Introduction

This curriculum outlines the major focus of the mathematics programme of learning for students of Grades 7, 8, and 9. It provides a set of teaching activites for each learning out come as listed under each strand for each grade. The philosophical assumptions, rational and general aims of the curriculum are identified. Some suggestions relating to teaching, learning and assessment are also included.

Philosophy

The philosophical assumption underpinning this curriculum suggests that school mathematics needs to simultaneously educate all students about mathematics while equipping them with the skills necessary for them to be able to use their mathematical knowledge. The belief is that all students CAN LEARN both to acquire basic mathematics knowledge, skills and strategies; and to use such mathematical awareness as a tool for further learning.

The intent is to give students not only a body of mathematics facts and knowledge, but also a rich repertoire of skills, values and insights into mathematics. The curriculum therefore serves to assist all students in constructing their mathematical journey along which they will regularly use their mathematical experiences to make sense of the physical, cultural, social and environmental issues which impact on their lives.

In this way, this curriculum would achieve the intended goal of assisting all students to readily and consistently use their mathematical awareness to:

- acquire more mathematical knowledge
- enjoy and appreciate their mathematics learning
- better understand real life occurrences
- gain meaningful insights into other subject disciplines

Essentially, the philosophy guiding this curriculum suggests that the stated programme of learning prepares students for adult life while

Rationale

If education is to realize the prescribed goal of producing adults who are capable of becoming problem solvers, then the mathematics education of all students must be emphasized. Indeed “the study of mathematics began because it was useful, continues because it is useful and is valuable to the world because of the usefulness of its results while the mathematicians who determine what the teachers shall do, hold that the subject should be studied for its own sake’ (Griffith & Howson, 1974).

Mathematics is a way of thinking. Mathematics stimulates the mind and interests curiosity. It promotes structured learning, logical thinking and sound reasoning. Mathematics is therefore considered as an activity; not a stock of knowledge. It is something the learners do – the vehicle through which knowledge is discovered in a meaningful way.

As an activity, mathematics challenges the learner to go beyond simply accepting information. It influences the mind to ask ‘how’, ‘why’ and ‘what if’, as justifications have to be given to support generalizations. The use of generalizations also allows for classifications of ideas, and the use of precise and concise language in describing patterns and relations. Mathematics therefore invites the learner to experience the world’s richness. It empowers the learners to ask his/ her own questions and to seek his/ her own answers; and then motivates him/ her to understand the world’s complexities. Mathematics provides for investigative learning, a process which allows the learner to construct his/ her own learning and thereby establish meaningful comprehension of the things which impact on him.

Mathematics education therefore promotes the acquisition of useful skills such as questioning, reflecting, hypothesizing, critical thinking and proof. The aesthetic value of mathematics and the fun enjoy from mathematics related activities add much to the importance of the study of mathematics in any educational programme.

General Aims

This curriculum aims to produce students who are ‘at home’ with basic mathematics concepts, principles and strategies. To achieve this general aim, several broad goals covering the essential process skills to be developed and the content to be covered are suggested as key targets for all students.

Process

- To communicate ideas in precise but meaningful ways
- To utilize a variety of mental strategies when doing mathematics
- To develop and apply mathematical thinking and reasoning skills
- To adapt an analytical approach to learning of mathematical concepts
- To learn in ways which make for easy transfer of knowledge gained
- To regularly explore concepts in detail and systematic ways

Content

- To deepen understanding of mathematical concepts related to the five named strands
- To identify connections that exist across concepts, strands and topics
- To develop the skills of estimation, computation and calculation
- To gather, organize, present and analyze data in meaningful ways
- To study examples and non examples as related to a concept and use such information to formulate generalizations
- To construct and use formulae
- To develop spatial awareness and the skills of accurately measuring and recording
- To use algebraic thinking as a strategy in problem solving
- To identify properties of shapes

Problem Solving

- To use mathematical knowledge to identify causes and consequences
- To make informed choices based on analysis of data
- To use mathematics knowledge to investigate and solve routine and non-routine; theoretical and real life problems
- To enjoy problem solving as an fun activity

Information Technology

- To use the calculator effectively and efficiently as a tool to aid in computations and investigations
- To utilize technological devices to model data in different forms
- To use the internet as a medium for researching ideas relating to the study of mathematical ideas

Values and Attitude

- To experience the aesthetic value of mathematics
- To have fun while learning
- To develop theme approach to work
- To experience and value the social construction aspect of learning

Structure of the Curriculum

The curriculum outlines the content areas to be covered by students in grades 7, 8 and 9. The stated content areas are summarized into five strands. These include Number and Number Sense; Measurements; Geometry; Data Handling and Patterns and Algebra. An Attainment Target is identified for each named strand. Several Learning Outcomes with related Achievement Indicators are listed under each Attainment Target. The table below lists each strand with matching attainment target.

Strand	Attainment Target
Number & Number Sense	Students develop competency, knowledge, skills and understanding in mental and written computations as well as effective calculator use and numerical reasoning when working with numbers
Measurement	Students develop competency, knowledge, skills and understanding in identifying and communicating the attributes of shapes and objects; and employ measurement strategies to explore, investigate and solve theoretical and real life problems
Geometry	Students develop geometric knowledge, skills and understanding; and readily apply geometric reasoning to solve problems relating to spatial visualization
Data Handling	Students develop competency, knowledge, skills and understanding in collecting, organizing, representing, analyzing and evaluating information in order to make informed decisions, reasonable predictions, draw logical conclusions and solve problems
Patterns and Algebra	Students develop knowledge, skills and understanding in interpreting and constructing patterns, generalizations and graphical representations

Guiding Principles

The goal of this curriculum is to provide opportunities for students to learn about mathematics in ways that will equip them with knowledge and build their confidence in and attitude to the subject. Accordingly, it would be useful to adapt the following guiding principles in developing and implementing this unit.

Learning Activities

• As much and as far as possible learning activities should provide students with plenty of opportunities to construct understanding.
• Concepts should be developed in context using sufficient examples that embodied the concepts as well as non examples
• Students should be guided to deduce generalizations and formulae through structured exercises rather than giving formulae to students as rules
• Time should be allotted and learning activities organized for students to use their mathematical knowledge to investigate real life situations on a regular basis
• As much as possible students should be encouraged to develop the skill of estimating answers as a first step in their working towards solutions
• Small group activities should be used to encourage the development of interpersonal skills

Teachers will find it helpful to:

• develop an extensive knowledge of concepts, skills, processes and principles connected to the subject matters that they are expected to teach
• adopt classroom instructional practices that allow every child regardless of ability level to achieve some measure of success in every class
• plan every lesson on the basis of what students already know; what students need to know; and what students are able to do

Students will need to be given opportunities to:

• work mathematically by asking and using questions; constructing and solving problems; and reflecting and assessing their own learning
• participate in activities that help them to develop knowledge pertaining to the ‘how’ and ‘why’ of the concepts that they are exploring
• engage in activities that will challenge them to use their mathematics knowledge to explore new situations
• communicate their mathematics ideas in their own way and to be able to defend such thinking along mathematics lines
• connect their prior knowledge and experiences to new ideas and in the process develop a network of concepts, skills and processes related to the concepts under study
• share ideas and experiences by working in small groups
• reflect on their approach to learning and their progress in learning

Notes for the Teacher

Mathematics as a relevant tool is rendered meaningless when educators limit students to merely reproduce mathematical content. Additionally, mathematics as powerful as it is loses its effectiveness when educators rob students of opportunities to investigate phenomena and explore their environment. It is out of these two principled positions that the conviction has been reached that the mathematics teacher needs to adopt approaches that support the learner.

In using this curriculum, the emphasis should be on helping students to see their mathematics knowledge as a tool that they can use inside as well as outside the mathematics classroom. The focus of the curriculum is on teaching for understanding and learning for application. To realize these goals, students need to be regularly engaged in activities that guide them to discover mathematics relations for themselves in meaningful contexts. In essence, the teacher's responsibility is to create the learning climate that challenges students to learn how to learn. The teacher does this by encouraging self initiated inquiry, providing suitable materials and activities for learning tasks, and sensitively mediating teacher/ students; and student/ student interactions. This curriculum must therefore be guided by every teacher wanting to find time in every lesson to help students to:

- enjoy mathematics;
- understand its power;
- want to know more about it;
- feel confident about their ability to do mathematics

To achieve this goal, systematic planning is necessary at all times.

Planning for Teaching

Purposeful planning leads to insightful teaching approaches which provide clear learning pathways for students of all abilities. Much effort, time and resources needs to be put into planning for teaching. One useful approach to meaningful planning is for the teacher to conduct an analysis of each topic prior to teaching. This kind of planning brings gives clarity to the teacher about the major factors which might impede or support the learning process. The format given below provides a guide on how an analysis of a topic may be done.

Pre-requisites

As a first step in approaching the teaching of any concept/ topic, the teacher will find it useful to ensure that students have the necessary pre-requisite skills and knowledge rather than beginning to teach on the assumption that such are in place. It will be necessary in some instances for the teacher to devote some time prior to teaching a concept to assess the needs (readiness) of students. Where students are identified to be lacking in the necessary pre-requisites, it is advised that adequate activities be provided to facilitate students in acquiring the skills and knowledge that are needed to begin meaningful work in the particular area of study.

Development of concepts

Concepts need to be introduced and developed with students in practical ways. It is always important to facilitate for the emergence of mathematical ideas through students' engagement in a rich series of structured activities. Construction of understanding by students is therefore critical. This should never be replaced by the giving of definitions of concepts, formulae and a string of rules. This approach involves students' interactions with several examples that embodied the concept being introduced. Students' development of understanding of concepts also benefits when students' experiences are valued in the learning process.

It is important that the teacher remember, too, that it is not only the things that children can do that measures progress, but how they do them and whether their methods are of a kind that can be built on in subsequent development (Tall & Faster 1996)

Establishing Connections

The hierarchal structure of mathematics itself necessitates that concepts be taught in a logical and sequential order. In teaching this curriculum, it is considered useful that focused effort be taken to identify and emphasize connections:

- between concepts and topics within mathematics itself
- with other subject disciplines
- across grade levels

In this regard, an approach to learning mathematics that helps students to see mathematical concepts not as isolated bits of information, but as ideas that are interrelated needs to be emphasizes. This makes learning more meaningful, as it allows for students to actively involve in constructing a network of concepts and skills. In this way, students are able to make sense of the knowledge so gained as they would have proven it to be true and can also explain why it is so. According to Selinger (1994) if mathematics is to have any meaning then inter-weaved with the learning of skills there must be recognition about how such skills are connected.

Application of Knowledge

This curriculum lends itself to much investigative work. Students can therefore be given several open ended tasks in which they are encouraged to explore mathematical ideas as they relate to issues within students' experiences. Such investigative tasks may form part of regular class activities or home work tasks and may be done as whole class, small groups and individual assignments. Ideally, the choice of activities will be based on the environmental and social issues prevailing in the immediate environments of students.

Vocabulary

Language plays a significant role in any programme of learning. Mathematics is no exception. Some words carry a different meaning within a mathematical context than their usual meaning. Other words used in mathematics are peculiar to mathematics. This situation adds to the challenges encounter by the student of mathematics

Many students find mathematics difficult because they do not understand the words being used. Some words are peculiar to mathematics and are used only in the context of mathematics (ROSE1 Curriculum 1998).

Based on this understanding, it seems necessary that the teaching of any mathematics curriculum will require some focus on the mathematics vocabulary that is related to the aspect of mathematics that is being studied. The provision of opportunities for students to build and extend their mathematics vocabulary is therefore central to this programme of learning. In this regard, students' mathematics learning seems likely to benefit where mathematics language emerge out of appropriate contexts; and students are encouraged to keep tract of the development of their own mathematical vocabulary.

Assessment

The philosophical underpinning and the proposed approach to teaching governing this curriculum necessitates a type of assessment procedure that emphasizes a shift from the usual paper and pencil tests to a more encompassing assessment structure. Assessment should aim primarily at enhancing students' learning by providing useful information to the teacher and students. Research suggests that students learning benefits when assessment is intricately linked to instruction. Teachers may achieve this goal by integrating assessment with their teaching instruction rather than approach assessment as an entity that is seen as interrupting instructions and or tagged on at the end of each unit of work.

One useful strategy is for the teacher to encourage students to frequently ask questions and to respond to students' questions with questions, as a means of challenging students to make their own interpretation of ideas. This approach to assessment provides the additional advantage of allowing the teacher a window into the minds of the learner. This has a further benefit of enabling the teacher to readily detect students' mistakes thereby providing for the teacher to work along with students to determine corrective measures on an ongoing basis.

Assessment may be further broadened to include oral presentations, project work, reflective writing, port folio and performance on authentic tasks. The idea of using a wide range of assessment tasks is to allow students to demonstrate their learning in different ways. Additionally, engaging students in investigative work provides useful opportunities for direct assessment of students' ability to apply their knowledge to novel situations.

Writing as a tool for assessment may be incorporated as a systematic way of assessing students' understanding, while encouraging students to communicate mathematical ideas. This can be done to encourage self-assessment of mathematical learning by students while allowing the teacher to get a sense of how students see themselves in learning a particular concept.

Essentially, assessment of students' learning associated with this curriculum should as much as possible provide useful information on students':

- development of mathematical insights
- mental attitude to mathematics and the particular strand, topic and concept being studied
- creativity and problem solving abilities
- reflective approach to learning
- perceptions of their teacher's approach and attitude to teaching

When assessment encompasses these different aspects, assessment would determine students' progress rather than just provide the teacher with a grade to be assigned to students.

Questioning

Accepting the commonly held view that effective teacher stimulates learning demands the adoption of a rich repertoire of effective strategies capable of provoking and cultivating productive thoughts by students. A deliberate move to create a shift in teaching to reflect the inclusion of provisions for increasingly more mental challenges is considered most relevant. In this regard, the use of good questioning skills seems an immediate priority as the teacher will of necessity need to tell students less while asking students to tell him. her more.

This means that the teacher has to consciously find ways of providing students with plenty of opportunities for them to communicate using the mathematical ideas they are learning. It is for this reason that questioning is considered an important teaching strategy. A questioning strategy supports the learning process by serving as a necessary tool for guiding students to classify misunderstandings. The preference for suggesting questioning over teacher talk is embedded in the fact that the questioning style lesson tends to promote:

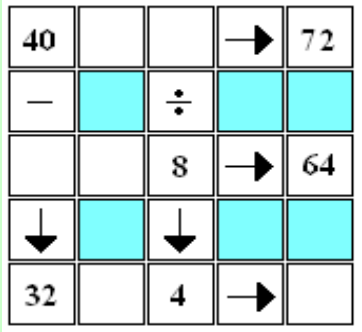
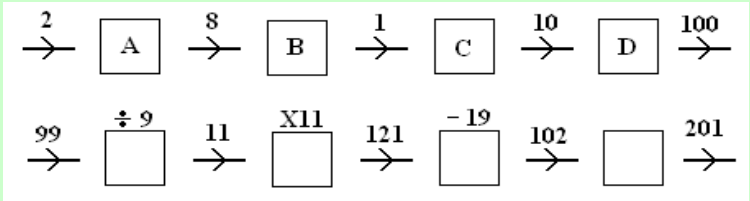
- students' thinking over regurgitation of knowledge
- the building of understanding over knowing
- stimulation of curiosity over memorization
- divergent thinking over convergent thinking

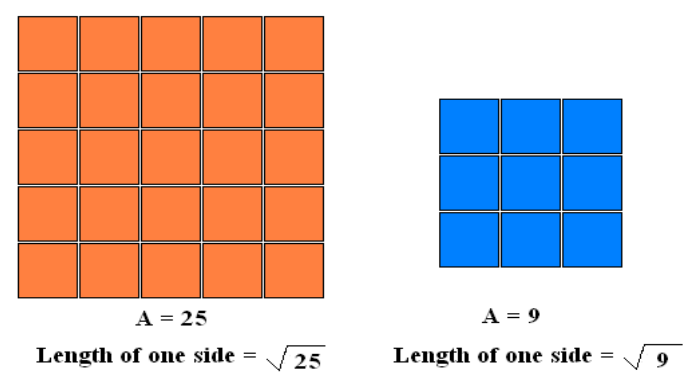
The motive therefore for asking questions is to stimulate and challenge the intellectual ability of students. In the words of Petty (1992) questioning teaches students to think for themselves.

SUGGESTED TEACHING, LEARNING AND ASSESSMENT ACTIVITIES

Learning Outcomes		
	Suggested Learning Activities (NUMBER & NUMBER SENSE)	**Assessment**
LO:1 **Demonstrate an understanding of place value by reading, writing and ordering, whole numbers of any size; and using related vocabulary**	• Insert very large numbers into the calculator and discuss the scientific display on the screen • Verbalize the meaning of numbers written in scientific notation. For example: - 6×10^4 (6 groups of 10^4 or six groups of 10 000) - 5.35×10^6 (5.35 groups of 1 000 000 or 5.35 groups of one million) - 9×10^{-2} (9 groups of 10^{-2} or 9 groups of one hundredths $\frac{1}{100}$) . • Use knowledge of rounding as a guide in writing numbers in significant figures. For example: - 3 718 is closer to 4 000 than it is to 3 000, if I write it correct to one significant figure my answer will be 4 000 - 5 382 is closer to fifty four hundred than it is to fifty three hundred. If I write it correct to two significant figures my answer will be 5400 • Convert from ordinary form to scientific notation and vice versa. For example: - write in scientific notations (a) two million, (b) 0.000 243 - Express in ordinary form (a) 5.13×10^2 (b) $0.001\ 5 \times 10^3$ • Explore the use scientific notation as an aid to computing with very small and very large numbers. For example: - 0.000 001 3 × 170 may be rewritten as $1.3 \times 10^{-6} \times 1.7 \times 10^2$ which is equal to $1.3 \times 1.7 \times 10^{-4}$ - 6 400 000 ÷ $\frac{4}{1000}$ may be rewritten as $6.4 \times 10^6 \div 4$ which is equal to $6.4 \div 4 \times 10^2$	• Students write numbers in scientific notations • Students write numbers correct to a stated number of significant figures and vice versa • Students round off whole numbers to nearest ten, hundred, thousands, million • Students write short notes to explain the strategies used in rounding off numbers to a given number • Students work in small groups to develop a scrap book to include examples of numbers writing in different forms (expanded notation, scientific notation, significant figures, rounded to a stated specification,). These numbers may include examples cut from newspapers, magazines, brochures, national budgets • Students perform computations involving the conversion of numbers from base ten to other bases and vice versa • Students make a chart showing examples of numbers written in different bases

Learning Outcomes		
LO:2 **Use the vocabulary of estimation and approximation; make and justify estimates and approximations of numbers**	**Suggested Learning Activities (NUMBER & NUMBER SENSE)**	**Assessment**
	• Make estimates about real life situations and explain strategies used in arriving as stated estimations. For example, estimate: - the population of your community - the number of policemen standing side by side that will be needed to enclosed a playing field of a particular dimension - amount of water that can be wasted in a day/ week/ year by leaving the school tap running - the amount of time that will be gained by members of your class in a year by arriving early for classes • Explain/ Justify/defend strategies used to worked out each estimate • Estimate the position of a point on an undivided line. Explain how you made your decision. • Identify instances when they will round numbers to the nearest 10, 100, 1 000, 10 000, 100 000, 1 000 000 • Round whole numbers to the nearest multiple of 10, 100, 1 000. For example: - round the population of a country to the nearest 10 000, 100 000, 1 000 000; - record measurements to the nearest mm, cm, m km, g, kg, millilitre, litre	• Students make estimates and write short notes to explain strategies used in arring at estimations • Students collect picture depicting large numbers of similar object (a photo showing a large crowd, picture showing many small insects) with a stated estimation of the number contai9ned in the photo with notes ex

Learning Outcomes		
LO:3 **Understand, select and apply appropriate strategies for the four basic operations; and develop ways to check accuracy of computations**	**Suggested Learning Activities (NUMBER & NUMBER SENSE)**	**Assessment**
	• Use knowledge of the four basic operations to design and solve games, puzzles and flowcharts. For example: Each empty space conatins either a number of a mathematical symbol (+ , - , × , ÷) Copy the square and fill in the missing details.  Begin at the box marked; start . Work out the answer to the question in the box look for that answer in the top corner of another box. Write down the letter in that box, then work out the answer to the question in that box. look for the answer as before and continue until you arive back at start. Read the message found. 147 Start 15+19 | 153 Y 21x7 | 101 S 200-47 | 42 V 26+98 124 E 22x3 | 91 I 20x6 | 34 M 5x15 | 36 A 11+90 63 H 11x11 | 66 R 84÷4 | 21 Y 110-70 | 81 T 36+27 75 A 100-19 | 40 E 216÷6 | 121 S 95-4 | 120 S 61-19 Look at the flow charts and work out the operations which will replace the letters in the boxes  	• Students give worked examples to illustrate communicative, associated and distributed principles involved in computations • Students work computations involving the order of operations • Students work in small groups to develop a chart that includes examples that reflect different aspects of the order of operations • Student make games/ puzzles that involve computations with the four basic operations

Learning Outcomes		
LO:4 **Distinguish between; order; and calculate with different types of numbers**	**Suggested Learning Activities (NUMBER & NUMBER SENSE)**	**Assessment**
	• Use the calculator to explore number written in different forms. For example: - use the key X^Y to evaluate numbers written in index form - use the calculator key $\sqrt[3]{Y}$ to evaluate the cube root of numbers • Link square root to geometry. For explore finding the square root of a number by looking at: - the area of a square and determining the side of the length of one side of the square. for example.  **Investigate the result of computations of the form:** (1) $\sqrt{a} \times \sqrt{a} = a$ & $a^{\frac{1}{2}} \times a^{\frac{1}{2}} = a$ (2) $\sqrt[3]{a} \times \sqrt[3]{a} \times \sqrt[3]{a} = a$ & $a^{\frac{1}{3}} \times a^{\frac{1}{3}} \times a^{\frac{1}{3}} = a$ where a is positive (3) $a^{\frac{1}{2}}$ & $\sqrt{a}$ (4) $a^{\frac{1}{3}}$ & $\sqrt[3]{a}$ where a is positive	• Students • Respond to questions such as: - write as a single number in index form $3^5 \times 4^2 \div 3^6$ - work out the exact value of $4^5 + 3^2 - 2^5$ • Students use calculator to perform computations involving square root, cube root, index number • Students compute the value of items such as: - $\sqrt{5} \times \sqrt{5}$ $\sqrt{6} \div \sqrt{6}$ $3^{1/2} \times 3^{1/2}$ $6^{1/3} \times 6^{1/3} \times 6^{1/3}$ • Students solve problems involving computations with square root, cube root

Learning Outcomes		
	Suggested Learning Activities (NUMBER & NUMBER SENSE)	**Assessment**

Integers

• Investigate the behaviour of integers under multiplication by studying, completing and extending number patterns. For example:

2 × 1 = 2
2 × 0 = 0
2 × −1 = −2
2 × −2 = −4
2 × −3 = −6
2 × −4 = −8

−3 × 2 = −6
−3 × 1 = −3
−3 × 0 = 0
−3 × −1 = 3
−3 × −2 = 6
−3 × −3 = 9

:

×	−3	−2	−1	0	1	2	3
−3	9	6	3	0	−3	−6	−9
−2	6	4	2	0	−2	−4	−6
−1	3	2	1	0	−1	−2	−3
0							
1							
2							
3	−9						

• Use knowledge of inverse operations to investigate the result of dividing positive and negative numbers. For example:
- 5 × −3 =−15 implies that:
  −15 ÷ 5 = −3 & −15 ÷ −3 = 5
• Use knowledge of inverse operations to investigate the result multiplying a negative number by a negative number. For example:
- 15 ÷ −3 = −5 implies that:
  −5 × −3 = 15
• Use the calculator to perform multiplication and division involving negative and positive numbers
• Verbalize generalizations relating to multiplication and division of negative and positive numbers
• Solve problems involving addition and subtraction of negative numbers

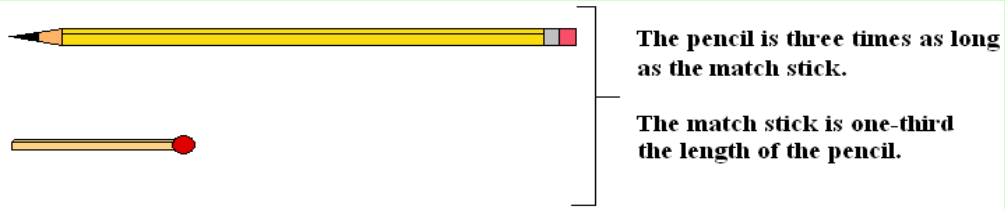
Learning Outcomes		
	Suggested Learning Activities (NUMBER & NUMBER SENSE)	**Assessment**
LO:5 **Model, compare and represent fractions, decimals and percentages**	• Reduce fractions to their lowest terms. For example - Write in its lowest terms $\frac{212}{20}$; $\frac{42}{141}$ • Generate sets of fractions that are equivalent to a given fraction • Compare and order fractions, by converting them to fractions with common denominators. For example, arrange a set of fractions in order of size beginning with the smallest/ largest • Compare the relative size of fractions and decimals. For example: - create a list of numbers that fall between 0•1 and 0•2 - insert these fractions $\frac{17}{20}, \frac{19}{25}, \frac{44}{50}, \frac{81}{100}$ between $\frac{4}{5}$ and $\frac{9}{10}$	• Students work as a whole class to make a bulletin board to display sets of equivalence fractions/ decimals • Students perform computations in which they: - express one number as a fraction of another - convert fractions to decimals and vice versa - convert improper fractions to mixed numbers and vice versa - compare and order fractions and decimals • Students make sets of card that are equivalent fractions.
LO:6 **Compare, order and calculate with decimals, fractions and percentages**	• Multiple fractions in which cancellation is applied to simplify computation. For example: $\frac{3}{5} \times \frac{14}{30} \equiv \frac{1}{5} \times \frac{14}{10}$ $2\frac{1}{2} \times \frac{4}{5} \equiv \frac{5}{2} \times \frac{4}{5} \equiv \frac{1}{1} \times \frac{2}{1} = 2$ • Use knowledge of inverse to aid in the division of a fraction by a fraction including mixed numbers. For example: $\frac{7}{8} \div \frac{3}{4} \equiv \frac{7}{8} \times \frac{4}{3}$ $3\frac{1}{5} \div \frac{3}{8} \equiv \frac{16}{5} \times \frac{8}{3}$ • Multiply and divide fractions including mixed numbers and decimals by converting from fraction to decimal and vice versa. For example: $3\frac{1}{2} \times 4\frac{3}{4} \equiv 3 \cdot 5 \times 4 \cdot 75$ 10•4 × 0•2 $\equiv$ $10\frac{4}{10} \times \frac{2}{10}$	• Students perform computations involving addition, subtraction, multiplication and division with fractions and decimals • Students arrange fractions and decimals in ascending and descending order ; on a number line • Students complete tables showing equivalence between fractions, decimals and percentages • make up story problems to match a worked computations involving fractions, decimals and percentages • Students make a bulletin board to display sets of equivalence fractions/ decimals

Learning Outcomes		
	Suggested Learning Activities (NUMBER & NUMBER SENSE)	**Assessment**
	• Employ a variety of strategies in working with percentage. For example: $2\frac{1}{2}$ % of 620 ≡ 1% 620 × 2.5 ≡ 6•2 × 2•5 (finding 1% then multiplying by the given percentages) • Apply knowledge of percentage increase/ decrease in solving problems • Link to consumer arithmetic	
LO:7 **Demonstrate an understanding of ratio and proportion and apply the same in problem solving**	• Share the same number of objects in several given ratios and compare the results obtained. • Write ratio between two quantities in the simplest form. For example: - John is 10 years and Mary is 15 years. Ratio of john's age to Mary's age is 10 to 15 or 10 : 15 - 25 : 40 reduces to 5 : 8 - 18 : 12 reduces to 3 : 2 • Explore combinations that give the same ratio • Identify quantities that can be shared in a given ratio • Write a quantity consisting of different parts as a ratio showing a comparison between the different parts. For example, write the: - population of their class as a ratio of male to female; - population of their household as a ratio showing adults to children; - furniture in classroom as ratio comparing desk to chair; • Share an amount of money or a number of objects among up to three persons in a given ratio. For example share $50 among Sam, Peter and Mary in the ratio 1:2:7 respectively. • Apply the concept of ratio to compare male/female; ethnic composition of the population of a community or country • Identify the total amount that has been shared given the ratio and one of two shares • Work out one proportion or total amount given ratio and one proportion. For example: - The ratio of boys to girls in Bay Road School is 3 :2. There are 60 boys in the school. How many girls are there? What is the total number of students in the school?	• Students write ratios in their simplest terms • Students write quantities consisting of different parts as ratios showing comparison of the different parts • Students share an amount of money in a given ratio

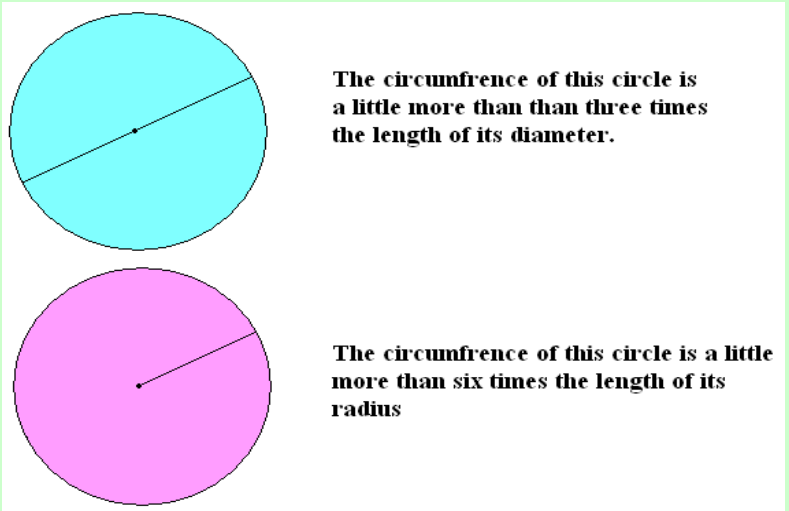
Learning Outcomes		
	Suggested Learning Activities (NUMBER & NUMBER SENSE)	**Assessment**
LO:8 **Solve consumer arithmetic problems involving earning and spending money; taxes, interest, appreciation and depreciation.**	• Read meters (water, electricity) over a short period (weekend, few days, a week) and construct bills to reflect information regarding: - present reading - previous reading - consumption (units used) - fixed rate (where appropriate) - total charge for the period • Use calculations based on conditions of sales to compare the cost price of similar articles offered at two or more stores. • Collect information from stores relating to their Hire Purchase and Cash Sales. Use calculations to compare the difference in prices of an article offered for sales on Hire Purchase as against Cash Purchase. • Work in small groups to make up 'pay slips' that shows: - normal hours of work; - over time - basic hourly rate - over time rate - deductions (such as National Insurance Services, Income tax, stamp duty • Use calculations based on a given exchange rate and the price of an article stated in two different currencies. • Complete local Income Tax Return forms **Money** • Perform four basic operations involving money • Comput the bill for purchase of a number of articles • Work out the unit price per article, per gallon, per litre, etc • Work out simple currency conversions	• Students construct advertisements which make appropriate use of percentages • Given sufficient information, students calculate profit, loss, percentage profit, percentage loss; discount, sale tax, percentages increase and decrease in price, hire purchase price, deposit, cash price • Students write short notes/ give examples to explain/ illustrate the meaning of terms (discount, profit, loss, percentage profit, percentage loss; discount, sale tax, percentages increase and decrease in price, hire purchase price, deposit, cash price) • Given sufficient information, students calculate profit, loss, percentage profit, percentage loss; discount, sale tax, percentages increase and decrease in price, hire purchase price, deposit, cash price • Students perform calculations involving money to determine the unit cost of an item, the "Best Buy" for money • Students solve problems involving computations with money • Students construct and answer questions related to aspects of consumer arithmetic as depicted in advertisements collected from flyers and newspapers • Given sufficient information, students construct/design samples of utility bills

Learning Outcomes		
LO:1 **Estimate, measure, compare and record measurements of lengths, distances and perimeters using appropriate units and devices**	**Suggested Learning Activities (MEASUREMENT)**	**Assessment**

• Continue to estimates linear measurements (lengths, distances and perimeter) and to explain how such estimates were arrived at.
• Measure the length of two objects and talk of the length of one object in relation to the length of the other object. For example



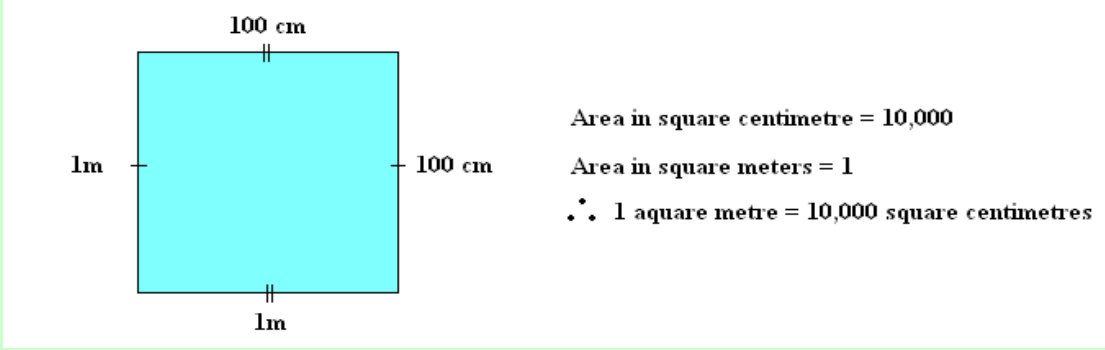
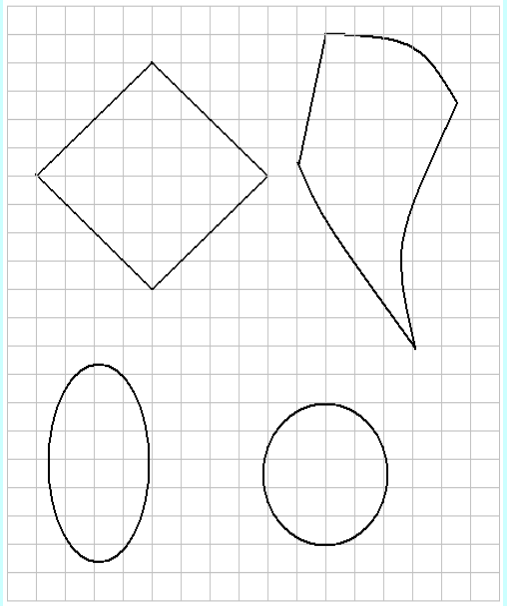
• Use the relationship between different units to convert from one unit to another.
• Use string to measure and compare the measurement of the diameter of a circle to the diameter of the same circle;
• Guide students through questioning to speak of the diameter of a circle as being "little more than" three times the length of its circumference and to use this relationship as a tool to estimate the circumference/ diameter of a circle.

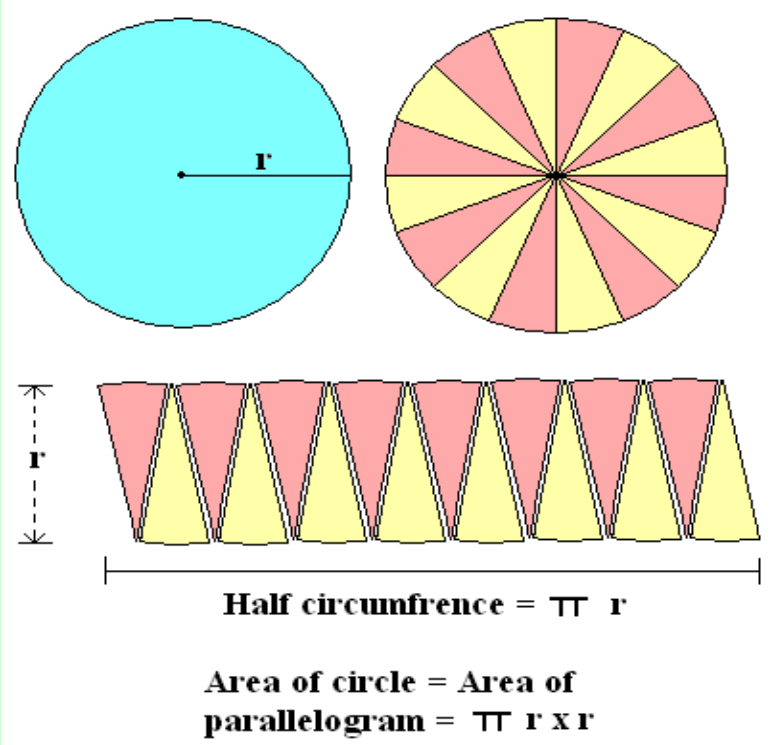


• Students perform the actual task of measuring a set of objects in different units within a given time period or to a given degree of accuracy
• Students complete exercises involving conversion from one unit of measurement to another
• Students complete a table to show equivalence between different units of measurements. For example

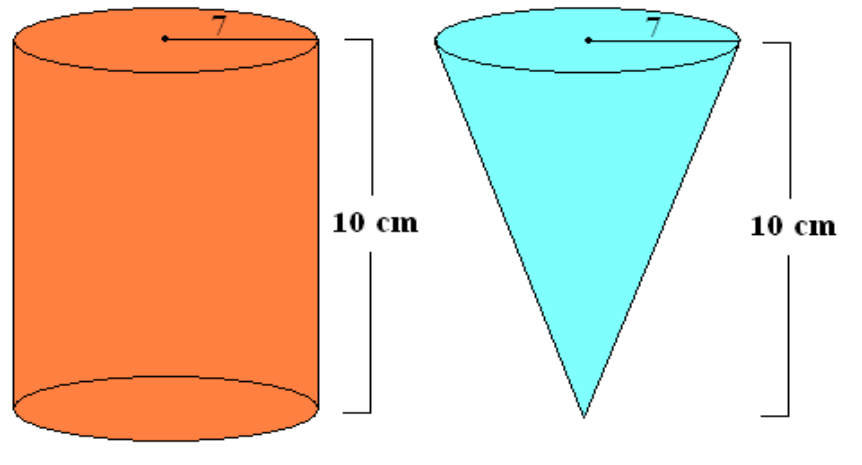
MM	CM	M	KM
5000	500	5	.005
		1000	1
100		0.1	

Learning Outcomes		
	Suggested Learning Activities (MEASUREMENT)	**Assessment**
	• Calculate the circumferences of circles and referring to the circumference as the perimeter of the circle • Create and solve problems relating to measurement of length, distance and perimeter.	• Students give examples to illustrate the meaning of terms such as: twice as long; three times as long; one-third as long as • Students complete/ construct tables to show equivalence between different units used to record linear measurements • Given sufficient information, students estimate the circumference of circles and explain the strategy used • Students calculate the circumference of circles; length of arc of semi-circle, quarter circle • Students calculate the perimeter of shapes made up of straight lines and curves • Students complete tables such as: Map Scale | Length on map | Actual length on land 1:200 | 10cm | 20 metres 1:500 | 100cm | 500 metres

Learning Outcomes		
LO:2 **Estimate, measure, compare and record the areas of surfaces in square centimeters and square metres**	**Suggested Learning Activities (MEASUREMENT)**	**Assessment**
	• Apply formulae to calculate the area of polygons (rectangles, parallelogram, trapezium, and composite shapes • Calculate the area of the same shape in different square unit and use result to deduce relationship between square cm and square m. For example.  • Cut a box (cube & cuboid) into rectangles and squares. Calculate the area of each face. And speak of the sum of the areas of all the face as the total surface area of the box (cube/cuboid). • Cover the curved surface area of cylindrical containers with rectangular shaped paper and speak of the area of the curved surface of the cylindrical containers in terms of the area of the rectangular paper used. Draw circles on 1cm grid paper and estimate their area by counting the number of unit squares enclosed.	• Students estimate the area of regular and irregular shapes draw on grid/dotted paper • Students draw/ sketch shapes on dotted/ grid paper that enclosed a given area. For example: Draw as many shapes as possible that enclosed an area of 2 square centimeters 

Learning Outcomes		
	Suggested Learning Activities (MEASUREMENT)	**Assessment**
	• Cut circles into eight or more sectors and rearrange sectors to form a 'parallelogram' then applying formula for area of parallelogram to deduce area of a circle.  • Create and solve problems relating to measurement of surface area. For eg. - investigate the relationship between squares formed on the hypotenuse and the sum of the areas of squares formed on the other two sides of the right angled triangle.	• Students use formula to calculate the area of triangles and quadrilaterals • Students calculate the area of: - the faces of cubes and cuboids - the curved surface of cylinders - the total surface are of cubes and cuboids • Students calculate the area of circles; semi-circles and quarter circles • Students solve problems involving computations of are measurements • Students make a chart/ booklet consisting of the different formulae used for calculating the area of different plane shapes with sketch of each plane shape and worked examples involving use of each formula

Learning Outcomes		
	Suggested Learning Activities (MEASUREMENT)	**Assessment**
	• Continue to estimate, measure, record and compare measurement of volume capacity and mass; giving reasons for estimations and strategies used to obtain measurement • Recognize and refer to 1 000 millitres as 1 litre and one millilitre as one-thousandth of one litre; 1 000 grams as one kilograms and one gram as one-thousandth of one kilogram • Investigate the relationship between the length, breadth, height and volume of rectangular prisms	
LO:3 **Estimate, measure, compare and record volume, capacity, and weight using appropriate units of measurement**	**Volume & Capacity** • Estimate, measure, record and compare measurements of volume and capacity; giving reasons for estimations and strategies used to obtain measurement • Place irregular solids into measuring cylinder containing water and determine the volume of the solid as the amount of water displaced. For example: - place a stone into a measuring cylinder half fill with water and calculate the volume of the stone as the difference between the reading before and after the stone was place in the water. • Use the relationship between the length, breadth, height and volume of rectangular prisms to carry out related calculations • Use several different size cylinder, to investigate ($V = \pi r^2 h$) the relationship between the volume of a cylinder and the area of its circular base height. • Tabulate results obtained and use the same to formulate a generalization in determining the volume of a cylinder	• Students use stated formula to compute the capacity and volume of cubes, cuboids, cylinders and cones • Given sufficient information, students calculate the height, length, area of base of different solid shapes. • Students give the dimension of cubes and cuboids with the same volume/ capacity • Students use the relationship 1000 cm3 = 1 litre to convert from between cubic centimetres and litres • Students perform computations involving conversion from grams to kilograms and vice versa • Students give the dimension of cubes and cuboids with the same volume/ capacity • Students use the relationship 2.2 pounds = 1 kilogram to convert from pounds and kilograms and vice versa • Students solve problems related to measurement of weight, volume and capacity

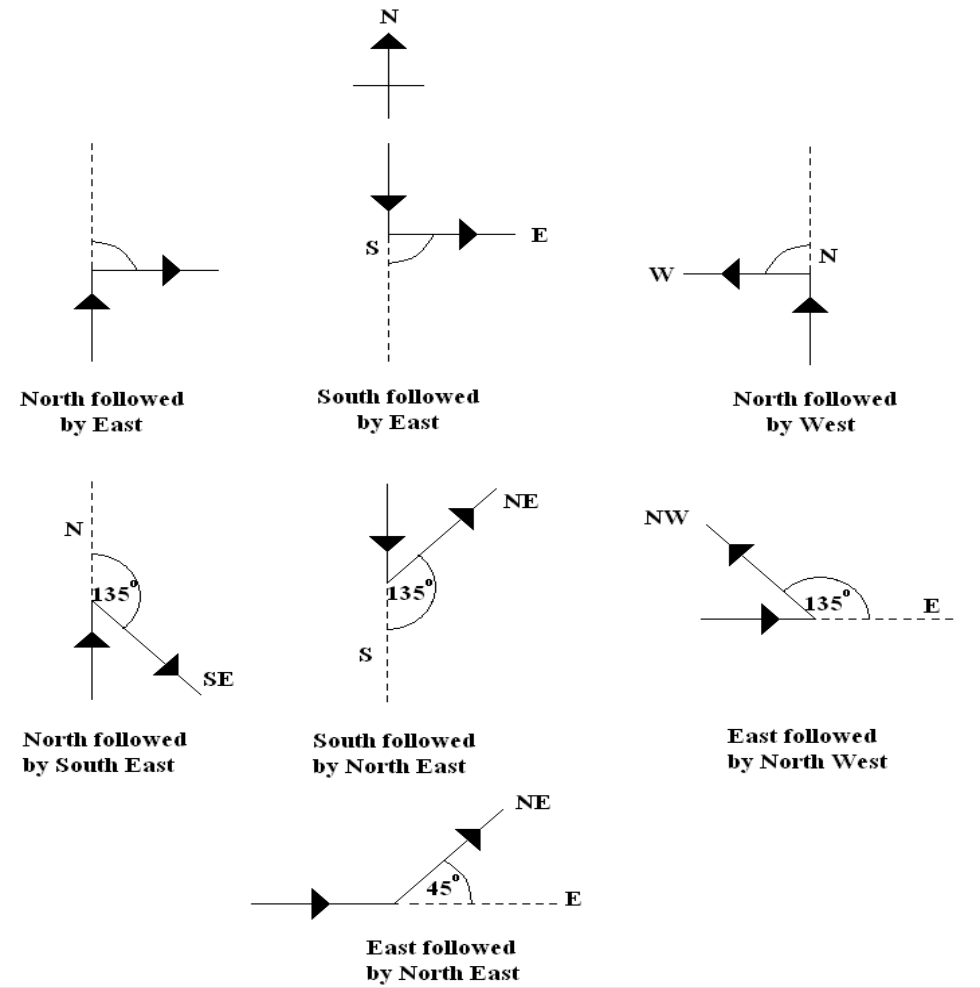
Learning Outcomes		
	Suggested Learning Activities (MEASUREMENT)	**Assessment**
	• Investigate the relationship ($V=\frac{1}{3}\pi r^2h$) between the volume of a cone and a cylinder with similar height and circular base. - For example fill a cone with a circular base of radius 7 cm and height 10 cm into a cylinder with a circular base of radius 7 cm and height 10 cm. How many times must you pour the fill cone into the cylinder to completely fill the cylinder?  • Use formulae for volume of cone to calculate the volume, height, radius and area of circular base of cone • Solve problems involving calculation of volume of solids	

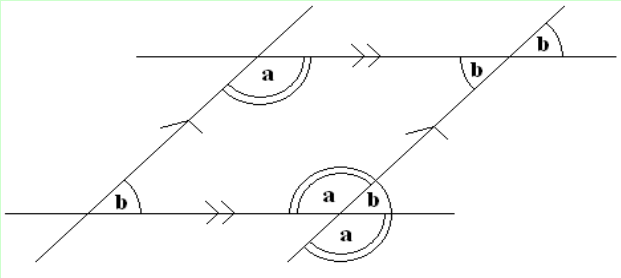
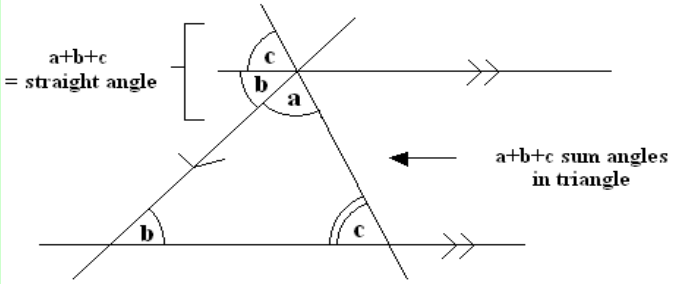
<table>
<tr><td>Learning Outcomes</td><td colspan="2"></td></tr>
<tr><td></td><td>Suggested Learning Activities (MEASUREMENT)</td><td>Assessment</td></tr>
<tr><td>LO:4

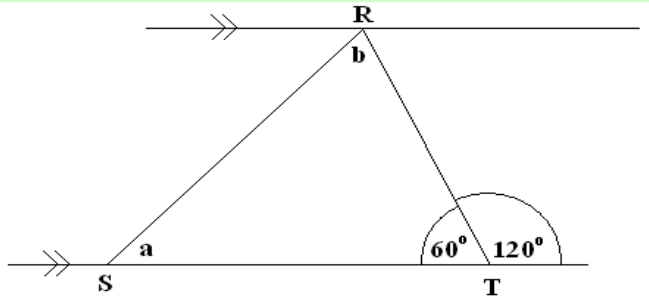
Read and record time; perform calculations involving mixed units of time</td><td>• Read and interpret information relating to time such as:
- itinerary on airline tickets
- time tables
- schedule of events
• Make time tables; schedule of events; itinerary to fit into a given time period
• Look at the display of time in St Vincent and the Grenadines and another time zone and calculate the difference between both time zones. For example

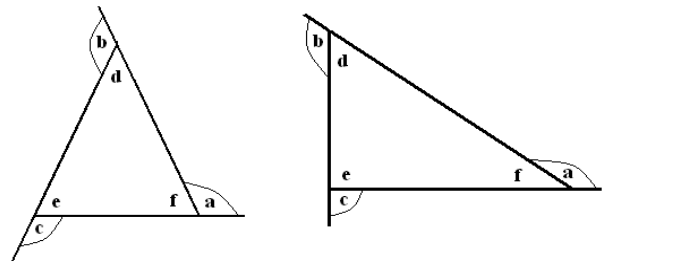
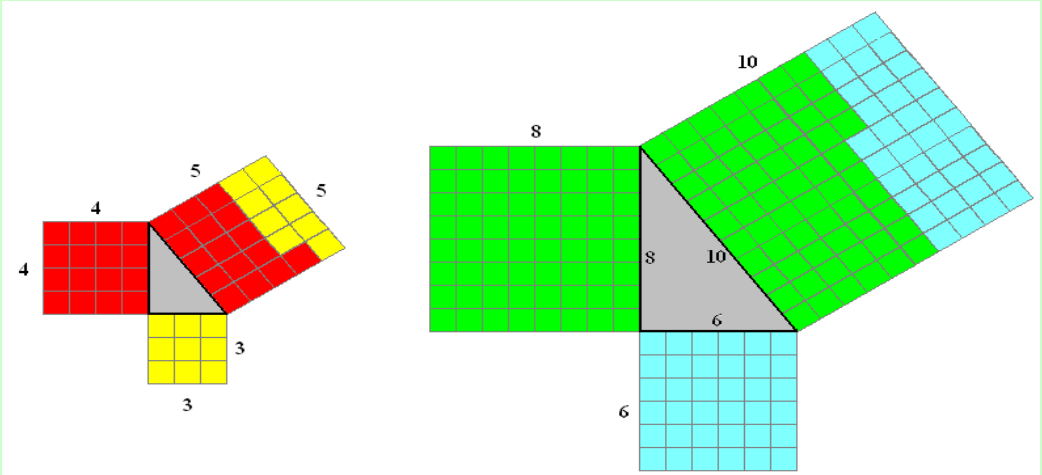
<table><tr><th>Country / City</th><th>Time</th><th>Day</th></tr><tr><td>Australia - Adelaide</td><td>1:10 am</td><td>Thursday 25th</td></tr><tr><td>Pakistan - Karachi</td><td>9:40 pm</td><td>Wednesday 24th</td></tr><tr><td>Italy - Rome</td><td>5:40 pm</td><td>Wednesday 24th</td></tr><tr><td>England - London</td><td>4:40 pm</td><td>Wednesday 24th</td></tr><tr><td>ST. Vincent - Kingstown</td><td>11:40 am</td><td>Wednesday 24th</td></tr></table>
• Give the corresponding time in St. Vincent and the Grenadines to a given time in a different time zone
• Create and solve problems involving time</td><td>• Perform calculation involving measurments of time
• Convert from one unit of measurment to another
• Construct and solve problems involving time.
• Complete table to show equivalent time in different time zones</td></tr>
<tr><td>LO:5

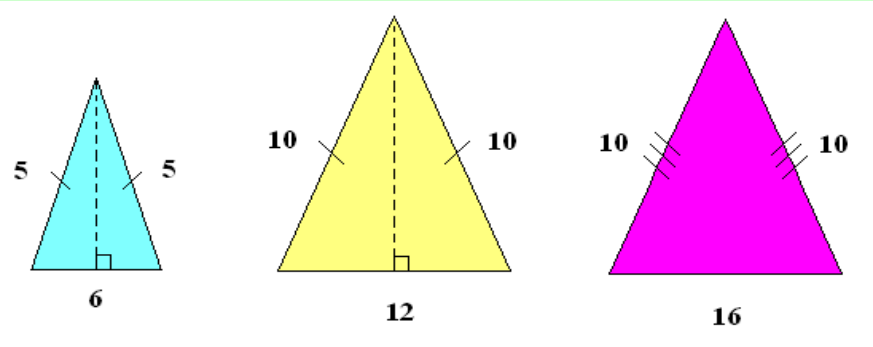
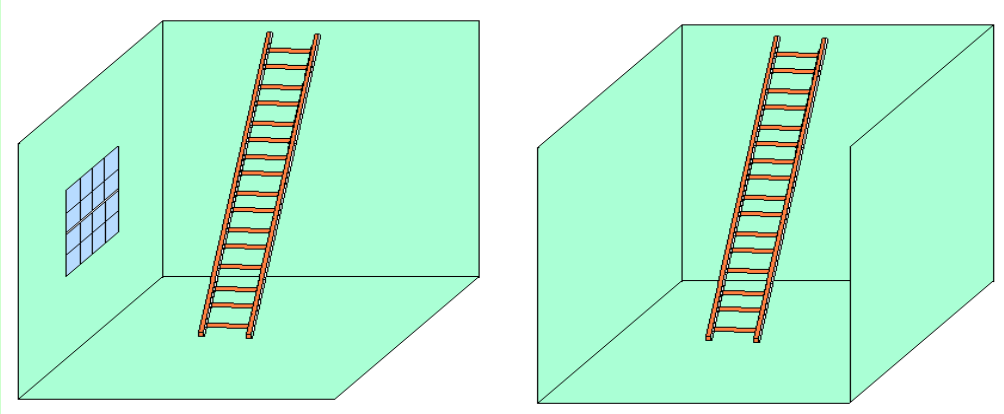
Temperature Record, interpret and calculate measurement of temperature</td><td>• Link to the study of directed numbers to record temperature below zero degrees
• Construct table and use the same as a guide in devising approaches in converting from degrees Fahrenheit to degrees Celsius and vice versa. For example measure the following objects in both oF and oC and record information in a table
- a sample of boiling water
- a block of ice
- body temperature
- the inside of a refrigerator
• Use formula $C = (F - 32) \times \frac{5}{9}$ to convert from Fahrenheit to Celsius
• Solve problems involving measurement of temperature
• Link to related topics in Geography and Science</td><td>• Students perform the task of measuring and recording the temperature of different objects in degrees Celsius (^{o}C) and degrees Fahrenheit (^{o}F)
• Students complete a table to show the equivalence between degrees Celsius (^{o}C) and degrees Fahrenheit (^{o}F)
• Students solve problems involving addition and subtraction of temperature</td></tr>
</table>

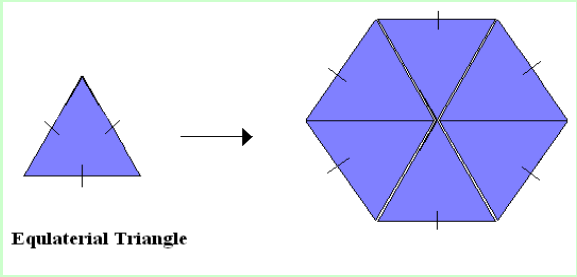
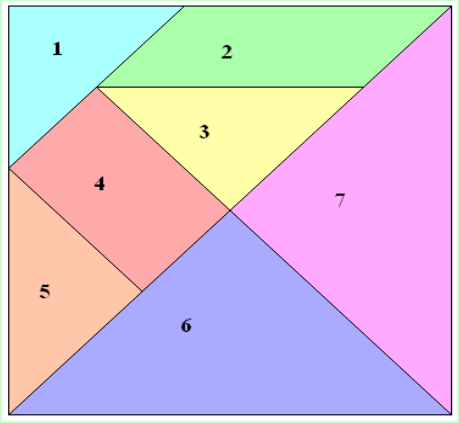
Learning Outcomes		
LO:1 **Angles** **Identify properties of angles and use such knowledge in solving problems**	**Suggested Learning Activities (GEOMETRY)**	**Assessment**
	• Link to the four major and four secondary Cardinal points. For example sketch two or three movements according to given cardinal direction and speak of the angle/angles so formed. For example A move to the North followed by a move to the East or West form a 90o angle  	• Students sketch/ draw diagrams to illustrate different types of angles in different orientations • Students sketch/ draw lines that meet given specification. For example: Draw lines that are parallel, perpendicular • Students calculate the missing angles in diagrams consisting of; - two intersecting lines - two parallel lines cut by a transversal • Students calculate missing internal and external angles in triangles and quadrilaterals • Students draw diagrams/ write short notes to show that: - angles in a triangle add up to 180^o - opposite angles in a parallelogram are equal - angles in a straight angle add up to 180^o - vertically opposite/ corresponding angles/ alternate angles are equal - sum of exterior angles of triangles equal 180^o • Students use a pair of compasses and a ruler to construct a line to a given measurement • Students use a ruler and a set-square or a ruler and a pair of compasses to construct a line that is parallel or perpendicular to a given line • Students sketch parallel and perpendicular lines in different orientations

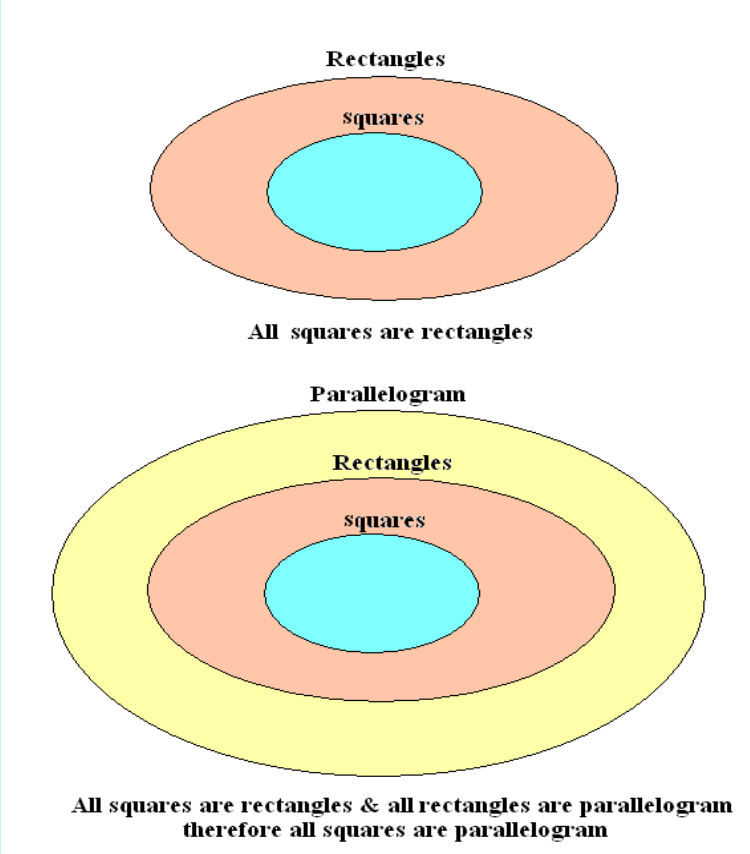
Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
	• Estimate, measure and record the measurement of angles to the nearest degree • Use the protractor to measure the same angle in both the clockwise and anti-clockwise directions. • Use knowledge of alternate and corresponding angles to show that opposite angles in a parallelogram are equal.  **Opposite angles in a parallelogram are equal** • Use relationships between angles formed by parallel lines to show that: - sum of angles in triangle equal to 180^{o}  **Two angles marked c are corresponding angles** **Two angles marked b are alternate angles** **Angles a, b, and c form a straight angle therefore a, b, and c add up to 180^{o}**	

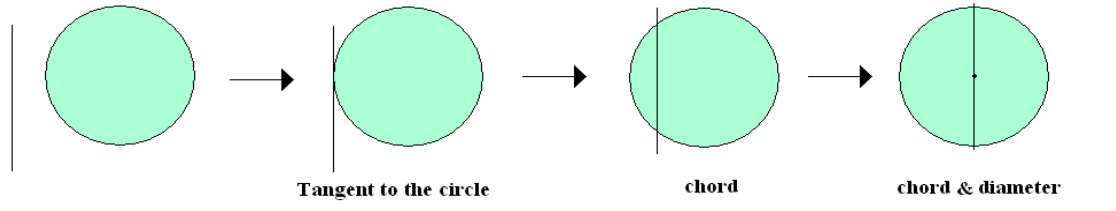
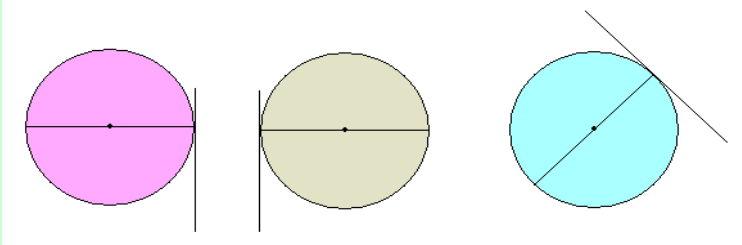
Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
	- An exterior angle of a triangle is equal to the sum of the two opposite interior angles.  a + b + 60 = 180 (sum of angles in a triangle) ∴ a + b = The exterior angle (120°) at T • Solve problems related to angles	
LO:2 **Polygons (triangle) Identify and use the geometrical properties of triangles in problem solving**	• Compare properties of different types of triangles to deduce why a single triangle may belong to more than one type of triangle. For example: - speak of all equilateral triangles are being acute angled triangles, giving reasons. - speak of some triangles as being scalene and also acute angled, giving reasons. • Investigate the order of roataional symetry and lines of symetry of different types of triangles 	Types of Triangles	Order of rotational symetry	Lines of symetry
				• Students sketch different types of angles in different orientations • Students use the protractor to measure and record the size of a given angle • Students sketch different types of triangles in different orientations • Students draw Venn diagrams to illustrate/ show relationships between different types of triangles

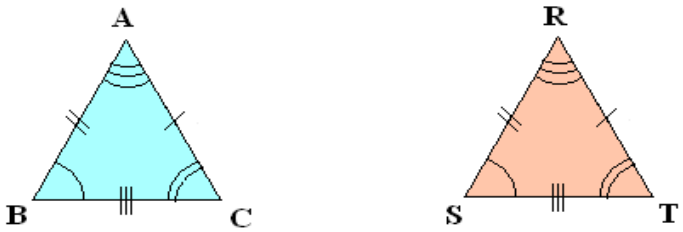
Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
	• Measure an exterior angle of a triangle and compare the measurement with the sum of the two opposite interior angles.  **Measure angle a and compare its size with the sum of angles d and e** **Measure angle b and compare its size with the sum of angles e and f** **Measure angle c and compare its size with the sum of angles d and f** • Use the edge of a 3x3, a 4x4 and a 5x5 grids to form a right angled triangle and speak of the sum of the area of the grid on the hypotenuse in terms of the sum of the area of the grids on the other two sides  **Area of square formed on the hypotenuse is equal to the sum of the area of the squares formed on the other two sides of the right angle triangle.**	• Students write short notes to state the properties of different types of triangles • Students construct angles using a pair of compasses and a ruler • Given an angle in a triangle, student identify the side that is opposite to the angle and the side that is adjacent to the angle • Students list set of Pythagoras triples. For example (3,4,5; 6, 8, 10) • Students make a chart consisting of several examples that illustrate Pythagoras Theorem ($a^2 = b^2 + c^2$) • Students design a chart consisting of several examples • Students apply Pythagoras Theorem in calculating missing sides and angles in right angled triangles

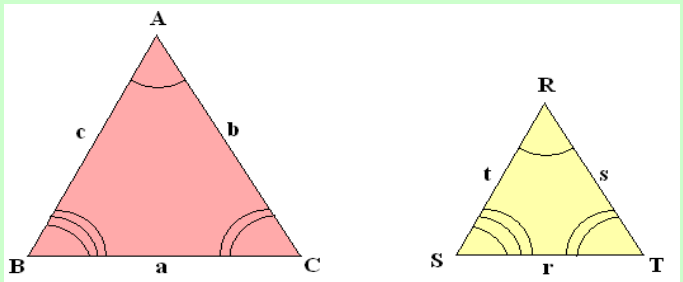
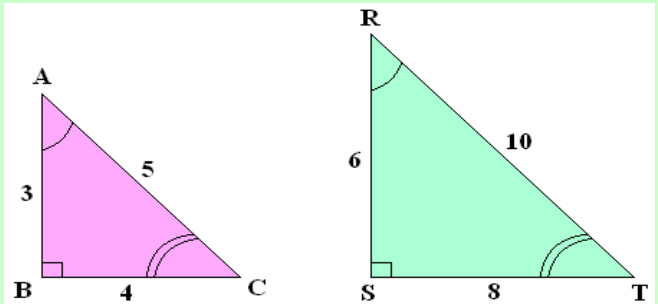
Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
	• Generate Pythagoras' triples by dividing isosceles triangles (5,5,6; 5,5,8; 10,10,12; 10,10,16) into two identical right angled triangles and speak about the measurement of the  • Place objects such as rods, ladder against the classroom wall and floor to form right angled triangles and by measuring verify the whole number length of the foot of the ladder from the base of the wall; and the length of the base of the wall from the top of the ladder.  • Continue to apply geometrical facts, properties and relationships to solve numerical problems such as finding unknown sides and angles of triangles, and justifying solutions to problems by giving reasons	

Learning Outcomes		
LO:3 **Polygons** **Identify and use the geometrical properties of polygons in solving problems**	**Suggested Learning Activities (GEOMETRY)**	**Assessment**
	• Investigate the order of rotational symmetry and lines of symmetry • Speak of the properties of quadrilaterals in terms of the relationship between opposite sides; adjacent sides; diagonals; angles • Discuss/explain/justify (using geometric properties) why a quadrilateral may belong to more than one type. • Use 'cut outs' of different types of triangles to form sided figures and speak of the types of quadrilaterals so formed. For example: - form a regular hexogan by placing six similar equalterial triangles together.  Equlaterial Triangle - arrange different number of pieces from a tangram to form different shapes. 	• Students list the properties of the different quadrilaterals • Students sketch examples of different polygons to match stated properties • Students draw Venn diagrams to show relationship between different types of quadrilaterals • Given sufficient information, students calculate the length of missing sides and the size of missing angles in quadrilaterals • Students make a chart using polygons of different sizes, shapes and colours that they have cut from Bristol board. Each polygon is correctly labeled with the name of the type of polygon it depicts • Students apply knowledge of properties of quadrilaterals in solving problems • Students complete tables to show the number of diagonals that name polygons have. For example **Types of Triangles** | **Order of rotational symetry** | **Lines of symetry** | | | | | |

Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
	• Investigate the properties of polygons with more than five sides by measuring and comparing length of sides, size of angles, number of diagonals and lines of symmetry • Use knowledge of the properties of quadrilaterals to draw and interpret simple Venn diagrams which show relationships between different types of quadrilaterals.  • Apply knowledge of quadrilaterals to solve problems.	• Students state the number of lines of symmetry and order of rotational symmetry of named polygons • Students make a booklet consisting of polygons of different shapes and sizes. This booklet may include pictures from magazines and newspapers that illustrate the types of polygons labeling each

Learning Outcomes		
	Suggested Learning Activities (GEOMETRY)	**Assessment**
LO:4 **Circles** **Identify and use properties of circles**	• Identify, name and sketch the different parts of the circle. Speak of the diameter of a circle in terms of the radius of the circle; and the circumference of the circle in terms of the length of its (Draw eg of circles - the radius of this circle is 6 units so the diameter is twice as long/ the diameter is 6 units + 6 units; - the diameter of this circle is 8 units, so the circumference is about three times as long, hence the circumference is about 24 units • Draw diagrams of a line and a circle moving towards each other and speak of the name given to the line at the different stages where the line - touches the circle (the line is a tangent) - intersects the circle at two points without passing through the center of the circle (the line is a chord dividing the circle into two segments) - intersects the circle at two points and also passes through the center (the line is the diameter (the longest chord) dividing the circle into two semi-circles)  • Make sketches of diagrams to illustrate the meaning of sectors and minor and major segments • Produce diagrams where a tangent to a circle and a diameter meet and measure the angles so formed and speak of the results obtained. 	• Students make sketches to illustrate the different parts of the circle • Students write short notes to explain the meaning of named parts of the circle • Students estimate the diameter/ radius of a circle given the circumference and vice versa • Given sufficient information, students calculate the circumference, radius, diameter of a circle • Students construct circles to a given radius, using a pair of compasses and a ruler

Learning Outcomes		
LO:5 **Congruency** **Apply properties of congruent and geometric plane shapes to solve problems**	**Suggested Learning Activities (GEOMETRY)**	**Assessment**
	• Investigate congruency by super imposing one shape on the other and rotate/translate shapes to verify whether one shape fits exactly onto the other and noting matching sides and angles.  $BC = ST$ $AB = RS$ $AC = RT$ $\angle A = \angle R$ $\angle B = \angle S$ $\angle C = \angle T$ **Both triangles are therefore congruent because ther are:** **(1) The three angles in ABC are equal to the three angles in RST.** **(2) The three sides in angle ABC are equal to the three sides in RST.** • Draw sets of triangles and quadrilaterals that are congruent to a given shape and explain why the shapes are congruent • Write congruent statements using ($\equiv$) to show the relationship between sides and angles of two congruent shapes • Deduce properties of congruent triangles and quadrilaterals by: - measuring and recording length of matching sides; - magnitude of matching angles; - perimeter and area of congruent shapes • Apply geometrical facts of congruency to solve problems such as finding unknown sides and angles, perimeter and area in diagrams. Provide opportunities for students to justify their solutions to problems by giving reasons for their approach/ results etc.	• Students draw sets of triangles/ quadrilaterals that are congruent • Students name corresponding sides and angles in two shapes (triangles and quadrilaterals) that are congruent • Students write short notes to explain the properties of congruency

Learning Outcomes		
LO:6 **Similarity** **Apply properties of Similarity and geometric plane shapes to solve problems**	**Suggested Learning Activities (GEOMETRY)**	**Assessment**
	• Speak of similarity in relation to shadow of an object and the object; photographs; plans • Match corresponding sides and angles of two similar shapes (triangles and quadrilateral). Begin by looking at similar shapes that are in the same orientation  $\angle A = \angle R \quad \angle B = \angle S \quad \angle C = \angle T$ **corresponding sides are:** **a and r ; b and s** • Produce and draw/sketch a set of triangles and quadrilaterals by increasing/decreasing the sides of a given shape by a scalar quantity  $\angle A = \angle R \quad \angle B = \angle S \quad \angle C = \angle T$ **Pair of corresponding sides are:** **AB & RS BC & ST AC & RT**	• Students draw sets of triangles/ quadrilaterals that are congruent • Students name corresponding sides and angles in two shapes (triangles and quadrilaterals) that are congruent • Students write short notes to explain the properties of congruency

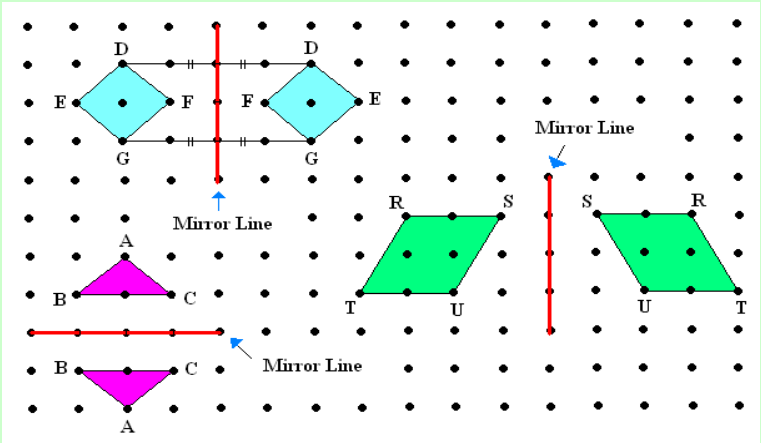
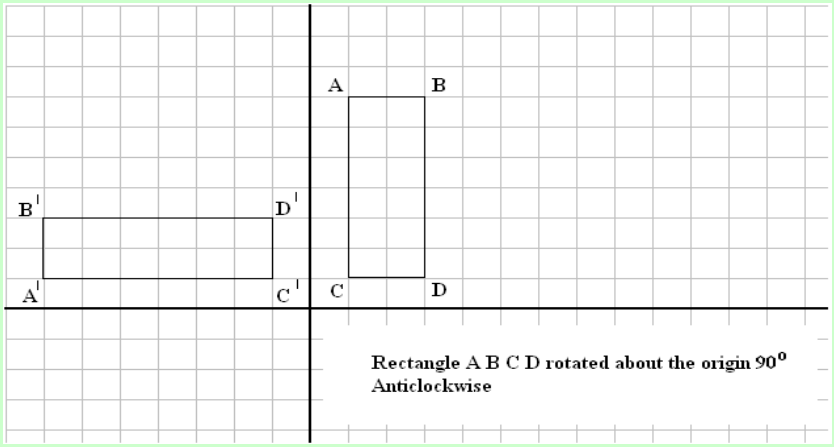
<table>
<tr><td>Learning Outcomes</td><td colspan="2"></td></tr>
<tr><td></td><td>Suggested Learning Activities (GEOMETRY)</td><td>Assessment</td></tr>
<tr><td></td><td>• Deduce the principles of similarity of shapes by:
- measuring, recording and comparing matching sides and angles.
- Making verbal and written statements about matching sides and angles
• Name the vertices of similar triangles and quadrilaterals in matching order when using the symbol (≡) in similarity statements.

• Use a given ration to draw/sketch triangles and quadrilaterals that are similar
• Apply properties of geometric similarity to solve problems such as finding unknown sides and angles in triangles and quadrilaterals b</td><td></td></tr>
<tr><td>LO:7

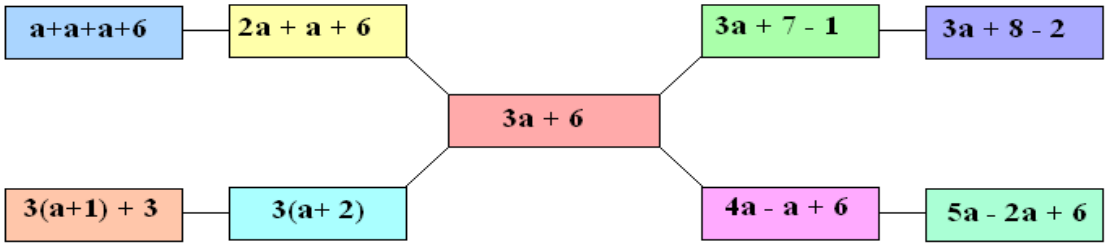
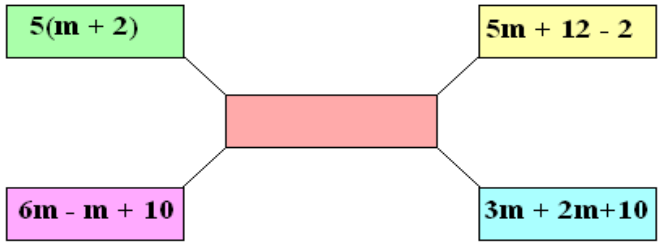
Solid Shapes
Recognize the properties of solids and apply such knowledge to solve problems</td><td>•Sketch the net of solid shapes

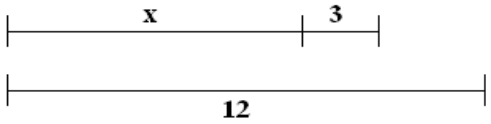
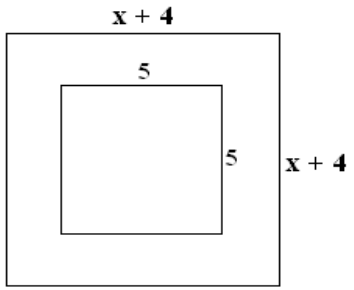
• From practical activities develop an understanding of cross-section of a solid. For example cut a cylindrical object into two parts and talk of the cross section seen</td><td>• Students classify solids and solid shapes and explain the rule governing such classification
• Students draw the corresponding nets for various solid shapes and vice versa
• Students complete tables such as:

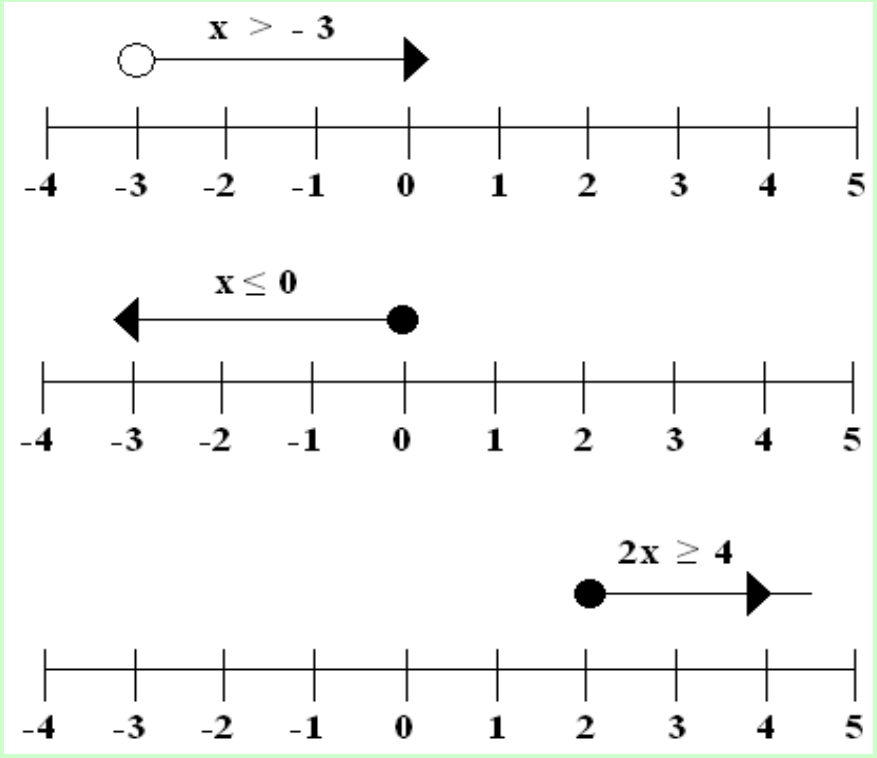
<table><tr><th>Name of solids</th><th>No. of Faces</th><th>No. of Vertices</th><th>No. of Edges</th></tr><tr><td>Cube</td><td>6</td><td>8</td><td>12</td></tr><tr><td>Cylinder</td><td>3</td><td>0</td><td></td></tr></table></td></tr>
</table>

Learning Outcomes		
LO:8 **Transformational Geometry** **Identify properties of transformation and use such knowledge to solve problems relating to geometry**	**Suggested Learning Activities (GEOMETRY)**	**Assessment**
	• Observe and note the similarites between and object and its image after a reflection  • Rotate shapes anticlockwise about the origin through a given angle and note the differences and similarites between the object and its image  Translation • Translate a shape on grid paper and note the similarites between and object and its image after a reflection	• Students sketch on grid paper, the object and its image after a stated transformation • Given sufficient information, students state the type of transformation that was performed on the object

Learning Outcomes		
LO:1 **Generate, describe and complete number and geometrical patterns using a variety of strategies and completing simple number sentences by calculating missing values**	**Suggested Learning Activities (PATTERN & ALGEBRA)**	**Assessment**
	• Begin to translate rules of arithmetic sequences into linear expressions that can be used to determine the nth. For example: 3, 6, 9, 12 term | 1st | 2nd | 3rd | 4th | nth | 3×1 | 3×2 | 3×3 | 3×4 | 3×n 3, 7, 11, 15 term | 1st | 2nd | 3rd | nth | 4×1-1 | 4×2-1 | 4×3-1 | 4×n-1 • Deduce linear expressions for arithmetic sequence by comparing the common difference between successive terms. For example: 21, 27, 33, 39, 45 Term | 1 2 3 4 5 | 21 27 33 39 45 Common difference | 6 6 6 6 T(a) = common difference × term + constant	• Students complete, extend and generate arithmetic sequences and geometric patterns • Students describe in words, the rule depicted by a given number sequence or geometric pattern • Students complete tables to show common difference and state the rule governing the sequence. For example Term | 1 2 3 4 | 5 8 11 14 Common Difference | 3 3 3 T (1) = 3x1 + 2 T (2) = 3x2 + 2 T (3) = 3x3 + 2 T (n) = 3xn + 2

Learning Outcomes		
LO:2 **Construct, simplify and transform algebraic expressions**	**Suggested Learning Activities (PATTERN & ALGEBRA)** •Use concrete materials such as counters, cups, boxes to model algebraic expressions of the form: - 2(a + 1); 4(y + 3) (variable plus a constant more than once) - b + b + y + y + y • Complete/generate tree diagrams to generate sets of equivalent expressions. **Start with the expression in the central box and generate as many equivalent expressions as possible.**  **Write in the central box, the expression which is similar to the given four expressions**  • Develop and use geometrical model for expressions of the form (a + b) (c + d). For example the total area of the rectangle below is the sum of (3c + 5c + 3d + 5d)	**Assessment** • Students translate verbal statements and geometric models into algebraic expressions • Students perform computations with algebraic expressions to include: - simplifying algebraic expressions - expanding algebraic expressions involving work with brackets - factorizing algebraic expressions • Students generate sets of equivalent expressions equivalent to a given expression. For example: **10t + 12** may be rewritten as: **5t + 5t + 12; 9t + t +12; 10 t + 6 + 6; 2 (5t + 6)** • Students produce geometric models to illustrate expressions of the form: **a(b + c) (a + b) (b + c)**

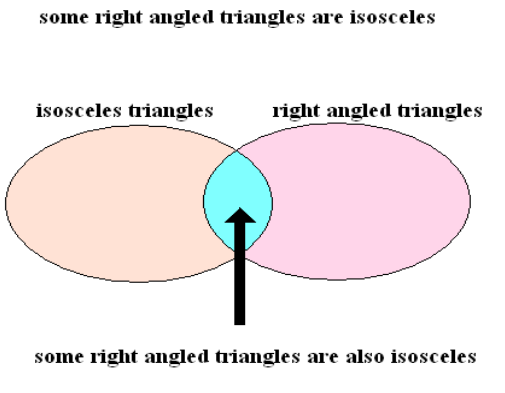
Learning Outcomes		
LO:3 **Construct and solve algebraic equations and inequalities**	**Suggested Learning Activities (PATTERN & ALGEBRA)**	**Assessment**
	• Discuss/ produce situations which will give rise to the use of signs < & > to denote inequality between two expressions. For example speak of the length of one line in relation to another. Gradually move away from the use of words to use of symbols.  **The length of the line at the top is shorter than the length of the line at the bottom therefore:** $x + 3 < 12$  **The perimeter of the inside square is shorter than the perimeter of the oustside square therefore:** $25<4x+16$ • Produce geometrical models of inequalities • Find a range of values that satisfy an inequality using a 'guess and check' strategy • Simplify equations and inequalities by matching and cancelling similar terms on either side of the equation/inequality. For example by matching and cancelling out equal lengths (n for n in both line) the inequality 3n < 8 can be reduced to n < 8.	• Students translate verbal statements and geometrical representations into algebraic equations and inequalities • Students write the inverse of given algebraic equations and solve algebraic equations and inequalities • Students model the solution to inequalities on a number • Students write short notes to explain the steps followed in solving an algebraic equation

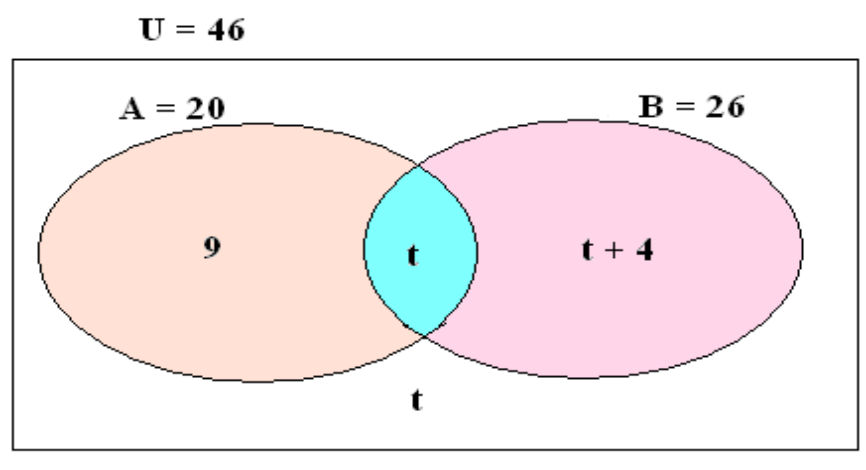
Learning Outcomes		
	Suggested Learning Activities (PATTERN & ALGEBRA)	**Assessment**
	• Speak of the possible values that the variable can take on in respect of the given inequality. For example in the inequality $\chi < 14$, recognize that χ can be 13, 12, 11,.. since χ is less than 14. - Model solutions to inequalities or number line for example. • Translate problems into algebraic equations, and simple inequalities solve the equations or inequalities and translate the solution into answers to the problems • Represent solutions to simple inequalities on the number line. 	

Learning Outcomes		
	Suggested Learning Activities (PATTERN & ALGEBRA)	**Assessment**
LO:4 **Identify, transpose and apply familiar mathematics formulae**	• Make use of drawings and examples to illustrate/ explain the meaning of familiar formulae used in other strands of mathematics and other subject disciplines, such as - P = 2L + 2W or 2(L + W) - A = L × W A = ½ h × b; - A = h × b A = πr^2 - A = ½ h (a + b) - $a^2 = b^2 \times c^2$ - T = D × S • Transpose familiar formulae and describe procedures followed in transposing such formulae. Substitute identical values into original formula and that obtained after transposing to verify correctness of the transposition obtained. • Solve equations arising from substitution into known mathematics formulae. For example. For example: $c^2 = a^2 \times b^2$ • Work out solutions to to more complex binary operations. For example: - if $t * m = t^m + m$, then $2 * 3 = 2^3 + 3 = 2 \times 2 \times 2 + 3$ • if $r * q = 2r - q$, $5 * (-1) = 2 \times 5 - -1 = 10 + 1 = 11$	• Students give examples that match a given mathematics formula • Students calculate solutions to simple binary operations

Learning Outcomes		
LO:5 **Express functions; and represent mappings diagrams graphically. Graph and interpret linear relationships on the number plane Express and represent functions in mapping diagrams on linear graphs**	**Suggested Learning Activities (PATTERN & ALGEBRA)**	**Assessment**
	• Generate a number patterns and tables of values from given algebraic expression. For example: f(x) = x+3 • Sketch mapping diagrams for given functions and draw the corresponding linear graphs • Plot linear graphs that reflect real life occurrences such as time graphs, population growth over time. • Calculate the function given ordered pairs and vice versa. • Calculate the gradient of linear graphs. • Draw linear graphs for - y = x - y = − x - y = 2 - x = 2 • Investigate the relationship between pairs of graphs of the form **y = mx + c**; where the value of **m** is equal.	• Students produce geometric models to match known mathematics formulae • Students known mathematics formulae in term of a given subject. For example: **T = D X S** written with **S** as the subject gives **S = T ÷ D** with **D** as the subject gives **D = T ÷ S**

χ	1	2	3	4	5
X + 3	4	5	6	7	8

Learning Outcomes		
LO:1 **Use set notations to organize information and; solve problems**	**Suggested Learning Activities (DATA HANDLING)**	**Assessment**
	• Construct Venn diagrams given sufficient information. For example draw the Venn diagram, given that: $A \cap B = \{5\}$ $A' = \{4, 6, 8, 9, 10\}$ $B' = \{2, 4, 3, 7, 6, 8, 9\}$ • Draw Venn diagrams to show relationship between different types of numbers. For example: - given that **P =** $\{\text{odd numbers}\}$, **R =** $\{\text{even numbers}\}$ draw the Venn diagram which illustrates the relationship between **P** and **R** **Link set theory to geometry** • Construct Venn diagrams to explore/ illustrate the relationship between properties of different geometrical shapes. For example Draw Venn diagrams to illustrate statements such as: - all squares are rectangles. - all equilateral triangles are acute angled triangles. - all squares are rectangles and all rectangles are parallelograms. • Respond to questions based on information presented in Venn diagrams. • Interpret information presented in a Venn diagram. For example in the Venn diagram shown below $Y\ \{\text{dogs}\}$ = , A= $\{\text{pit bull}\}$ B = $\{\text{black pit bull}\}$  	• Students list members of a set given a description of the set and vice versa • Students give examples of different types of sets (null, infinite, finite, equal, equivalent) • Students use set language notations to describe set relationships • Students answer questions based on information presented in Venn diagrams • Students draw simple Venn diagrams to show relationships between given sets • Students translate verbal statements into Venn diagrams • Students use set notation/ language to communicate information about the relationship between two sets • Students respond to questions based on information presented in Venn diagrams

Learning Outcomes		
	Suggested Learning Activities (DATA HANDLING)	**Assessment**
	• Link Set theory to algebra • Use knowledge of set theory in solving problems. For example the number of members belonging to the various sets in the Venn diagram may be determined by formulating algebraic equations such as: - t + 9 = 20 - t + 4 + t = 26 - 3t + 4 + 9 = 46  • Link to number theory, geometry, algebra and other related area of the mathematics curriculum.	

<table>
<tr><th>Learning Outcomes</th><th colspan="2"></th></tr>
<tr><td>LO:2

Design and use simple instrument for relevant data collection</td><td>Suggested Learning Activities (DATA HANDLING)</td><td>Assessment</td></tr>
<tr><td></td><td>• Discuss issues that might form the basis for data collection. For example:
- the growth of certain seedlings per day
- rainfall over certain period
- population growth of school, community, country

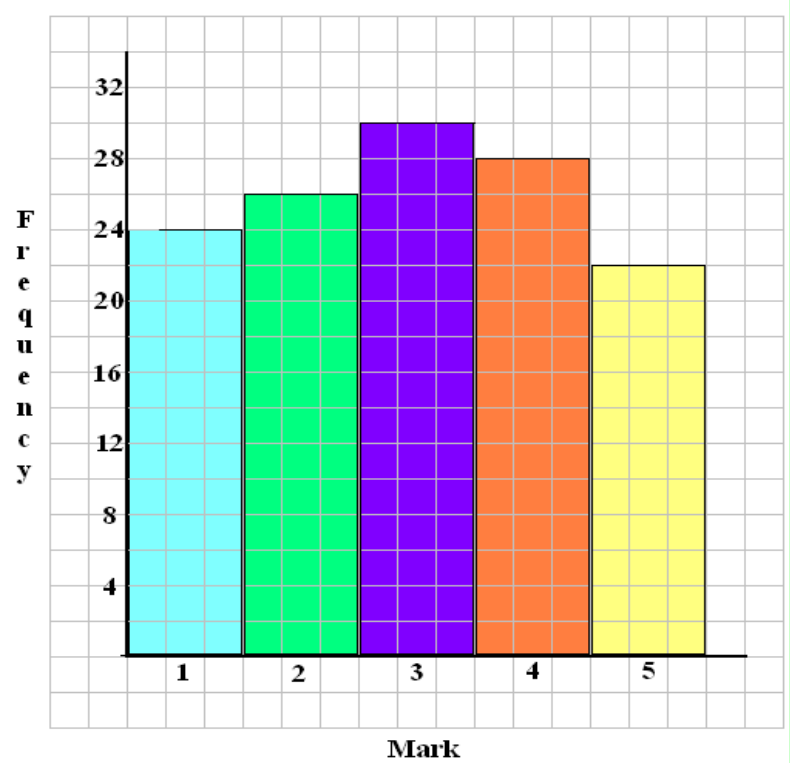
• Collect data through other class/ school engagements. For example record the:
- the time the computer different students computer takes to booth up or the length of time different students take to type a given task when the class visits the computer laboratory for ICT subject
- length of time class members skip for or the number of ‘push up’ done by students during a Physical Education session
- time taken by different solutions, such as pure water; salt water, sugar water; lime juice before they reach boiling point in an experiment carried out during a science class
- the amount of rain fall over a five day or week end period by placing containers in suitable places out doors

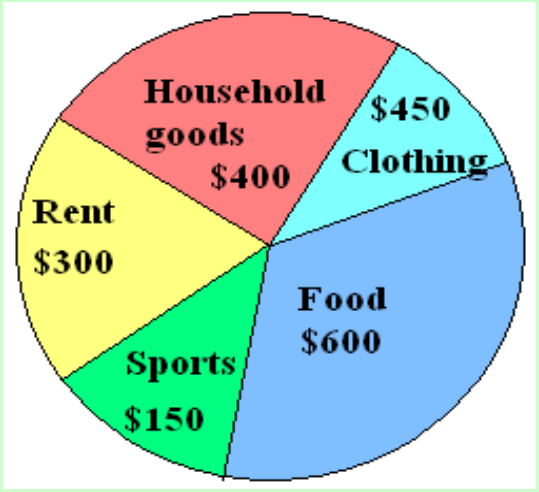
• Collect data about consumption by reading the water/ electricity meter at home/ school at the same time each day for a week

• Make use of suitable class intervals in recording large sets of raw data. For example:
<table><tr><th>Age</th><th>Population</th></tr><tr><td>0 - 9</td><td></td></tr><tr><td>10 - 19</td><td></td></tr><tr><td>20 - 29</td><td></td></tr><tr><td>30 - 39</td><td></td></tr><tr><td>40 - 49</td><td></td></tr><tr><td>50 - 59</td><td></td></tr><tr><td>60 - 69</td><td></td></tr><tr><td>70 - 79</td><td></td></tr></table></td><td>• Students select the most appropriate data collection method to collect information for a stated purpose
• Students design suitable questions, tally chart, tables that can be used to collect data for a stated purpose
• Students perform the actual task of collecting data through observation, and administration of questions and direct measure</td></tr>
</table>

Learning Outcomes		
LO:3 **Organize and display data using different forms of presentations**	**Suggested Learning Activities (DATA HANDLING)**	**Assessment**
	• Choose and use suitable class size/intervals to organize large sets of data in constructing grouped frequency tables. For example discuss giving reasons for your choice what class size might be used to record this set of data. - 52, 61, 75, 50, 54, 82, 84, 90, 75, 63, 83, 99, 65, 50, 65, 43, 84, 92, 98, 77, 79, 80, 32, 39, 44, 66, 79, 79, 55, 81, 90, 70, 59, 63, 23, 20, 56, 34, 57, 97, 64, 40, 15, 7, 19, 29, 47, 9, 49, 61 • Construct grouped frequency tables for given set of data. For example	• Student organize data in grouped and ungrouped frequency tables • Students construct frequency tables, graphs, bar charts, histogram, pie charts from a given set of data • Students construct tables from bar chart and vice versa

Age	Frequency
0 - 9	2
10 - 19	2
20 - 29	3
30 - 39	4
40 - 49	5
50 - 59	8
60 - 69	8
70 - 79	7
80 - 89	6
90 - 99	6

Learning Outcomes		
	Suggested Learning Activities (DATA HANDLING)	**Assessment**
	• Construct histograms for a table of values. For example 	

Learning Outcomes		
	Suggested Learning Activities (DATA HANDLING)	**Assessment**
	• Organize and present data in the form of pie charts. For example:  • Use data presented in one form to construct another form of representation. For example Use the information presented in a bar chart to construct the equivalent pie-chart. • Select and use appropriate scales in presenting data and record the scales on both axes • Construct models of time distance graphs • Construct a paragraph to explain a time distance graph • Discuss the appropriateness(advantages, disadvantages) of one form of representation over another • Use simple graphing software to enter data and create graphs such as spreadsheets	

Learning Outcomes		
	Suggested Learning Activities (DATA HANDLING)	**Assessment**
LO:4 **Determine and use typical statistical measures from data**	• Determine the modal class from a set of grouped data as presented in grouped frequency tables and bar charts • Calculate the mean of a set of data from frequency tables and bar charts of ungrouped data • Calculate the mean of sets of similar data; one with an extreme value and the other without an extreme value and discuss how an extreme value affects the mean.	• Students calculate the mean from a given set of ungrouped data • Students determine the mode, range, median, maximum, minimum scores from a given set of raw data and data presented in the form of frequency tables, bar charts, histogram
LO:5 **Interpret data and draw conclusions**	• Construct and respond to questions based on information presented in tables, charts, and graphs. For example: • Compare two or three sets of data by using the mean and the mode or the median or the range • Analyze, comment on and make predictions on information presented in simple tables, charts and graphs as collected from local departments such Health Centres; Forestry Department: Fishery Unit which give information relevant to local communities or country • Make relevant comments on information presented in print such local newspapers; brochures, textbooks	• Students construct a frequency tables from a given bar chart, line graph or pie chart • Students make predictions and conclusion based on presented in tables, bar charts, line graphs or pie charts • Students answer questions based on information presented in tables, bar charts, line graphs or pie charts
LO:6 **Probability**	• Generating a list of all the possibilities of a simple event. For example: - a cricket match may end in a loss, a win, a tie, a draw, a no result - • Using the term 'sample space' to refer to all the possible outcomes of an event. For example the sample space for: - tossing a coin (head, tail) - rolling a fair sixe sided die (1, 2, 3, 4, 5, 6) • explaining the meaning of a probability of 0, ½, 1 in a given situation • interpret and use probabilities expressed as percentages or decimals • Collect and evaluate statements make reference to probability such as statements in newspapers, other subject texts • Solve simple probability problems	• Order events from least likely to most likely. • Determine the probability(likelyhood) of an outcome