - Propose a suitable method to divide the profits.
- Get ready to present the group findings to the class.

Assessment and Evaluation:

- Assessment criteria:
 - Presets reasons logically with regard to fairness/unfairness of dividing profits in partnerships.
 - Accepts that it is reasonable to divide on the profit which an entrepreneur deserves according to the amount he invests and the period of investment.
 - suggests methods to divide profits fairly.
 - Applies the knowledge of ratios to divided the profits of the businesses.
 - Works activity in the group presenting the ideas and suggestions of self.
 - Works cooperatively within the group.
- Direct the students to do the relevant exercises in lesson 16 of the textbook.

For your attention...**Development of the lesson:**

- Plan and implement a lesson following a method appropriate for students for learning outcomes 1 providing suitable examples.
- Using a suitable methodology after learning opportunities for the learning outcomes relevant to competency level 4.2

Assessment and Evaluation:

- Prepare a puzzle or a pack of cards and engage students in exercises joyfully.
- Direct the students to do the relevant exercises in lesson 16 of the textbook.

For further study:

<https://www.mathsisfun.com/numbers/ratio.html>

- <https://www.khanacademy.org/math/pre-algebra/rates-and-ratios/proportions/v/introduction-to-ratios-new-hd-version>

Annex-1

Exercise sheet

Part A

Mr.Perera and Mr. Silva started a partnership each investing Rs.50 000. Is it fair to divide the profit of Rs. 40 000 obtained at the end of the year equally between the two? If not what are the reasons? According to your opinion, what is the profit each person is getting if the profit is divided between the two?

Part B

Case 1 : Mr.Dhanushka and Mr.Priyanyha started a business by investing Rs. 50 000 by Dhanushka and Rs.75 000 by Priyantha. At the end of an year, division of the profit of Rs.40 000 between the two.

Case 2: Mr.Kumar started a business by investing Rs.50 000. After 3 months Mr. Ganesh joined it ploughing in Rs.50 000. At the end of the year, division of the profit of Rs.40 000 between the two.

Case 3: Mr.Hussain started a business by putting in a capital of Rs.50 000. After 3 months Mr.Nuffiel joined it by investing Rs.75 000. At the end of the year, division of the profit of Rs.34 000 between the two.

17. Equations

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

Competency Level 17.1: Uses linear equations to solve problems.

Number of Periods: 05

Introduction:

An equation is constructed by indicating the equality of two mathematical expressions. An equation with one unknown of power one is a simple equation.

Finding the value which the unknown can take so that the relationship of the equation is satisfied is the solution of the equation. The value obtained by solving the equation is called the root or the solution of the equation.

Equations are frequently used not only in algebra but also under other themes of mathematics. The knowledge of solving equations is very important in learning other subjects such as science and economics excepts mathematics.

This section aims to develop the understanding about constructing equations of the type $ax + b = c$ and equations with a single pair of parentheses, to check the accuracy of the solution by substituting the value obtained and solve problems using the knowledge about simple equations. Both flow diagrams and algebraic methods can be used to solve equations. Axioms are used to solve equations. To remove the parentheses in an algebraic expression with parentheses, all the terms within the parentheses should be multiplied by the number outside the parentheses. When solving equations with fractional coefficients, it is easier to remove the denominators of the coefficient first. For this the equation is multiplied by the least common multiple of the denominators. The equation obtained can be solved later and the values of unknown can be found.

Learning Outcomes for Competency Level 17.1:

1. **Develops simple equations of the form $ax+b=c$ where $a,b,c \in \mathbb{Q}$ and $a \neq 0$.**
2. Develops a simple equation with one pair of parentheses.
3. Solves simple equations of the form $ax+b=c$.
4. Solves simple equations with one pair of parentheses.
5. Checks the correctness of the solution by substituting the answer in the simple equation.
6. Solves problems using the knowledge of simple equations.

Glossary of terms:

Simple equations	- සරල සමීකරණ	- எளிய சமன்பாடுகள்
Flow chart	- ගැලීම් සටහන	- பாய்ச்சற் கோட்டுப்படம்
Un known	- අඥාතය	- தெரியாக்கணியம்
Solution	- විසඳුම	- தீர்வு

Instructions to pan the lesson:

Given below is a specimen lesson plan that includes a students' activity with a group activity which can be carried out individually within the group to develop in students the subject concepts related to the first learning outcome under the competency level 17.1

Time: 40 minutes

Quality inputs:

- Copies of the students' activity sheet

Instruction for the teacher:**Approach:**

- recall that in grade 7 students have learnt how to construct and solve simple equations whose coefficient of the unknown is 1
- As they had learnt there already, discuss how the flow diagram $x \xrightarrow{+5} x+5$ and the equation $x+5=8$ were written in relation to the statement, when 5 is added to x , the answer is 8.
- Approach the lesson letting the students know that in this lesson, construction of simple equations that include multiplication of an unknown by a whole number are studied.

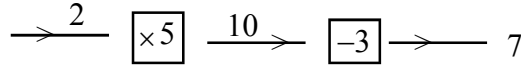
Development of the lesson:

- Discuss that the algebraic expression obtained with respect to the instruction, multiply the number x by 5 is $x \times 5$ and it is written as $5x$.
- Group the students, distribute the activity sheets and engage them in the activity so that they work individually.
- After completion of the task, display the answer sheets prepared by the groups and discuss about the correctness.

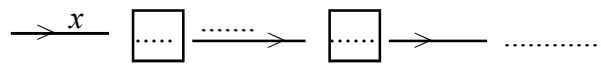
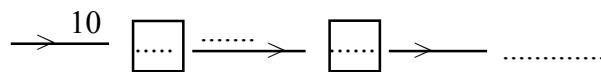
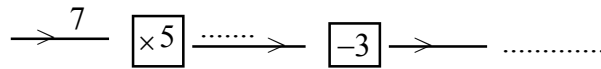
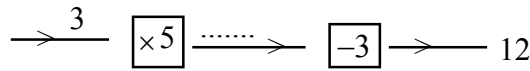
Activity sheet for the students:



- Given below is a flow diagram for the answer obtained by multiplying a number by 5 and subtracting 3. If the number is 2,



Accordingly fill in the blanks of the following flow charts.



- Write in the form of an equation, the algebraic expression and the answer obtained using the flow diagram for the statement 'when the number x is multiplied by 5 and 3 is subtracted the number is 32'.

Accordingly construct and write equations relevant to each of the following statements.

- When the number x is multiplied by 3 and 5 was added to it the answer is 23.
- When 7 is added to twice the number a , the answer is 15.
- When 10 is subtracted from five times the number p , the answer is 30.
- When the number y is divided 2 and 3 is added, the answer is 8.
- When the number m is multiplied by 3 and subtracted from 15, the answer is 2.

- Discuss about the answers obtained individually and prepare a common answer script for the group.
- Present the product to the class.

Assessment and Evaluation:

- Assessment criteria:
 - Writes the flow chart according to given instructions.
 - Constructs an equation combining the expression indicated by the flow chart and its answer.
 - Constructs equations relevant to the statements given.
 - Accepts that it is easy to write a given statement as an equation.
 - Works cooperatively and efficiently within the group.
- Direct the students to do the relevant exercises in lesson 17 of the textbook.

For your attention...**Development of the lesson:**

- Design appropriate activities and exercises to develop in students the learning outcomes 2, 3, 4, 5 and 6 in the competency level 17.1 and implement using interesting methods.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 17 of the text book.

For further study:

- <http://www.youtube.com/watch?v=KyHvVJWjW6Y>
- <http://www.youtube.com/watch?v=RGbA2lyJILY>
- <http://www.youtube.com/watch?v=W254ewkkMck>
- http://www.youtube.com/watch?v=bAUT_Pux73w
- <http://www.youtube.com/watch?v=pPqPj8CAPvl>
- <http://www.youtube.com/watch?v=DplUpe3oyWo>
- <http://www.youtube.com/watch?v=0UIrs9BgCS8>
- <http://www.youtube.com/watch?v=roHvNNFXr4k>
- <http://www.youtube.com/watch?v=xKH1Evwu150>
- <http://www.youtube.com/watch?v=f15zAOPhSek>
- <http://www.youtube.com/watch?v=CGS0vihzSlc>
- <http://www.youtube.com/watch?v=1c5HY3z4k8M>
- <http://www.youtube.com/watch?v=zKotuhQWIRg>
- http://www.youtube.com/watch?v=eTSVTTg_QZ4
- <http://www.youtube.com/watch?v=DqeMQHomwAU>
- <http://www.youtube.com/watch?v=9DxrF6Ttws4>
- <http://www.youtube.com/watch?v=tuVd355R-OQ>
- <http://www.youtube.com/watch?v=XoEn1LfVoTo>
- <http://www.youtube.com/watch?v=h9ZgZimXn2Q>
- <http://www.youtube.com/watch?v=PL9UYj2awDc>
- <http://www.youtube.com/watch?v=CJyVct57-9s>
- http://www.youtube.com/watch?v=a5uNoOnEy_A

18. Percentages

Competency 5: Uses percentages to make successful transactions in the modern world.

Competency Level 5.1: Develops the relationship between fractions, ratios and percentages.

Competency Level 5.2: Solves problems related to percentages

Number of Periods: 06

Introduction:

Modern world uses percentages for successful transactions. A fraction with a denominator of 100 is a percentage. The symbol for the percentage is % and as a fraction it is indicated as $\frac{1}{100}$. A ratio can also be indicated as a percentage. When indicating like that, it should be discerned in students that, first the ratio should be turned into a fraction. The fraction is then converted to an equivalent fraction with the denominator of 100 and then to a percentage. This section also aims expressing percentage as a ratio. Calculation of a percentage from a certain quantity when a percentage as a ratio are also discussed in this section.

Learning Outcomes for Competency Level 5.1:

1. Identifies basic characteristics of a percentage and writes fractions as percentages.
2. Writes percentages as fractions.
- 3. Writes a ratio as a percentage.**
4. Writes a percentage as a ratio

Glossary of terms:

Percentages	-	புகினை	-	சதவீதம்
Ratio	-	அனுபாபை	-	விகிதம்
Fractions	-	பாபை	-	பின்னம்

Instructions to pan the lesson:

Given below is a specimen lesson plan designed with a group activity to develop in students the learning outcome 3 after reinforcing in them the learning outcomes 1 and 2 relating to the competency level 5.1

Time: 40 minutes

Quality inputs:

- The enlarged (10×10) grid (as in annex 1)
- Copies of the students' activity sheet

Instruction for the teacher:


Approach:

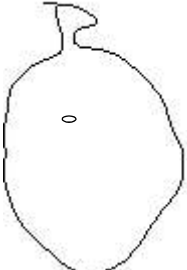

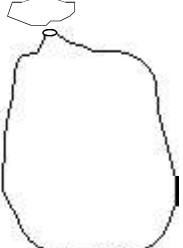
- Show the enlarged grid to the students and say that the fraction represented by one square is $\frac{1}{100}$.
- Discuss with students that
 - $\frac{1}{4}$ th the area of the grid is $\frac{25}{100}$ by the number of squares.
 - The relationship between $\frac{25}{100}$ and $\frac{1}{4}$ are that they are equivalent fractions $\left(\frac{1}{4} \times \frac{25}{25} = \frac{25}{100}\right)$ as a ratio, the fraction $\frac{25}{100}$ can be written as a ratio 25 : 100; as a percentage $\frac{25}{100}$ can be written as 25%.

Development of the lesson:

- Divide the students into groups as appropriate.
- Distribute an activity sheet to every group and engage the students in the activity.
- After completion of the activity, inquire into the ideas of the groups and remind again how a ratio is written as a ratio. Engage the students in extra exercises to see whether the subject concept learned is established.

Activity sheet for the students:



Saman	Ganesh	Mohammed
		
3 : 5	6 : 10	

• The above figure shows the ratio of raw and ripe mango three merchants. Using the above data complete the following table.

	Saman	Ganesh	Mohammed
1. The ratio of raw mangoes and ripe mangoes with the merchants.	3 : 5	6 : 10	<input type="text"/>
↓	↓	↓	↓
2. Ratio as a fraction	$\frac{3}{5}$	<input type="text"/>	<input type="text"/>
↓	↓	↓	↓
3. Making as an equivalent fraction with the denominator 100	$\frac{3 \times 20}{5 \times 20}$	<input type="text"/>	<input type="text"/>
↓	↓	↓	↓
4. Equivalent fraction with the denominator 100	$\frac{60}{100}$	<input type="text"/>	<input type="text"/>
↓	↓	↓	↓
5. Percentage	60%	<input type="text"/>	<input type="text"/>
<p>• Write the ideas of your group about the steps you followed when writing as a percentage the ratios of raw and ripe mango fruits possessed by the merchants.</p>			

Assessment and Evaluation:

- Assessment criteria:
 - Writes ratios as percentages.
 - Accepts that in day to day life there are occasions where ratios have to be written as percentages.
 - Solves problems seeing the relationship between ratios and percentages.
 - Works cooperatively within the group.
 - Expresses ideas correctly within the group.
- Direct the students to do the relevant exercises in lesson 18 of the textbook.

For your attention...

Development of the lesson:

- Plan and implement a suitable methods to develop the subject concepts related to the learning outcome 4 under the competency level 5.2

Assessment and Evaluation:

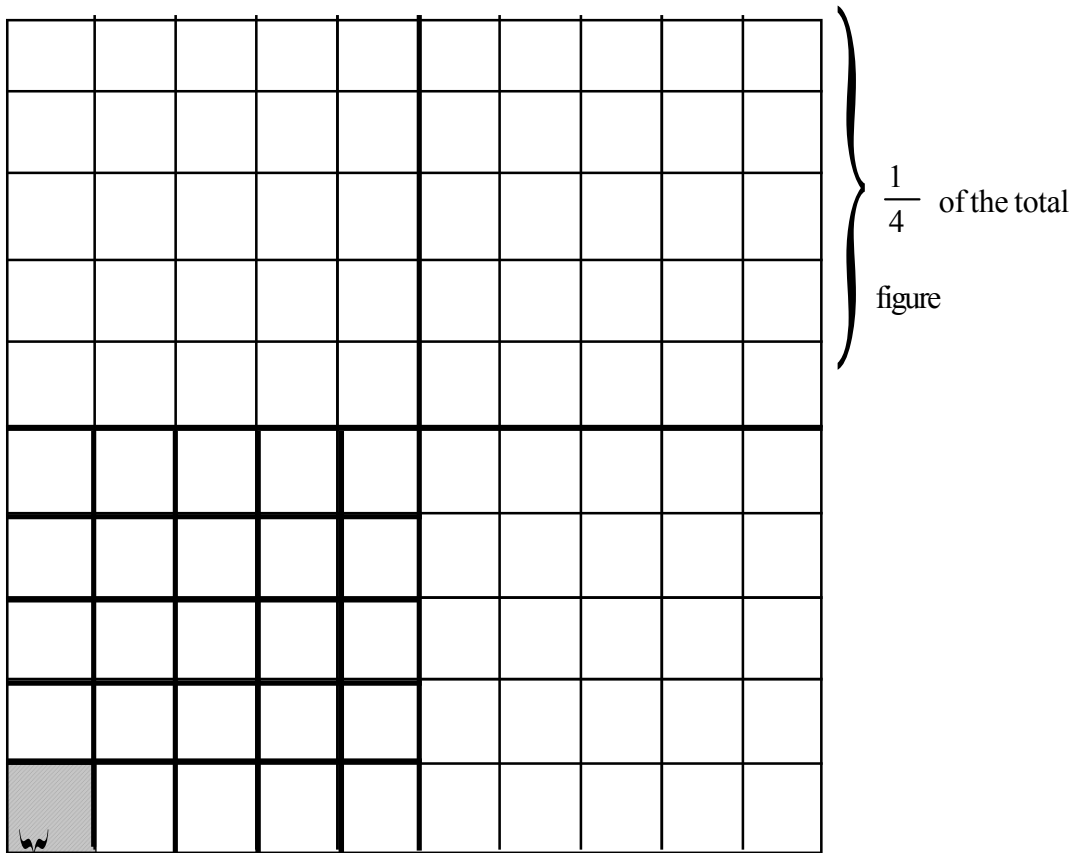
- Direct the students to do the relevant exercises in lesson 18 of the text book.

For further study:



- <http://www.youtube.com/watch?v=FSpSrZQzzVs>
- <http://www.youtube.com/watch?v=xEDnwEOOf7Y>
- <http://www.youtube.com/watch?v=JaScdH47PYg>
- <http://www.youtube.com/watch?v=AjYil74WrVo>
- <http://www.youtube.com/watch?v=Llt-KkHugRQ>
- http://www.youtube.com/watch?v=SpE4hQ8D_o
- http://www.youtube.com/watch?v=4oeolOan_h4
- <http://www.youtube.com/watch?v=TvSKeTFsaj4>
- <http://www.youtube.com/watch?v=N4kDzoQOngY>
- http://www.youtube.com/watch?v=DAikW24_00A
- <http://www.youtube.com/watch?v=d1oNF88SAgg>
- <http://www.youtube.com/watch?v=1LtBcfk1uHg>
- <http://www.youtube.com/watch?v=LRKMoqrMbGw>
- <http://www.youtube.com/watch?v=gKywkLHV6Ko>
- <http://www.youtube.com/watch?v=-lUEWEEpml0>

Annex 1:



$\frac{1}{100}$ of the total figure

19. Sets

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

Competency Level 30.1: Analyzes the various relationships related to sets.

Number of Periods: 04

Introduction:

In set notation, the symbol \in indicate that a certain element belong to a given set and symbol \notin is used to indicate an element does not belong to a given set.

A null set is a set without any element and is symbolized by \emptyset or $\{\}$.

To indicate the number of elements in a set A, the symbol $n(A)$ is used.

Learning Outcomes for Competency Level 30.1:

1. Uses \in symbol to indicate that the element is an element of a given set.
2. Uses \notin symbol to indicate that an element is not an element of a given set.
3. Describes the null set with examples.
4. Uses symbols \emptyset or $\{\}$ to indicate an null set.
5. Uses $n(A)$ to indicate the number of elements of a set 'A'.
6. Solves problems related to set notation.

Glossory of terms:

Set	- කුලකය	- தாயம்
Null set	- அகிலுதாய கුலகய	- தாயவரிசை
Elements	- அலகல	- நிரை தாயம்
Number of elements of a set	-குலகக அலகல ஂவலல- நிரல் தாயம்	

Instructions to plan the lesson:

Given below is a specimen lesson designed on the basis of an activity carried out in pairs and lecture-discussion method to develop in students the subject concepts relating to the learning outcomes 3, 4 and 5 after reinforcing the concept relevant to the learning outcomes 1 and 2 under the competency level 30.1.

Time: 40 minutes

Quality inputs:

- Copies of the activity sheet

Instructions for the teacher:

Approach:

- Recall set notation. Explain the writing of the elements of a set within braces using an example.

Development of the lesson:

- Get the students grouped in pairs and engage them in the activity
- Give guidance to engage in the activity successfully giving necessary instructions. Tell that the last column of the table has to be completed after receiving teacher's instructions.
- After the students finish their work, conduct a discussion with them surfacing the following facts.
- Explain that a null set is a set without any element and it is symbolized by \emptyset or $\{\}$.
- Confirm in students that $\{0\}$ is not a null set.
- Ask students mathematical examples such as {multiple of 10 between 0 and 5} for null set.
- State that the symbol $n(A)$ is used to indicate the number of elements in the set A.
- Discuss the correct answers in the table with the students.

Activity sheet for students:



- Complete the following table taking into consideration the elements of the following set.
 1. A = Set of the colours of the rainbow
 2. B = Set of the multiples of 2 between 1 and 10
 3. C = Set of the multiples of 10 between 5 and 10
 4. D = Set comprising the first 10 letters in the English alphabet.
 5. E = Set of even digits used to write the number 13573
 6. F = Set of integers between -1 and 1
 7. G = Set of positive whole numbers below 10
 8. H = Set of odd digits used to write the number 2468
 9. I = Set of letters used to write the word "Colombo"

11. $K =$ Set of prime numbers less than 2

Set	Elements written within braces	Number of elements	Elements
1.A	$A = \{\text{violet, indigo, green, blue, yellow, orange, red}\}$	7	$n(A) = 7$
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			

- Is there any set without any element among the sets you have got?
- Write those sets separately.
- Propose a special name for these sets.

Assessment and Evaluation:

- Assessment criteria :
 - Writes the number of elements in a set described in words while writing the elements within braces.
 - Differentiates the sets without any element from a given group of sets.
 - Accepts the set without elements as the null set.
 - Writes a null set in symbols.
 - Writes the number of elements in a set using symbols.
 - Acts fervently in the group.
- Direct the students to do the relevant exercises in lesson 19 in the textbook.

For further study:



• https://www.khanacademy.org/math/probability/independent-dependent-probability/basic_set_operations/e/basic_set_notation

• <https://www.mathsisfun.com/sets/sets-introduction.html>

20. Area

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

Competency Level 8.1: Finds the area of compound plane figures in the environment and has an awareness of the space allocated for them.

Competency Level 8.2: Fulfills daily needs by investigating the surface area of various solids.

Number of Periods: 06

Introduction:

Area is the space of a surface surrounded by a boundary. When the measurements of the surface are given in centimeters, the unit of measurement of area is square centimeters (cm^2). When they are given in metres, the unit of area is square metres (m^2).

The area A of a square of side a units can be found by $A = a^2$ square units whereas the area (A) of a rectangle of length a and width b can be found using $A = a \times b$ square units. The area of rightangled triangle is exactly half the area of the rectangle drawn using the two sides forming the rightangle the adjacent sides of the rectangle. Here attention is paid to the fact that the area of any triangle can be found using the formula, area = $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$. Hence it is expected to find the area of a triangle when the base and perpendicular height are given and vice versa.

Attention has also been paid to find the area of compound plane figures formed by the compounding of two similar or dissimilar shapes of triangles, squares and rectangles. The compound plane figures can be divided into triangles, squares or rectangles as appropriate and the area of each of those plane figures can be found.

The lesson also aimed to find the surface area of a cube and cuboid. A cube has six equal faces. The surface area of a cube can be found by multiplying the area of one face by six. A cuboid has three pairs of similar faces. Its area can be found by multiplying the sum of the areas of three dissimilar faced by two. The surface area of a cuboid of length a , width b and height c is given by $2(ab+bc+ca)$

Learning Outcomes for Competency Level 8.1:

1. Finds the area of a right- angled triangle based on the area of a rectangle.
2. Accepts that area of any triangle can be calculated by $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$.

3. Finds the area of a triangle using the formula.
4. Solves problems relating to the area of a triangle.
5. Accepts that compound plane figures have to be divided into appropriate parts when its area is calculated.
6. Finds the area of compound plane figures consisting of plane figures triangles, squares and rectangles similar or dissimilar.

Glossary of terms:

Area	-	வரம்பளவு	-	சமனிலிகள்
Triangle	-	திரிகோணம்	-	தீர்வுத் தொடை
Right triangle	-	சுழுகோண திரிகோணம்	-	சமனிலிகள்
Base	-	அடிக்கோடு	-	தீர்வுத் தொடை
Altitude	-	உயரம்	-	தீர்வுத் தொடை
Rectangle	-	சுழுகோணவடிவம்	-	தீர்வுத் தொடை
Square	-	சமவகுவடிவம்	-	தீர்வுத் தொடை
Cube	-	கனம்	-	தாடை
Cuboid	-	கனவடிவம்	-	தாடை
Compound Solids	-	கூடுதல் கனவடிவம்	-	தாடை

Instructions to plan the lesson:

A specimen lesson envisaging an individual activity that can be performed in a group under the teacher's guidance to develop in students the subject concept relevant to the first learning outcome under the competency level 8.1 is given below.

Time: 40 minutes

Quality Inputs:

- Kits of rightangled triangles cut from thick cardboard conforming to the measurements given in right triangles in the activity sheet. (one kit for each group)
- A copy of the activity sheet

Instructions for the teacher:

Approach:

- Find the area of some sketches of squares and rectangles drawn on the blackboard.
- Discuss about the diagonals of squares and rectangles.
- Discuss that a diagonal divides a rectangle into two equal parts. Get from the students that the resulting triangles are rightangled triangles.

Development of the lesson:

- Divide the class into groups appropriately.
- Distribute the kits of plane figures prepared and activity sheets to the groups and engage the students in the activity.
- After the students complete the activity, ask the students about the results.
- Making use of the students' findings surface the fact that the area of a rightangled triangle is half the product of the two sides forming the rightangle.

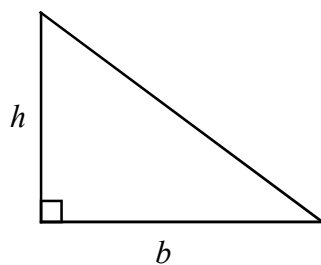
Activity sheet for the students:

- Select two equal triangles from the sets of rightangled triangles provided to your group. Ensure that the two triangles are identical by coinciding them.
- Make a rectangle using those two triangles.
- Calculate the area of the rectangle.
- Using the area of the rectangle made, obtain the area of one rightangled triangle.
- Select another pair of identical rightangled triangles. Ensure their similarity by coinciding. Construct a rectangle, calculate its area, and thereby find the area of a rightangled triangle.
- Write a relationship to find the area of a rightangled triangle in terms of the length of the sides forming its rightangle.
- Make rectangles using the rightangled triangles; find the area of each rightangled triangle and complete the table.



Rightangled triangle	Rectangle	Area of the rectangle	Area of the rightangled triangle

•



- Derive a relationship to find the area of the above rightangled triangle without making a rectangle.

Assessment and Evaluation:

- Assessment Criteria:
 - Construct a rectangle using two identical rightangled triangles.
 - Calculate the area of the rectangle.
 - Accepts that the area of a rectangled triangle is exactly half the area of the rectangle.
 - Builds up the relationship that the area of a rightangled triangle is half the product of the two sides that include the rightangle.
 - Works cooperatively in the group.
- Direct the students to do the relevant exercises in lesion 20 in the textbook.

For your attention . . .**Development of the lesson:**

- Plan and implement suitable activities with teacher demonstrations to develop the subject concepts relating to the learning outcomes from 2 to 6 relevant to the competency level 8.1.
- Plan and implement suitable methods to achieve the learning outcomes relevant to the competency level 8.2.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 20 in the textbook.

For further study:

- <http://www.youtube.com/watch?v=kqqmJiJez6o>
- <http://www.youtube.com/watch?v=YOYQys52sPs>
- <http://www.youtube.com/watch?v=YTRimTJ5nX4>
- <http://www.youtube.com/watch?v=UKQ65tiIQ6o>
- <http://www.youtube.com/watch?v=LoaBd-sPzkU>
- http://www.youtube.com/watch?v=b8q6i_XPyhk
- <http://www.youtube.com/watch?v=7S1MLJOG-5A>
- <http://www.youtube.com/watch?v=vWXMDIazHjA>
- <http://www.youtube.com/watch?v=vaOXkt7uuac>
- <http://www.youtube.com/watch?v=BJSk1joCQsM>
- <http://www.youtube.com/watch?v=I9eLKDbc8og>

21. Time

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

Competency Level 12.1: Investigates the rotation of the earth and inquires into its results.

Competency Level 12.2: Investigates the difference in time between countries and finds their relative positions.

Number of Periods: 06

Introduction:

Earth takes a spherical shape. It is located in the solar system with an inclination of $23\frac{1}{2}^{\circ}$ to the vertical. The earth which rotates around its own axis and revolves round the sun takes 24 hours for one rotation and 365

days, 5 hours, 8 minutes and $47\frac{1}{2}$ seconds to complete a revolution around

the sun. The earth is divided into northern and southern hemispheres by an imaginary line called the equator. The imaginary lines parallel to the equator are latitudes. The imaginary lines drawn from the north pole to south pole of the globe are longitudes. The longitude passing through the Greenwich city in England is assigned 0° and the other longitudes falling to the West and East of it have been assigned the due degrees. This 0° line is called the Greenwich Mean Time (GMT). The location of a country can be described in terms of the latitudes and longitudes. Since the earth takes 24 hours to complete one rotation, the time spent to spin through a single longitude is

$\frac{24 \times 60}{360} = 4$ minutes. The region of 15° between $7\frac{1}{2}^{\circ}$ from the Greenwich

Mean Time on both sides is identified as the 0 time zone. Other time zones are separated as +1, +2, +3, Up to +12 to the east and -1, -2, -3, up to -12 to the west. As 1° longitude corresponds to 4 minutes one time zone corresponds to $4 \times 15 \text{ minutes} = 1 \text{ hour}$.

Time in various countries of the world at the same time is decided using these time zones. A fact to be considered here is that one day is completed with the elapse of 24 hours. At that moment, a new day dawns for that country. When the 180° longitude or International Date Line (IDL) is crossed, the date changes by one day without changing the time.

Travelling from west to east result in a decrease in one day whereas travelling from east to west brings about an increase in one day. This lesson inquires into the change in time in different countries at the same moment along with the above facts.

Learning Outcomes for Competency Level 12.2:

1. Identifies that completion of 24 hours and passing the International Date Line are the events that change the date when setting up standard time of each country compared to Greenwich Mean Time (GMT).
2. Obtains the time, date and the day of other countries compared to the standard time given for any country according to its location.

Glossory of terms:

latitudes	- அக்தாண்ட	- வட்டநாற்பக்கல்
Longitudes	- டீளாண்ட	- எதிர்க்கோணங்கள்
Greenwich Mean Time	- ட்ரீனிசி மடயாண்ட டீல	- மிகைநிரப்பி
International Date Line	- சாதுண்ட டீல டீல	- புறக்கோணம்
Times Zones	- காட கலாச	- ஏறிகள்

Instructions to plan the lesson:-

Given below is a specimen lesson designed as an outdoor activity to develop the learning outcomes 1 and 2 relating to the competency level 12.2 after the students understand well the Greenwich Mean Time and time zones under the competency level 12.1.

Time: 40 minutes

Quality Inputs:

- 26, 12cm x 10cm cards prepared as per the table in annex 1
- 26 cards, size 8cm x 8cm to represent the time zones -12, -11, ..., 0, +12 including $5\frac{1}{2}$
- Map in annex 2
- Pins to fix the cards

Instructions for the teacher:**Approach:**

- Recall that the globe spins around its axis and revolves around the sun and the revolution occurs from west to east, so a country located eastwards relative to a country on the west can view sunrise early.
- Recall the same time does not prevail in all the countries at the same moment and it poses a problem. As a solution to this imaginary time zones and international Date line are used in relation to the Greenwich Mean time.

- Recall that the difference between two adjoining time zones is one hour and there is an advancing of 1 hour going from one time zone to another from west to east. Take the students to a place outdoor and engage them in the following activity to identify how the time changes in different countries.

Development of the lesson:

- Select 26 students at most (Of this number of student is not available take the number whatever available)
- Let the students select a card randomly from a set of disorderly arranged cards in which the numbers from -2 to +12 are written.
- Ask the students to pin the number on their bust and tell them that they represent the corresponding time zone.
- Place the students in a circle in order and give each student a card given in annex I
- Get each student to tell the country to which he/she belongs and the time zone.
- Get the student in the “0” time zone representing the GMT to state a time and ask the others representing other time zones standing on either side to tell the time in respective countries at the same moment in order (Ignore the instances where the date changes)
- To highlight an instance where the date changes, get the students representing 0 time zone to state Sunday 22:00(GMT) and ask the others to state the time in the time zones +1, +2, +3 etc.
- In order to pick up the next occasion of change of date, get the student representing +9 time zone (Japan) to state the time 23:00 on Sunday. Ask the students how the time of the person in -8 time zone is obtained and get them to tell the time in +9, +10, +11, +12, -12, -11, -10, -9, and -8. Explain how the time changes when moving from west to east across the IDL. At that moment when one revolution is completed and on reaching the +9 zone again, confirm that the time is 23:00 Sunday.
- Get the student representing Sri Lanka to talk to any other of his choice and ask the time and any other representing to talk to any one of his choice and get the time.
- At the end of the activity complete any shortcomings using the map of time zones and countries given in annex II.

Assessment and Evaluation:

- Assessment Criteria:
 - Write the time of another country at a given moment according to GMT when the date doesn't change.
 - Writes the time of another country given the time of one country with the change in date.
 - State the date and time in a country on one side of the IDL given the date and time in a country on another side of the IDL at the same moment.
 - Accepts that if no change in date and time occurred when crossing the IDL, time in different countries of the world cannot be stated.
 - Acts fervently and cooperatively with commitment to make the activity a success.
- Direct the students to do the relevant exercises in lesson 21 in the textbook.

Practical applications . . .

- The adjustment of time is very important during air travel. During international flights when arriving at a country after the departure from another country, the time is adjusted to suit the new soil.

For your attention ...**Development of the lesson:**

- If you find that the students still struggle when converting times, help them individually using the map in annex 2 and the chart of time zones.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 21 in the textbook.

For further study:

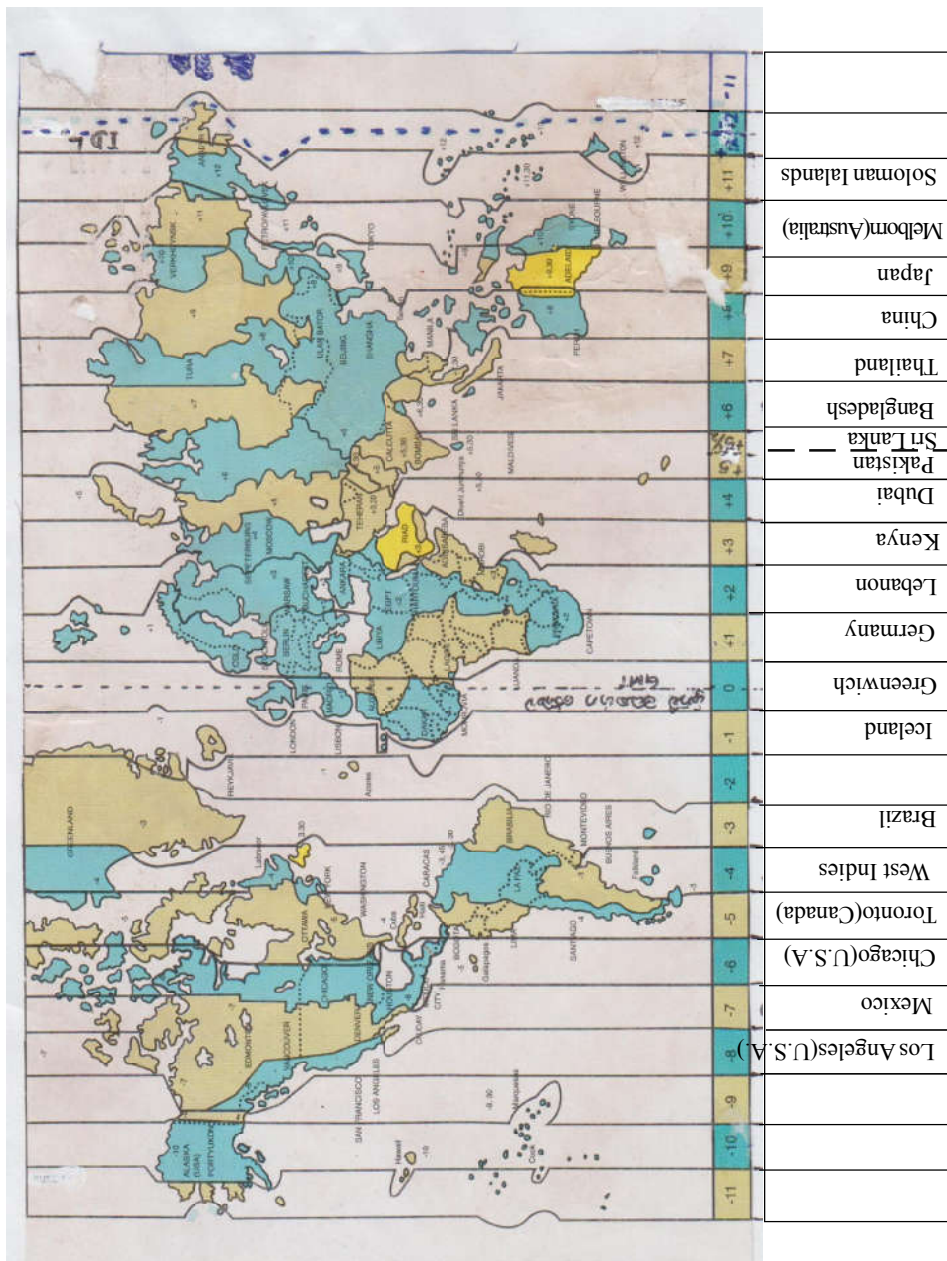
- <https://www.mathsisfun.com/time-zones-world.html>

Annex I

Time zone	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+5 1/2	+6	+7	+8	+9	+10	+11	+12
Country			Honolulu (U.S.A)		Los Angeles (U.S.A)	Mexico	Chicago (U.S.A)	Toronto (Canada)	West Indies	Brazil		Iceland	Greenwich	Germany	Lebanon	Kenya	Dubai	Pakistan	Sri Lanka	Bangladesh	Thailand	China	Japan	Melbourn (Australia)	Soloman Islands	Newzealand

Annex II

Standard Time



22. Volume and Capacity

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

Competency 11: Works critically with the knowledge of liquid measures to fulfill daily needs.

Competency Level 10.1: Determines for daily needs, the space that is taken up by various solids.

Competency Level 11.1: Facilitates daily work by investigating the capacity of liquid containers.

Number of Periods: 06

Introduction:

The space taken by a given solid object is called the volume of that object. There may be solid objects with the same volume but with different shapes.

The international unit of volume is cubic metre (m^3). The quantity of space occupied by a cube 1m long, 1m broad and 1m height is 1m^3 .

$$1\,000\,000\text{ cm}^3 = 1\text{m}^3$$

The units cubic foot and cube are also in common usage.

$$100\text{ cubic feet} = 1\text{ cube}$$

The volume of a cube with a side of a units in length is given by the formula a^3 whereas the volume of a cuboid of a length a , width b and height c can be given by the formula abc .

The quantity of a liquid required to fill a container completely is known as its capacity. Litre (l) is international unit of capacity.

$$1000\text{ ml} = 1l$$

Giving an approximate value by experience about the quantity of a liquid that can be contained by a given vessel, that means estimating capacity, is very useful for day to day life.

This section aims to impart the ability of deriving formulae to find the volume of cubes and cuboids, calculating the volume using those formulae, understanding the concept of capacity and estimating capacity.

Learning Outcomes for Competency Level 10.1:

1. States that the volume of a cube with side length a can be found by a^3 .
2. Calculates the volume of a cube using the formula.
3. Solves problems related to the volume of a cube.
- 4. States that volume of a cuboid can be found by abc when length, width and height are a , b and c respectively.**
5. Calculates the volume of a cuboid using the formula.
6. Solves problems related to cuboids.
7. Solves problems related to the volume of cubes and cuboids.

Glossary of terms:

Cube	- கனகய	- வட்டம்
Cuboid	- கனகா஑ய	- ஆரை
Volume	- பரிமாவ	- தொடலி
Capacity	- ஡ாரீகாவ	- செங்குத்து
Formula	- ஐனுவ	- மையம்

Instructions to plan the lesson:

Given below is a specimen lesson plan based on a group activity to achieve the learning outcome 4 after developing the subject concept relating to learning outcomes 1, 2 and 3 under the competency level 10.1.

Time: 40 minutes

Quality Inputs:

- A prepared cube of side 4cm with a lid.
- 8 cuboids of volume 50cm^3 with different dimensions with lengths, breaths and height in whole number measurements in cm (better if transparent)
- Copies of the activity sheet.
- Centicubes.

Instructions for the teacher:**Approach :**

- Explain that the space occupied by a solid object is known as its volume.
- Explain that the international unit of measuring volume is the cubic metre but in some instances cubic centimeter can also be used.
- Display a centicube and show that its volume is 1 cm^3 .
- Get the students to fill the lidless, transparent cube with centicubes orderly and explain its volume in relation to the number of centicubes.
- Highlight the need of an easy method to find the volume using the length, width and height and direct the students for the activity.

Development of the lesson:

- Divide the students into four groups.
- Distribute to each group a copy of the activity sheet, 50 centicubes and two cuboids made.
- Engage the students in the activity according to the activity sheet.
- After step 1 of the activity sheet, surface the fact that the volume of the cuboid = length \times width \times height.
- After completion of the group activity, give an opportunity to present the students' findings. Evaluating them, derive the formula abc for the volume of a cuboid of length a , width b and height c .

Activity sheet for the students:

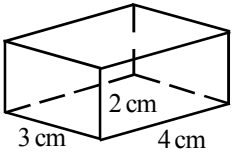
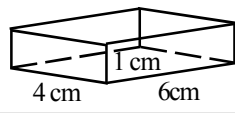
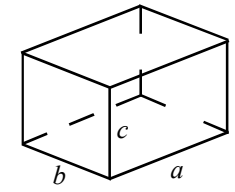
- Examine well the two cuboids provided to your group.
- Fill the two cuboids orderly with centicubes.
- Using the relevant number of centicubes, get the length, width and height and enter in the table given under step 1.
- Enter the volume of each cuboid in the table according to the number of centicubes filling each cuboid.
- Discuss within the groups whether the same value for the volume can be obtained by a relationship among the length, width and height.
- State the relationship identified by the group at the end of step 1 in the sheet.

- Then, in step 2, complete the table using the information given in figures.
- Present your finding to the whole class.

Step 1

Solid objects	length (cm)	width (cm)	height (cm)	volume of the solid object according to the number of centicubes needed to fill completely (cm ³)
1.cuboid 2.cuboid				

Step2

Cuboid	length	width	height	length × width × height	volume
					
					
					

Assessment and Evaluation:

- Assessment Criteria:
 - Identifies correctly and notes the data marked in a figure.
 - States the relationship among the length, width, height and volume of a cuboid.
 - Derives a formula for the volume of a cuboid.
 - Accepts that an understanding of the volume of substances is required when arranging them.
 - Accomplishes the task correctly according to instructions.

- Works cooperatively within the group.
- Direct the students to do the exercises in lesson 22 in the textbook.

Practical applications:

- Packing cube or cuboid shaped objects in rooms, boxes or other containers having the shapes of cubes or cuboids.
- Measuring liquids, distributing liquids and filling other containers with liquids.

Assessment and Evaluations:

- Direct the students to do the relevant exercises in lesson 22 in the textbook.

For further study:

- http://www.youtube.com/watch?v=daCT_24RnIY
- <http://www.youtube.com/watch?v=I9efKVtLCf4>
- <http://www.youtube.com/watch?v=OanPzjf2EYY>
- http://www.youtube.com/watch?v=o_Vt7J08PE4

23. Circle

Competency 24: Thinks logically to make decisions based on geometrical concepts related to circles.

Competency Level 24.1: Inquires into the special properties related to circles.

Number of Periods: 05

Introduction:

In previous grades the students have come to know the centre of a circle, its radius and diameter. This lesson expects to give an understanding about the chord, sector of a circle, segment of a circle and symmetry of a circle. A straight line joining any two points marked on a circle is a chord. If a line joining two points on a circle passes through a centre, that chord is called the diameter. Diameter is an axis of symmetry of a circle. Since there is an infinite number of diameters for a circle, there is an infinite number of axes of symmetry for a circle. The part of the circle marked between two points of a circle is called an arc. The region of a circle bounded by the radii and the relevant arc is known as a sector of the circle. The region of a circle bounded by an arc and the chord joining the two ends of the arc is segment of a circle.

Learning Outcomes for Competency Level 2.1:

1. Identifies a straight line connecting any two points marked on a circle as a chord.
2. Identifies a fragment of a circle in between two points marked on the circles as an arc.
3. Identifies the area surrounded by two radii and the respective arc as a sector.
4. Identifies the area of a circles surrounded by an arc and the chord which connects the two extremes of the arc as a segment.
5. Identifies that the axis of symmetry of a circle is the diameter of the circle and a circles has infinite number of diameters.

Glossary of terms:

Circle	- வாத்கட	- வட்டம்
Centre	- கைக்ட்டு	- ஓழுக்கு
Chord	- த்லாக	- சுற்றுவட்டம்
Arc of a circle	- வாத்க வாக	- சுற்றுவட்டம்
Sector of a circle	- கைக்ட்டு ககக்ட்டு	- ஁வ்வட்டம்
Segment of a circle	- வாத்க ககக்ட்டு	- வெளிவட்டம்
Symmetry	- ககக்ட்டு	- துாடலி
Infinite	- ககக்ட்டு	- துாடலி

Instructions to plan the lesson:-

Given below is a specimen lesson with a student activity involving the inquiry method prepared to develop the learning outcome 5 after establishing in students the subject concepts relating to learning outcomes 1, 2, 3 and 4 under the competency level 23.1.

Time: 40 minutes

Quality Inputs:

- A4 papers, pair of scissors, coloured pencils
- A large circular lamina cut from a paper for the teacher

Instructions for the teacher:**Approach:**

- Draw a circle using the compass on the chalk board and remind students about its centre and radius.
- Take the circular lamina, fold it through the centre and display the diameter to the students.
- Demonstrate that the length of the diameter is twice the length of the radius.
- Recall that straight line joining any two points marked on a circle is called a chord.

Development of the lesson:

- Group the students as appropriate, distribute the materials given under the quality inputs and engage them in the activity.
- Give an opportunity to present the students' findings.
- After the presentations, conduct a discussion surfacing all the facts. Recall the following in the discussion.
 - The longest chord of a circle is its diameter.
 - Diameter is an axis of symmetry of a circle.
 - Infinite number of such axes of symmetry can be drawn.

Activity sheet for the students:

1. Cut two circular laminae of radius 5cm using an A4 paper.
2. Name as O the centre of all the circular laminae.
3. Take a circle and draw several chords joining two points on the circle.
4. Drawing chords, find the largest chord you can draw. Draw it with a coloured pencil.
5. is the longest chord of a circle.
(complete the above sentences)
6. take the other circular lamina and fold it through the centre. Unfold and draw the folding line.
7. Does the circle divide into two equal halves by the folding line?
8. Fold several times like this and examine the symmetry. Draw the axes of symmetry obtained.
9. Discuss within the group about the number of axes of symmetry in a circle.
10. Paste your work on a demy paper and get ready to present it.

Assessment and Evaluation:

- Assessment Criteria:
 - Draw a chord of a circle correctly by joining two points on a circle.
 - Accepts that the diameter of a circle is the longest chord.
 - Identifies diameter as the axis of symmetry.
 - Concludes that a circle has an infinite number of axes of symmetry.
 - Works actively in the group.
- Direct the students to do the exercises in lesson 23 in the textbook.

Practical applications:

- In various creative works.
- When straightening a circle.

For further study:

- https://www.youtube.com/watch?v=fdi3moO_NdU
- <https://www.youtube.com/watch?v=cAOVS2DTU0U>

24. Location of a place

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

Competency Level 13.1: Indicates the location of a place using a direction.

Number of Periods: 03

Introduction:

Old legends say that the group of caravans crossing the deserts during night identified the direction by observing the patterns of constellation in the sky and reached their destination. Earlier, people used to identify east by the direction of sunrise and later north by the compass. Based on them, the main directions and sub directions were identified. From time to time various methods were introduced to identify the directions in between main directions and sub directions. Though direction could be indicated as to east or west taking north or south as the basis, it is not adequate to decide the direction. It was understood that there should be a specified distance for this. This lesson deals with locating such a position by means of direction and distance.

Learning Outcomes for Competency Level 13.1:

1. States that location of a place can be indicated based on North and South.
2. Describes the location of a place as from North to West, North to East, South to West and South to East etc.
3. Denotes the location of a place with first letters of the directions on both sides and the magnitude of the angle at the middle.
4. Draws the rough sketch using the distance and the direction for denoting the location of a place from a fixed point.

Glossary of terms:

Direction	- திசை	- தொடை
Distance	- தூர	- மூலகங்கள்
Location	- இடம்	- தொடைக்குறியீடு
Rough sketch	- தரவு வரைபடம்	- தொடைக்குறியீடு
Protractor	- கோணமானி	- தொடைக்குறியீடு

Instructions to plan the lesson:

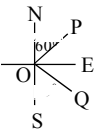
Given below is a specimen lesson plan that includes a practical activity to realize the learning outcomes 3 and 4 and experience the approximate idea of indicating a location presented through the learning outcomes 1 and 2 under the competency level 13.1 after their reinforcement in students.

Time: 80 minutes

Quality Inputs:

- Protractors shown in annex 1 and made by pasting on 20cm×20cm Styrofoam pieces 1/2" thick (one for each group)
- Drinking straws or ball point pen tubes(one for each group)
- Copies of the activity sheet
- Compasses (one for each group)

Instructions for the teacher:**Approach:**

- Draw a diagram showing the eight directions on the black board reminding that main directions and sub directions can be obtained using the direction of sunrise or the compass.
- Recall how north or south is used as the base when indicating the direction of a location except the four main directions and sub directions.
-  Recalling that the location of P from O is indicated as 60° from north to east (N 60° E) and that the location of Q is indicated as 60° from south to East (S 60° E), direct students to do the following activity to investigate how the locations of several points around a given point are marked in a rough sketch.

Development of the lesson:

- Divide the class into small group of four students.
- Take the students outdoor. Ask each group to carry a desk with flat top.
- Distribute to each group a copy of the activity sheet, protractor equipment and compass.

- Assign separate places for the groups and instruct each group to keep the protractor on the desk so that it aligns in the north- south directions identified with the compass.
- Give 5 points P, Q, R,S, T for students to observe. Two of them should be in the same directions.
- Tell the students that they will be assigned to find the location of the points of which two are in the same direction and they are required to draw a rough sketch of them taking the direction of location and distance into consideration. Ask them to measure the distance in paces where a pace is the distance between the two feet when one walks normally. Let the students engage in the activity.
- After the completion of the activity review the sketches made by the students and lead a discussion to show that the location of a place can be definitely indicated using direction and distance.

Activity sheet for the students:



- Keep the desk that the place assigned to you and place the compass on it. Identify north and draw the north - south line on the desk.
- Place the protractor on the desk so that line joining the north and south of the protractor coincides with the line drawn on the desk.
- Keep the protractor steady and pass the drinking straw through its wire loop. Observe each point assigned to you by the teacher through the straw and write its direction indicating the protractor angle from north/south to east/west as follows.
- N 40° E N 30° WS 40° E
- (N 40° E means 40° from north to east. S 25° W means 25° from south to west)
- Taking the distance between your feet in your normal walk as a pace, measure the distance to each point from the desk.
- Indicate your measurements in a table such as given below.

Observation point	Direction	Distance(paces)
P	-----	-----
Q	-----	-----
R	-----	-----
S	-----	-----
T	-----	-----

- Draw a rough sketch using the above information
- Discuss which measure helps identify the two points in the same direction
- Get ready to present your work to the whole class.

Assessment and Evaluation:

- Assessment Criteria:
 - State that in order to indicate the direction from one point to another at a distance, there should be a reference direction.
 - Indicates the directions of a point by the magnitude of the angle towards west or east based on north and south.
 - Accepts that both direction and distance are essential to locate a point.
 - Indicates the location of a given point on a rough sketch in terms of direction and distance.
 - Acts with group feeling and contributes to make the task a success.
- Direct the students to do the relevant exercises in lesson 24 of the textbook.

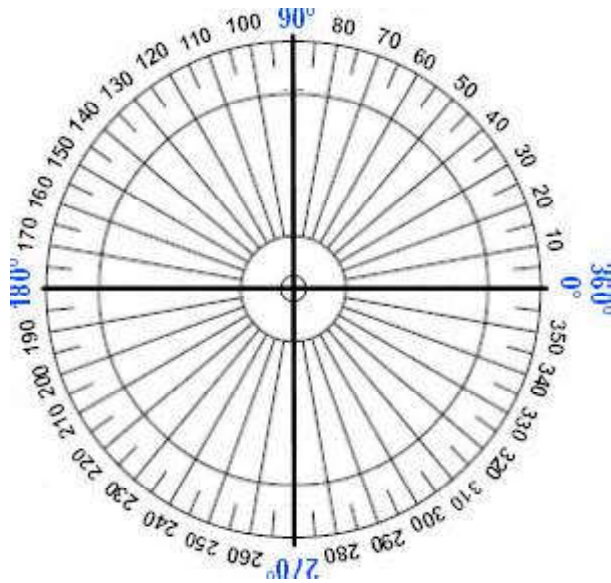
Practical Applications:

- This section is very important to obtain the essential measurements to draw the plan of a small plot of land.

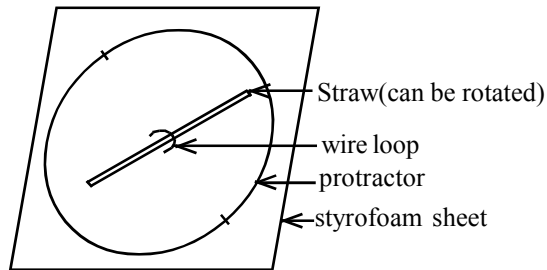
For further study:

- <https://www.youtube.com/watch?v=b7ZvpIF1jCk>
- <https://www.youtube.com/watch?v=pSNrrJ9ICP0>

Annex I



Protractor Apparatus



25. Number Line and the Cartesian Plane

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

Competency Level 20.1: Uses the number line to compare fractions and decimal numbers.

Competency Level 20.2: Illustrates the behavior of a variable pictorially.

Competency Level 20.3: Represents location on a Cartesian Plane.

Number of Periods: 09

Introduction:

Students have already learnt how to draw a number line and represent whole number on it. Competency level 20.1 expect to develop the ability of representing fractions and decimal with a single decimal place on the number line and comparing fractions.

The competency level 20.2 aims to develop the ability of marking closed and open intervals such as $x > a$, $x < a$, $x \geq a$, $x \leq a$ and $a \leq x \leq b$ on the number line. When marking an inequality such as $x < a$ on the number line, it should be stressed that point a shouldn't be shaded as it does not include $x = a$. Competency 20.2 also expects to promote the ability of writing algebraically an inequality represented on a number line.

Competency level 20.3 includes drawing a Cartesian plane with four quadrants, marking the point (x, y) where $x, y \in \mathbb{Z}$ and drawing the straight line graphs of the type $x = a$, $y = b$.

Learning Outcomes for Competency Level 20.3:

1. Draws the Cartesian plane including all four quadrants.
2. Marks the points $x, y \in \mathbb{Z}(x, y)$ on the Cartesian plane.
3. Writes a marked point on the Cartesian plane as an ordered pair.
4. Draws graphs of the form $x = a$, $y = b$ on the Cartesian plane where $a, b \in \mathbb{Z}$

Glossary of terms:

Cartesian co-ordinate plane - கார்டீசியன் ஆள்கூறுத்தளம் - தெக்காட்டின் ஆள்கூற்றுத்தளம்

Ordered Pairs - பரிபாலிதை யூதல் - சாரா நிகழ்ச்சி

Quadrant - வானை பாதக - காற்பகுதி

Instructions to pan the lesson:

Given below is a specimen lesson plan with an activity designed to develop in students the subject concepts relevant to the learning outcome 4 after reinforcing in students the subject concepts relating to the learning outcomes 1, 2 and 3 under the competencies 20.1, 20.2 and 20.3.

Time: 40 minutes

Quality inputs:

- An enlarged Cartesian plane for teacher demonstration
- Copies of the activity sheet (as required)

Instruction for the teacher:**Approach:**

- Ask how the points written as ordered pairs are marked on Cartesian plan.
- Conduct a discussion asking how a point marked on a Cartesian plane is written as an ordered pair.

Development of the lesson:

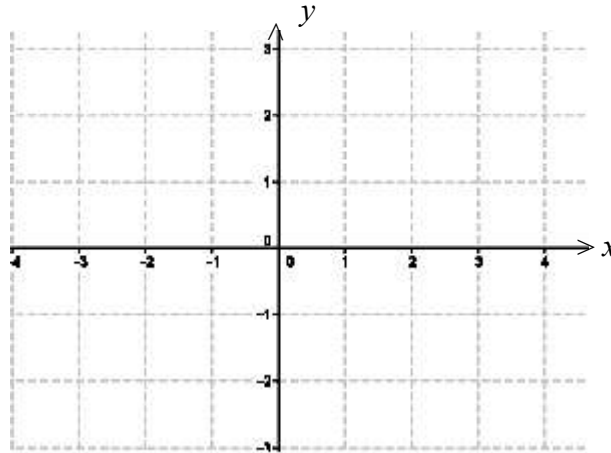
- Divide the students into groups as appropriate and distribute the copies of the activity sheet .
- Engage the students in the activity.
- After completion of the activity, let the students present their findings.
- Elicit from the students that when the coordinates are marked on the enlarged Cartesian plane and joined a straight line is obtained and the y-coordinate of any point on it is -3. Hence, that straight line can be called $y = -3$ line. Explain that line is parallel to x -axis. Therefore explain that any line of the type $y = b$ is parallel to the x -axis.
- State that similarly, when points are marked on the other Cartesian plane and joined in order a straight line is obtained and the x coordinate of any point on it 2. So, the straight line can be called $x = 2$ line and those lines are parallel to the y axis. Emphasize that any $x = a$ type line is parallel to the y axis.

Activity sheet for the students:



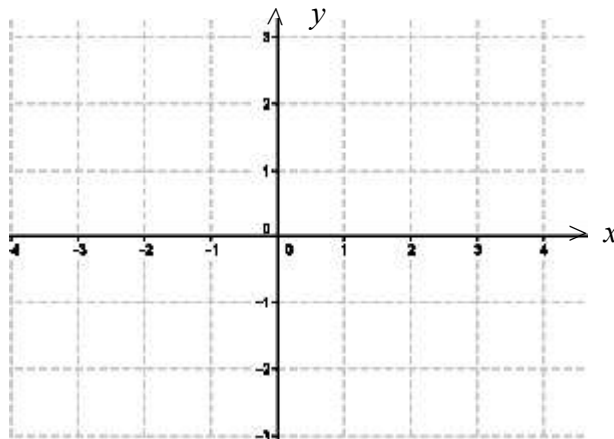
- On the cartesian plane provided to you, mark the points indicated by the following ordered pairs.

(a) $(-2, -3)$, $(-1, -3)$, $(1, -3)$, $(3, -3)$



- Joined the marked in respective order.
- Excepting the points you marked, write the coordinates of some other points located on the straight line.
- Observe those coordinates well. What can you say about the y coordinate of all those points?
- Accordingly name the straight line you drew.

(b) $(2, 4)$, $(2, 2)$, $(2, 0)$, $(2, -1)$, $(2, -3)$



- Mark the points as before and join them in order.
- Write the coordinates of some other points located on that straight line.
- Observe those coordinates well. What can you say about the x coordinate of every point?
- Name the straight line you drew.

Assessment and Evaluation:

- Assessment criteria:
 - Marks given points correctly on a cartesian plane.
 - Accepts that a straight line is obtained by joining points of equal x coordinates or y coordinates.
 - Responds clearly and correctly.
 - Decides on the equation of the line by examining the ordered pairs of the points marked on the straight line.
 - Works cooperatively within the group.
 - Direct the students to do the relevant exercises in lesson 25 of the text book.

For further study:

- <http://www.youtube.com/watch?v=N4nrdf0yYfM>
- <http://www.youtube.com/watch?v=VhNkWdLGpmA>
- <http://www.youtube.com/watch?v=5ctsUsvlp8w>
- <http://www.youtube.com/watch?v=1op92ojA6q0>
- <http://www.youtube.com/watch?v=Jeh5vudjmlI>
- <http://www.youtube.com/watch?v=b9H22F0Qbgw>

26. Construction of Triangles

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

Competency Level 27.1: Constructs the triangles using the awareness of necessary conditions for a triangle.

Number of Periods: 06

Introduction:

A triangle is a closed polygon bounded by three sides. In the set of polygons, triangle is the polygon with the lowest number of sides. This section discusses the need of the lengths of the sides of a triangle for its construction having introduced the three sides and the three angles as its conditions. This provides practical experience for it. The students are made aware about the construction of a triangle when the lengths of its three sides are given and at the end of this lesson, the students should be able to decide whether the three sides of known length given are sides of a triangle. In the future, more opportunities are offered to learn about triangles. This section focuses attention for construction of triangles given the lengths of three sides.

Learning Outcomes for Competency Level 27.1:

1. Identifies that the sum of lengths of two sides of a triangle is greater than the length of the remaining side.
2. Solves problems related to necessary conditions for the existence of triangle.
3. Creates the relevant triangle when the lengths of the three sides are given.

Glossary of terms:

Triangle	- த்ரிகோணம்	- முக்கோணி
Polygon	- சவ்வக ரூப	- மூடிய உரு
Closed figures	- மூடிய வடிவ	- மூக்கோணி
Sides of a Triangle	- த்ரிகோணம் க பாக	- முக்கோணியின் பக்கங்கள்
Constrution	- த்ரிகோணம்	- அமைப்பு
Greater than	- மீறல்	- இலும் பெரிய

Instructions to plan the lesson:-

This section aims to make students capable of finding out the requirements regarding the lengths of sides to construct a triangle in relation to 1 and 2 of the learning outcomes under the competency level 27.1. This present an example with a group activity leading to inquiry.

Time: 40 minutes

Quality Inputs:

- Activity sheets with the table(4 copies)
- An enlarged diagram of the triangle ABC
- Eakles (about 3 for each group of 5 students)

Instructions for the teacher:**Approach:**

- Present an enlarged diagram of a triangle to the students reminding them that a triangle is a polygon with three sides.
- Discuss that its sides are AB, BC and CA. get from the students that vertex B is formed by the union of sides AB and BC.

Development of the lesson:

- Divided the class into groups of five students.
- Distribute activity sheets and long eakles to the groups.
- Ask the students to break the eakles in to pieces of length 3cm, 4cm, 5cm, 6cm, 7cm, 8cm, 9cm and 10cm.
- When students are examining whether the triangles can be made as indicated in the activity sheet, see whether they make the triangles getting the ends of eakles meet to form vertices. Help when necessary.
- After the completion of the table, lead a discussion using it to see whether there is any relationship among the length of two eakles and the third which could be used make triangles.
- Surface the fact that when it is possible to make a triangle, the sum of the lengths of any two pieces of eakles is greater than the other piece of eakles.
- Emerge from the table that in cases where a triangle cannot be made the sum of the lengths of a pair of eakles is either less or equal to the third piece of eakle.

- Confirm that when three measurements of lengths are given, we can check whether they are sides of a triangle.
- Arrive at the conclusion that in a triangle the sum of the lengths of any two sides is greater than the length of the third side.

Activity sheet for the students:



- From the eakles given to you, get pieces of eakles 3cm, 4cm, 5cm, 6cm, 7cm, 8cm, 9cm and 10cm long.
- Take any pieces of eakles. Keep them on the table and check whether a triangle can be made from them making their ends meet to form vertices. Complete the table using lengths of the pieces of eakles whether it was possible to make a triangle or not. (see example)
- Take another three pieces of eakle and enter the lengths after repeating the procedure.
- Present the table completed by your group.

Lengths of the 3 pieces of eakles (i)	Sum of the length of two pieces of eakles (ii)	length of the third piece of eakle (iii)	Values obtained in (ii) and (iii) (related by < or >).	Whether a triangle can be made Yes (✓) / No (×)
Ex: 3, 4, 5	7 9 8	5 3 4	7 > 5 9 > 3 8 > 4	

Assessment and Evaluation:

- Assessment Criteria:
 - Name the sides of a given triangle
 - Breaks the eakles into pieces of given length.
 - Select the sets of eakles from which triangle can be made and cannot be made.
 - Accept that, for the formation of a triangle, there should be a relationship among the lengths of the sides.
 - From the sets of measurements given, selects the sets from which a triangle can be constructed.
- Direct the students to do the exercises in the lesson 26 in the text book.

Practical Application:

- When making vesak lanterns, this requirement can be used to select suitable splinters.
- Can also be used when preparing iron bars to make triangular roof struts that are used to support roofs.

For your attention ...**Development of the lesson:**

- Students can be instructed to check first the possibility of constructing a triangle with the given lengths of the sides in the next lesson on triangle construction.

Assessment and Evaluation:

- Direct the students to do the exercises in the lesson 26 in the text book.

For further study:

- <https://www.youtube.com/watch?v=dtmMOF07kgE>
- <https://www.youtube.com/watch?v=wDJrOWMeYOc>

27. Data Representation and Interpretation

- Competency 28:** Facilitates daily work by investigating the various methods of representing data.
- Competency 29:** Makes predictions after analyzing data by various methods to facilitate daily activities.
- Competency Level 28.1:** Represents data using a stem and leaf diagram for facilitating the communication.
- Competency Level 29.1:** Discusses the dispersion of data using stem and leaf diagram.
- Competency Level 29.2:** Inquires into numerical representative values of a group of data.
- Number of Periods:** 10

Introduction:

One mode of representing data in day to day life is the stem and leaf diagram. This section aims to prepare a stem and leaf diagram for a set of data comprising less than 30 pieces of data and value of the data are less than 1000.

Through a stem and leaf diagram it is expected to find the minimum value, maximum value and thereby the range of a set of data and to show that conclusions regarding the spread of data can be arrived it using same. As Same as, this section aims to finding the Mode, Median Mean and Range of the row data set.

Learning Outcomes for Competency Level 28.1:

1. Identifies the stem and leaf graph
2. Accepts that should be included a key for the stem and leaf graph.
3. Represents a data set with less than 30 pieces of data and value of the data are less than 1000 in a stem leaf graph.

Glossary of terms:

Data	-	தரவு
Stem and leaf diagram	-	தண்டு - இலை வரைபு
Minimum value	-	குறைந்த பெறுமானம்
Maximum value	-	கூடிய பெறுமானம்
Range	-	எண் தொடரி
Communication	-	எண் தொடரி
Mode	-	ஆகாரம்
Median	-	இடையம்
Mean	-	இடை

Instructions to plan the lesson:

A specimen lesson proposed to implement using the discussion method and a group activity in order to develop the subject concepts related to learning outcome 3 under the competency level 28.1 is given in the sequel.

Time: 40 minutes

Quality Inputs:

- A demy paper on which annex 1 is clearly written.
- Activity sheets for the groups

Instructions for the teacher:**Approach:**

- Recall through a discussion the methods picture graphs, bar graphs and stem and leaf diagrams used to represent to data.
- Present to student the demy paper carrying Annex 1
- Accordingly, explain the procedure that should be followed when preparing a stem and leaf diagram.
 - Group data as 0-9, 10-19 or 0-99, 100-199 etc.
 - Write numbers as 1, 2, 3 in sequence in the stem excepting the number in position one.
 - Enter into the leaf the number in the position of one in each group of data.
 - When the same number is repeated, pay attention to how they are indicated in the stem and leaf diagram.
 - If a certain datum in a group is missing, pay attention to the fact that the number should be written in the stalk and the leaf should be left blank.
 - During the discussion highlight the key of entering data into a stem and leaf diagram. **E.g. 3/2 means 32 and 11/5 means 115.**

Development of the lesson:

- Divide the class into groups as appropriate and distribute a copy of the students' activity sheet to each group. Assign the task and engage the group in the activity.

- Give an opportunity to present the findings.
- Based on the students' findings conclude how data are correctly represented by a stem-leaf diagram.

Activity sheet for the students:



(a) Given below are the marks obtained by students for four subjects.

- Group data as appropriate.
- Write the numbers suitable for the stalk in sequential order.
- Entering data, prepare the stem-leaf graphs.

Name	Marks of the subject			
	Maths	Science	English	Sinhala
Ranjani	78	85	60	74
Shrimathi	65	58	65	35
Bihansa	56	63	63	84
Geethima	62	74	72	95
Chamitha	38	42	34	37
Nethmi	85	58	83	65
Guari	28	65	58	78
Priyanka	43	70	46	48
Binari	78	83	52	90
Fathima	92	90	78	60
lakshmi	18	25	36	45
Nadev	78	42	58	70
Manuth	85	74	68	82
Binuka	83	78	57	56
Sithum	49	42	83	84
Savindu	90	64	88	92
Kavindu	78	63	45	38
Desandu	49	40	53	43
Supun	54	69	68	74
Tharanga	78	69	68	74

(b) Heights of 15 students measured in centimetres are as follows.

125 132 128 137 141 143 124 130 126
138 144 121 138 142 138

- Prepare a stem-leaf diagram using these data.

Assessment and Evaluation:

- Assessment Criteria:
 - Group the data given
 - Prepares stem-leaf diagram relating to data given.
 - States that organising data by way of a stem-leaf diagram is an easy method to present data.
 - Accepts that stem-leaf graphs can be used to present various types of data in day to day life.
 - Acts cooperatively within the group.
- Direct the students to do the exercises in lesson 27 in the textbook.

For your attention. . .**Development of the lesson:**

- Plan and implement suitable learning methods to achieve the learning outcomes relating to competency level 29.1 and 29.2.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 27 of the textbook.

Practical applications:

- To make decisions about the marks obtained by the students in a class for different subjects.
- To make decisions about the sums for different ranges during marketing.

For further study:

- <http://www.youtube.com/watch?v=9VZsMY15xeU>
- <http://www.youtube.com/watch?v=h8EYEJ32oQ8>
- <http://www.youtube.com/watch?v=k3aKKasOmlw>
- <http://www.youtube.com/watch?v=n6xCyzOP900>

Annex I

Data: - 32, 33, 44, 43, 42, 63, 65, 42, 70, 72, 73, 42, 101, 88, 103, 126

Stem -leaf diagram

3	2, 3
4	2, 2, 2, 3, 4
5	
6	3, 5
7	0, 2, 3
8	8
9	
10	1, 3
11	
12	6

28. Scale Diagrams

Competency 13: uses scale diagrams in practical situations by exploring various methods.

Competency Level 13.2: Describes various locations in the environment using scale drawings

Number of Periods: 05

Introduction:

When constructing buildings, preparing town plans, drawing country maps and plans of plot of land, we need to draw their diagrams. As drawing the actual figure in such instances is unrealistic, they are drawn by downsizing their measurements to a certain ratio. Such figures are also drawn to small things to enlarged. Such diagrams are called scale diagrams and they take the shape of the initial picture. In both these instances a scale is used and it is indicated as a description or a ratio (It may also be shown by joining with an arrow the true measurement and the corresponding measurement in the scale with true units).

A scale of a map describe as **1 cm represents $\frac{1}{2}$ km** can be written as 1 : 50 000 as a ratio or $1 \text{ cm} \Rightarrow \frac{1}{2} \text{ km}$ as a relationship. Very often scale is given as a ratio. Then its unit of measurements becomes centimetres. drawing scale diagrams enables one to see a large picture as a whole and to find the unknown distances in the actual situation. This lesson deals with scale diagrams which play an important part in making plans.

Learning Outcomes for Competency Level 27.1:

- Convertes a given scale
as a discription \Leftrightarrow as a numerical connection \Leftrightarrow as a ratio
(1 cm represents x cm) (1 cm \rightarrow x cm) (1 : x)
- Calculates the length of a scale diagram when the actual length and the scale of a rectilinear plane figure is given.
- Draws a scale diagram when the scale and actual dimensions of a rectilinear plane figures is given.
- Calculates dimensions of the actual figure using a scale diagram.

Glossory of terms:

Triangle	-த்ரிக்கோணம்	-முக்கோணி
Closed figures	-மூடப்பட்ட வடிவங்கள்	-முடிய உரு
Polygon	-பன்முகக்கோணி	-பல்கோணி
Sides of a Triangle	-த்ரிக்கோணம் க்கு பக்கங்கள்	-முக்கோணியின் பக்கங்கள்
Constrution	-சீர்தொண்டம்	-அமைப்பு
Greater than	-மேல்	-இலும் பெரிய

Instructions to plan the lesson:

This lesson is planned in such a way that the facts explained through the lecture-discussion method are reinforced by an activity. The lesson aims to develop the first learning outcome of the competency level 13.2.

Time: 40 minutes

Quality Inputs:

- The kit of 15 cards in which the scales stated in annex II are written (one kit for each group)

Instructions for the teacher:**Approach:**

- Write the following statements either on the blackboard or a demy paper and display to the class.
 - A scale diagram of a land is drawn so that 1cm represents 50 m .
 - A scale diagram of a wall hanger is drawn to the scale 1 : 10.
 - A scale diagram of a square panel is drawn to the scale 2cm \rightarrow 3m.
- Recall the facts learned in grade 7 and the three modes of representing the scale of a scale diagram given above.
- Tell that. in order to understand these scales, the students have to cast their minds back to the relationships among units and conversion of units.
- Write the conversions of units given in annex I on the blackboard and fill in the blanks while discussing with students.

Development of the lesson:

- Explain that the scale representing 50 m by 1cm given under approach can be written as 1cm \rightarrow 50m along with units and as 50 m = 5 000 cm the scale can also be indicated as 1: 5 000.

- Similarly explain that the scale 1: 10 represents 10cm by 1cm and could also be written as $1\text{cm} \rightarrow 10\text{cm}$.
- Explain that the scale $2\text{cm} \rightarrow 3\text{m}$ represents 3m by 2cm and can also be written as 2:300 as $3\text{m}=300\text{cm}$. Since the first term of a ratio is given as 1, emphasize that it is given as 1:150 by dividing the terms by 2.
- Display the maps such as the map of the world and map of Sri Lanka in the class. Give an opportunity for students to observe their scale and convert them as was done before.
- Explain that in the scale 1: 200 000, 1cm is equivalent to 200 000 cm and as $200\ 000\ \text{cm} = 2\ 000\ \text{m} = 2\ \text{km}$, this scale can also be written as $1\text{cm} \rightarrow 2\text{km}$ or described as **1cm represents 2km**.
- Say that the same scale can be written in various forms as illustrated by these examples. Divide the class into groups of four for such an activity.
- Give the list of exercises given in annex 2 and a set of cards to each group.
- After completing the activity, conduct a discussion and appreciate the students.

Activity sheet for the students:



- Do the exercises of filling the blanks given to you by the teacher in your exercise book.
- Mix well the set of cards given to your group and divide equally among the members of the group.
- Examine the scales written in the cards well and select the card in which the same scale is written in various forms. Align them on the table,
- After completing the task, show them to the teacher and get them confirmed correct.

Assessment and Evaluation:

- Assessment Criteria:
 - Write a scale given as a description in the form of a ratio using the relationships among the units of measurements.
 - States that the scale of a scale diagram can be written three forms.
 - Write a scale given in one form in two other forms.
 - From a set of cards carrying scales written in various forms, separate the kit of cards in which the same scale is written in three forms.
 - Contributes cooperatively and communally to group work.
- Direct the students to do the relevant exercises in lesson 28 in the text book.

For your attention ...

Development of the lesson:

- Develop the learning outcomes 2, 3, 4 in students by explaining examples as required and planing and implementing activities to engage students activity.

Assesment and Evaulation:

- Direct students as group to draw the scale diagrams of the beds in the matahematical garden or any other suitable plot of lands.
- Direct the students to do the relevant exercises in lesson 28 in the textbook.

For further study:



- <http://www.basic-mathematics.com/scale-drawings.html>
- <http://www.virtualnerd.com/geometry/similarity/ratios-proportions/scale-model-scale-factor>

Annex I

- $1m = \dots\dots\dots cm$
- $1km = \dots\dots\dots m = \dots\dots\dots cm$
- $50m = \dots\dots\dots cm$
- $\frac{1}{2} km = \dots\dots\dots m = \dots\dots\dots cm$
- $\frac{1}{2} km = \dots\dots\dots cm$
- $300cm = \dots\dots\dots m$
- $50000cm = \dots\dots\dots m = \dots\dots\dots km$
- $150000cm = \dots\dots\dots m = \dots\dots\dots km$

Annex II

Exercises

Copy and fill in the blanks.

(i) $1cm \rightarrow 50m$
 $1cm \rightarrow \dots\dots\dots cm \quad \therefore 1: \dots\dots\dots$

(ii) $2cm \rightarrow 3m$
 $2cm \rightarrow \dots\dots\dots cm \quad \therefore 1: \dots\dots\dots$

(iii) $1: 2000000$
 $1cm \rightarrow 2000000cm$
 $1cm \rightarrow \dots\dots\dots m$
 $1cm \rightarrow \dots\dots\dots km \quad \therefore 1: \dots\dots\dots$

Kit of cards:

1 : 200 000

1 cm \rightarrow 400 m

2 cm represents 1 km

1 : 40 000

1 cm \rightarrow $\frac{1}{2}$ km

1 cm represents 400 m

1 : 50

1 cm \rightarrow 2 km

1 cm represents 50 m

1 : 50 00

1 cm \rightarrow 50 cm

1 cm represents 2 km

1 : 5 000

1 cm \rightarrow 50 m

1 cm represents 50 cm

29. Probability

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

Competency Level 31.2: Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value.

Number of Periods: 06

Introduction:

There is a possibility of assigning a quantitative value for the likelihood of an event. A definitely occurring event can be given 1 whereas an event which does not occur definitely is assigned 0. An event whose occurrence is not definite is given a mark in between 0 and 1. These fall into three categories.

Occurrences with only two events of likelihood - In this type of occurrences, $\frac{1}{2}$ is assigned for the likelihood of one event.

Occurrences in which one event is more likely to happen than the other - In these, a value between $\frac{1}{2}$ and 1 is assigned for the likelihood of an event.

Occurrences in which one event is less likely to happen than the other - in these, a value between 0 and $\frac{1}{2}$ is assigned for the likelihood of the event.

This section confirmed that, the fraction that gives the number of successes out of the number of trials in an experiment is called the fraction of success.

The fraction that is obtained in greater magnitude by an experiment is called the experimental probability and the probability found on the basis of equal likelihood without an experiment is called theoretical probability. The fraction of successes obtained by a large number of occurrences will be very close to the theoretical probability.

Learning Outcomes for Competency Level 31.2:

1. States the success of fraction based on the number of successful events out of total number of experimental events.
2. States that when the frequency of an experiment is increased the fraction of success is the more suitable for the likelihood of the incident.
3. Identifies fraction of success obtained after increasing the frequency of experiments as the experimental probability.
4. Identifies the probabilities based on the likelihood but without experiments as the theoretical probability.
5. Solves simple problems related to experimental and theoretical probabilities.

Glossary of terms:

Experiment	- பரீக்ஷணை	- பரிசோதனை
Probability	- சமீபாவீவை	- நிகழ்தகவு
Events	- சித்டி	- நிகழ்ச்சிகள்
Events that are cannot happen	- சித்டு தாவை சித்டி	- நடக்கும் நிகழ்ச்சிகள்
Random events	- சமரவீவை சித்டுவை	- நிச்சயமாக நடக்கும் நிகழ்ச்சிகள் சித்டி (அதலு சித்டி)
Fraction of success	- சார்பக தாவை	- வெற்றிப்பின்னம்
Experimental probability	- பரீக்ஷணைவீவை சமீபாவீவை	- பரிசோதனை முறை நிகழ்ச்சிகள்
Theoretical probability	- சைத்டாவீவை சமீபாவீவை	- அறிமுறை நிகழ்தகவு
Possibility	- வீச தகவீவை	- இயல்தகவு
Scale	- பரிமாவை	- அளவீவை

Instructions to plan the lesson:

Given below is a specimen lesson plan with a group activity aimed at developing the learning outcomes 1,2 and 3 under the competency level 31.2 after reinforcing the learning outcomes under competency level 31.1 in students.

Time: 80 minutes

Quality Inputs:

- Copies of the activity sheet
- White and red glass balls in the same size

Instructions for the teacher:**Approach:**

- Conduct a discussion recalling the award of marks for the likelihood of an event on the 0-1 scale.
- Direct the students to do the activity asking how the results of the repeated occurrence are recoded in an experiment with equal likelihood.

Development of the lesson:

- Group the students as appropriate
- Distribute to each group a copy of the activity sheet and a kit of relevant materials.
- Direct the students to record the result obtained while engaged in the activity according to the instructions in the activity sheet.
- Assist when necessary.
- After completing the group activity give an opportunity to present the findings to the class.
- After the presentation lead a discussion to highlight the following facts.
 - Fraction of successes is obtained by writing the number of successes as a fraction of the number of times the experiment was done.
 - Fraction of successes obtained by repeating the experiment many times is called experimental probability.
 - In this experiment, The fraction of successes obtained by repeating the experiment many times (100 or more) is commonly close to $\frac{1}{2}$ for all the groups.

Activity sheet for the students:

Experiment: Without selecting, picking up a ball from a parcel containing six balls altogether with white and red equal size balls three each.

- Repeating the above experiment again and again complete the following table.

Number of times repeated	10	20	30	50
Number of times times getting a white ball				
Number of times times getting a red ball				

- Discuss within the group about the value of a result expressed as a fraction of the number of times doing the experiment when the experiment is repeated many times.
- Present the findings to the entire class.

Assessment and evaluation:

- Assessment Criteria:
 - Record information relating to a random event correctly.
 - Calculate the fraction of successes of an event using the result of an experiment.
 - Expresses experimental probability based on fraction of successes.
 - Accepts that an experiment has to be repeated many times to get the experimental probability
 - Complete the task assigned according to the instructions given.
- Direct the students to do the relevant exercises in lesson 29 in the textbook.

Practical Applications:

- Making weather forecast
- Making predictions an agriculture and business.

For your attention:**Development of the lesson:**

- Plan lesson appropriately and implement to develop the learning outcomes 4.5 under the competency level 31.1.

Assessment and Evaluation:

- Direct the students to do the relevant exercises in lesson 29 in the textbook.

For further study:

- <http://www.youtube.com/watch?v=dTwZ5N126gw>
- <http://www.youtube.com/watch?v=UTs4uZhu5t8>
- <http://www.youtube.com/watch?v=PNXozoJWsWc>
- <http://www.youtube.com/watch?v=FZ2APP6-grU>
- <http://www.youtube.com/watch?v=17a443nL7Qw>
- <http://www.youtube.com/watch?v=D1cKk48kz-E>
- <http://www.youtube.com/watch?v=cCMpin3Te4s>
- <http://www.youtube.com/watch?v=pbLiN8D9gAk>

30. Tessellation

Competency 26: Investigates the methods of organizing various geometric shapes and uses them to enhance beauty.

Competency Level 26.1: Studies shapes by creating various patterns that can be used to enhance beauty.

Number of Periods: 05

Introduction:

Students have already learnt that the tessellation using only one regular geometrical shape is regular tessellation and the tessellation using two or more regular shapes is the semi-regular tessellation.

In the case of **regular tessellation**, the plane figures that will create the tessellation should be identified. In tessellation all the shapes lie around the point at which vertices of all the shapes meet. At this point the sum of all the angle is 360° . If the multiple of the internal angle of a regular polygon gives 360; a tessellation can be made with that polygon. In pentagon the internal angle is 108° .so the regular pentagon cannot be tessellated.

Thus, in regular tessellation which uses only one regular shape, only the triangle, square and regular hexagon can be used. The tessellation where the clockwise or anti-clockwise arrangement of the vertices of two or more regular polygons remains unchanged is called semi-regular tessellation. This lesson deals with these aspects in details.

Learning Outcomes for Competency Level 26.1:

1. States that the tessellation using only one regular geometrical shape is the regular tessellation.
2. Creates regular tessellation by identifying geometrical shapes that can create regular tessellation.
3. States that tessellation using two or more regular shapes is the semi-regular tessellation.
4. Creates semi-regular tessellations identifying geometrical shapes leading to semi-regular tessellations.
5. Engages in creations using tessellation.

Glossory of terms:

Tessellation	- வெசலாகரன	- தெசலாக்கம்
Regular tessellations	- சலீடீ வெசலாகரன	- ஓமுங்கான தெசலாக்கம்
Semi regular tessellations	- ஂரீட சலீடீ வெசலாகரன	- அரைத் தூய தெசலாக்கமி

Instructions to plan the lesson:-

This lesson aims in developing subject concepts relating to learning outcomes 3 and 4 following the achievement of learning outcomes 1 and 2 under the competency level 26.1. Given below is a specimen lesson that encompasses a group activity and a teacher led discussion to realize this aim.

Time: 40 minutes

Quality Inputs:

- A poster depicting a regular tessellation using an equilateral triangle, square and the hexagon.
- Sets of cuttings of equilateral triangles, squares and regular hexagons.
- A poster depicting semi-regular tessellation and non-tessellation.
- Demy paper
- Glue

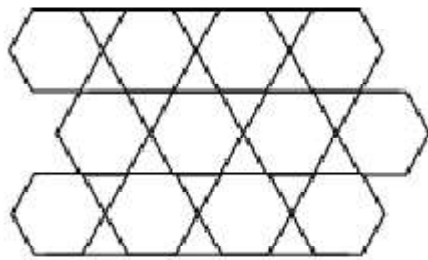
Instructions for the teacher:**Approach:**

- Embark on to the lesson by showing a poster depicting regular tessellation created using equilateral triangle, square and the hexagon.
- Discuss about the vertex point of each of these tessellations. Confirm that the sum of the angles at those vertices is equal to 360° .
- Engage the students in the following activity asking how a regular tessellation can be made using two or more regular shapes.

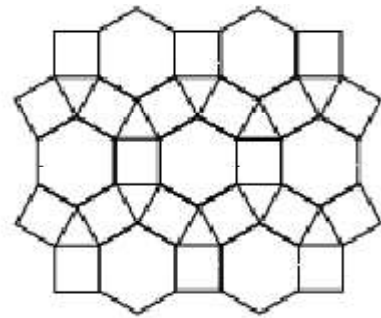
Development of the lesson:

- Group the students as appropriate, distribute the shapes equilateral triangle, square and regular hexagon to students and direct them to make a tessellations using more than one of those shapes.
- Observe with students the arrangement of the polygons at the vertices in each of the tessellations created by students.

- Emphasize that when writing that arrangement, the polygons placed clockwise or anti-clockwise should be written.
- If the arrangement of polygons at the vertices is equal, such a tessellation is called semi-regular tessellation.
- Using two tessellations such as given below (either prepared or selected from the works of students) explain further that no semi regular tessellation is resulted if the arrangement at vertices is not identical even if more than one type of regular polygons are used.



(a)



(b)

- Show that the arrangement of polygons at the vertices of (a) is identical whereas in (b) it is not identical.
- Based on them, explain further that a semi-regular tessellation is a work created by using more than one type of regular polygons and in them the arrangement of polygons at any vertex point is identical either clockwise or anti-clockwise.

Assessment and Evaluation:

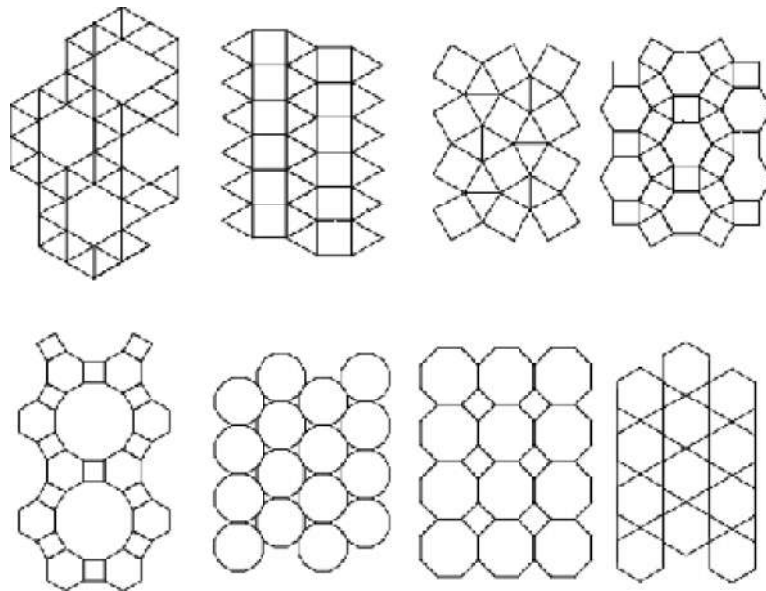
- Assessment Criteria:
 - Describe the characteristics of a semi-regular tessellation.
 - Create tessellation using several regular polygons.
 - Gives reasons why a semi-regular tessellation can/cannot be made using several regular polygons.
 - Accept that the environment can be beautified by tessellation.
 - Works cooperatively within the group.
- Direct the students to do the exercises 30.1 in the text book.

Practical Application:

- Discuss tessellations encountered in houses, shrine rooms, floor, wall hangers, printed cloths and in natural environment.

For your attention...**Development of the lesson:**

- Direct the students to carry out tessellations as they wish giving them equilateral triangles, squares, regular hexagons, regular octagons and regular dodecagon.
- Understand that there are a limited number of semi-regular tessellations that can be created like this.



- Follow a suitable method to make students understand the subject concepts related to the learning outcomes 1, 2 and 5.

Assessment and Evaluation:

- Direct the students to do the exercises in lesson 30 in the textbook.

For further study:

- <https://www.youtube.com/watch?v=yxYReJ1yjuE>