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ACCELERATED EDUCATION PROGRAMME

MATHEMATICS

SYLLABUS

Level 1 and 2

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Foreword

Education is a fundamental tool for protection of conflict-and-disaster-affected children and youths from harm and exploitation. This is a crucial part of UNESCO's advocacy messages. Under appropriate conditions of security, provision of education can help protect children and youth from recruitment into fighting forces, forced labour, prostitution, drug abuse and other criminal activities. In post-conflict settings, education contributes to the reintegration into society of former soldiers and other children and youths associated with fighting forces.

The National Curriculum Development Centre (NCDC), in collaboration with War Child Canada, embraced Accelerated Education Programme (AEP) that focuses on providing relevant and appropriate education to the learners in refugee camps and the host communities of secondary school age (ages 16–45+) in Adjumani district. The programme will help them to acquire the necessary competencies that will enable them to 'catch-up' and re-join the learners of the same (or near) age group in the formal education programme.

AEP subjects were selected based on the Ugandan regulation which states that learners must study the seven core subjects, i.e. Mathematics, English, Physics, Chemistry, Biology, History and Geography. So AEP learners shall take all the core subjects. In addition, the learners shall take: Religious Education which will help to address the prevalence of early marriages for the girl-child, cases of indiscipline and moral modelling of the learners; Personal Social and Health Education/Physical Education which will help the learners to develop physically, learn to live together, develop talents and become emotionally balanced; Guidance and Counselling in which the teachers will be trained on integration of guidance and counselling services in the delivery of the education curriculum.

This Programme will equip teachers and other stakeholders in schools and the communities with relevant information, values and skills that will enable them to effectively facilitate the teaching and learning processes.

I, therefore, recommend AEP to you because I trust that the materials will be valuable in your endeavour to meet the educational needs of the refugee learners and other beneficiaries from the host communities.

Hon. Janet Kataaha Museveni
MINISTER OF EDUCATION AND SPORTS

Acknowledgement

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Special thanks go to War Child Canada - Uganda for the financial support, their guidance in overseeing and taking timely decisions whenever necessary during the development and production of this AEP Mathematics Syllabus.

We also express our gratitude to NCDC Subject Specialists and panel members for their professional guidance and technical assistance.

Furthermore, NCDC recognises the work of the editors who worked with the writers through the development of this document.

NCDC takes responsibility for any shortcomings that might be identified in this syllabus and welcomes suggestions for addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through: P.O. Box 7002, Kampala or e-mail admin@ncdc.og.ug .

Grace K. Baguma
DIRECTOR
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Introduction to Accelerated Education Programme

Worldwide, substantial alternative schooling programmes are developed to meet the basic education needs of under-reached children. Of recent, it has been increasingly recognized that the goals of Education for All cannot be achieved unless more attention is paid to educating out-of-school children (UNESCO, Global Monitoring Report, 2008). Indeed, the UNESCO Global Monitoring Report 2010 'Reaching the Marginalized' focused on this issue. In a bid to help developing countries achieve the Millennium Development Goals, there should be initiatives to incorporate elements of accelerated learning to achieve SDG 4.

The Accelerated Education Programme (AEP) in Uganda is a form of curriculum option which combines the stronger features of earlier mainstreaming approaches into the new design to raise the success rates for refugee community learners. The AEP secondary school tier is a bigger stride to address the education gap within refugee communities not only in Uganda but also in other neighbouring countries. This AEP for Secondary has benchmarked on the Primary AEP Programme, and intends to infer the entire process of education and its cognitive, emotional, and social components.

The Accelerated Learning Programme at Secondary school level focuses on completing learning in a shorter period of two years. The AEP is complementary both in providing an alternative route and in matching its curriculum to the 'official' curriculum, thus allowing the learners to return to formal schooling at some stage. The programme intends to promote access to education in an accelerated timeframe for disadvantaged groups, out of school and over-age children, and youths who missed out or had their education interrupted due to poverty, violence, conflict and crisis. The goal of this programme is to provide the learners with competencies equivalent to those in the formal system in an accelerated timeframe, with the learners either transitioning back into the mainstream education or exiting with some competencies required for work.

Ideally, teaching AEP calls for a methodology that is interactive and learner-centred, incorporating other aspects of multiple-intelligence

learning. Because teaching and learning are accelerated, and the curriculum content is compressed and condensed, the four 'P' elements are at the core of the accelerated learning cycle: processes, psychological, physiological and physical. These core elements provide the physical and psychological space in which the learners can learn more effectively.

It is intentional to include alternative subjects in this programme e.g. life skills, peace education, environment, HIV and AIDS which are responsive to the context. The learners of AEP need alternative supporting knowledge and life skills to survive in the challenging world. It is equally important to note that this conception of accelerated learning requires an extremely well-resourced classroom and exceptionally well-trained teachers. The expanded learning time from the norm is because the teaching methodology is interactive and learner-centred.

It is our hope that AEP will register considerable success in meeting the educational needs of these underserved populations, not only in terms of access and equity, but also in being able to return to school for the completion of their education, and most importantly, in getting measurable learning outcomes.

Rationale for Mathematics

Mathematics forms a key element of every learner's education. The programme of study emphasizes the essential mathematical skills that all citizens need for full and effective participation in civil, social and economic life. The programme of study focuses primarily on the needs of the majority of the learners, some of whom may cease formal schooling before the end of Senior Four. It will allow these the learners to take a wide range of formal or informal workplace opportunities, or to proceed to other post-Senior Four programmes.

Prior to the reform, Mathematics throughout the Lower Secondary years was strongly geared towards the needs of the small minority of learners who might eventually go on to study Mathematics at Advanced Level and beyond. The programme in the reformed curriculum is much more inclusive. It is designed to ensure that the majority of learners will leave school with a worthwhile, relevant qualification in Mathematics that they will actually use in everyday life and work. In their daily life, knowingly or unknowingly, every human being uses and applies mathematical concepts in a wide range of contexts. Numeracy skills are essential to both work and daily life. Mathematics has evolved across all cultures over the years, and it is still developing. The study of Mathematics develops the learners' reasoning and logical thinking skills, and its applications cut across all Learning Areas. During the learning process, the beauty of Mathematics and its value in a wide range of contexts are recognised by the learner.

The Lower Secondary Mathematics programme of study focuses on developing mathematical understanding, logical reasoning, problem-solving and analytical thought. The concepts, understandings and skills acquired will help the learners to solve familiar and unfamiliar problems, giving them the flexibility, they need to meet new situations as they arise. The learners will be confident to use mathematical skills in their day-to-day activities in the home, in the workplace, in the community, and in society. They will also be ready to participate in civil life, using their mathematical skills to make informed decisions based on a sound understanding of facts, figures and opinions.

The skills and understanding that the learners acquire will be helpful throughout their lives. They will provide the essential mathematical tools required for a wide range of career paths including many of those in the fields of engineering, science or technology.

Topics

There are 33 topics for the two levels, that is, 18 topics for Level 1 and 15 topics for Level 2 as shown in the Programme Planner.

Time Allocation

It is proposed that Mathematics should have a minimum of three (3) hours per week for both levels. The three hours are contact time.

Programme Planner

Level 1	Topic	Duration (number of Periods in hours)
	1. Number Bases	8
	2. Working with Integers	8
	3. Patterns and Sequences	6
	4. Fractions, Percentages and Decimals	8
	5. Rectangular Cartesian Coordinates in 2-Dimensions	8
	6. Equation of Lines and Curves	7
	7. General Angle Properties of Geometrical Figures	7
	8. Geometrical Construction Skills	7
	9. Bearings	6
	10. Algebra	12
	11. Commercial Arithmetic 1	7
	12. Time and Time Tables	7
	13. Mappings and Relations	8
	14. Numerical Concepts	16
	15. Translations and Vectors	8
	16. Graphs	12
	17. Equations of a Straight Line	6
	18. Inequalities and Regions	10

Level 2	Topic	Duration (number of Periods in hours)
	1. Data Collection and Presentation	20
	2. Set Theory	7
	3. Circle	10
	4. Similarities and Enlargement	10
	5. Reflection and Rotation	8
	6. Matrices	12
	7. Quadratic Equations	10
	8. Simultaneous Equations	12
	9. Matrix Transformations	8
	10. Ratios and Proportions.	8
	11. Trigonometry	18
	12. Nets, Areas and Volumes of Solids	10
	13. Lines and Plane in Three Dimensional Geometrical Figures	14
	14. Commercial Arithmetic	10
	15. Probability	14

Year 1

Topic 1: Number Bases

Duration: 8 Hours

Overview

In this topic, the learner will gain knowledge of how to compute numbers in other bases other than base ten (decimal). The learner will also gain competency in the relationships amongst the various bases.

Competency

The learner should be able to use her/his understanding of decimal place value to develop her/his understanding of numbers written in other bases.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies place values of different bases using abacus (k, u). b. converts numbers from one base to another (u). c. manipulates numbers in different bases with respect to all the four operations (u s).	Playing number games, for example, matching numbers in base two with numbers in base ten, such as 1111_{two} is matched with 15_{ten}. *Hint:* • *convert numbers 1 to 15 in base ten to base two* • *place the numbers in four boxes provided according to the conversion above When a number appears in the box, record it as 1 and when it does not appear, then record it as 0.* • *E.g. The guessed*	• Observe the learners in their groups trying to identify place values of various number bases using abacus and converting numbers from one base to another. Observe individual learners in their groups whether they are cooperative and collaborative with their colleagues. • Let individual learners explain to you how they have identified the place values and converted numbers from one base to another. • Ask the learners individually to try out the following number in their exercise books.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
	number is 7, but 7 does not appear in the fourth box but appears in other 3 boxes... so $7_{ten} = 0111_{two}$ The number of boxes depends on the largest number in base ten that one chooses to use.	• Asaba, Rose and Nambi have ages 1101two, 1110 two and 1011 two respectively. • Give your answers to the following questions as binary numbers. a) What is the difference in age between the eldest and the youngest? Nambi's uncle is four times as old as Nambi. How old is Nambi's uncle? b) $10020_{base\ p} = 87_{base\ q}$ Find p and q

Hints to the Teacher

1. Carry out diagnostic assessment of the learners on number bases
2. For any base beyond base twelve the numerals used must be defined.
3. For better understanding of place values of various bases, use abacus (involve the learners in making their own abaci).

References

1. Mathematics for Secondary Schools Book 1 p. 195.
2. School Mathematics for East Africa Book 1 p. 1.
3. Secondary School Mathematics Students Book 1.

Topic 2: Numbers

Duration: 8 Hours

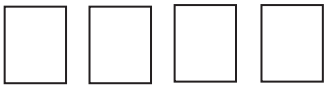
Overview

In this topic, there is extension of numbers from millions to trillions. The learner will appreciate how to correctly write numbers in words and also learn different types of numbers and the relationships amongst them.

Competency

The learner should be able to manipulate numbers.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies, reads and writes natural numbers as numerals and words in million, billion and trillion (u). b. differentiates between natural numbers and whole numbers (u). c. identifies even, odd, prime and composite numbers (u). d. identifies factors and multiples of numbers. e. works out divisibility tests of some numbers (u s). f. relates common factors with H.C.F and multiples with L.C.M. (u).	*Procedure:* *Collect 6 stones and pair them.* *Qn: How many pairs are there... 3 pairs and no remainder.* *Increase to 8 stones... 4 pairs and no remainder.* *Qn: How many pairs would be formed with 16 stones?* *Qn: What have you noticed with the 6, 8 and16 stones?* *Reduce to 7 stones.... 3 pairs and a remainder of 1.* *Increase to 11 stones... 5 pairs and a remainder of 1.*	• Observe the learners as they discuss in groups how they can read and write natural numbers in words, and how to differentiate between natural and whole numbers. • Observe the interaction of the within their groups. • Listen to the learners as they discuss in their respective groups. • Give the learners some exercise like the following to do: Nambi has these four number cards. She can rearrange the cards to form different numbers. For example, she can

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
g. identifies directed numbers (k). h. carries out mathematical operations on numbers using the rules of integers (k). i. uses BODMAS rule to carry out the four mathematical operations on integers (u). j. uses directed numbers (Limited to integers) in real life situations (u, s).	*Qn: How many pairs would be formed with 19 stones?* *Qn: What have you noticed with the 7, 11 and 19 stones?* *Conclude:* *Paired numbers are even and unpaired numbers are odd.* *Zero is an even number.*	form the number 3407.  • What is the greatest even number Nambi can form using all the four of her number cards? • What is the smallest odd number she can form using all four of her number cards? • How many hundreds are there in one million?

Hints to the Teacher

1. Attention must be taken in writing numbers given in figures and vice versa (commas must be used while writing in figures and avoid the use of the word 'and' when writing in words.
2. For better understanding of concepts by the learners, introduce different concepts one at time.

References

1. Mathematics for Secondary Schools Book 1 p. 35.
2. General Mathematics for Secondary Schools Book 1 pp. 1 & 13.
3. Mathematics for East Africa Book 1 pp. 30 &119.
4. Secondary School Mathematics Students Book 1 pp. 11 & 31.
5. Mathematics for Kenya Schools Book 1pp. 8-31).

Topic 3: Patterns and Sequence

Duration: 6 Hours

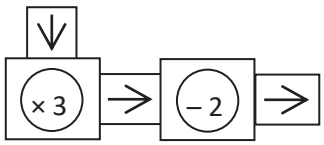
Overview

In this topic, the learner will understand how to determine what is likely to happen based on the previous event. In other words, what has already happened is likely to influence what is going to happen. In this particular topic, the sequences and patterns are formed using numbers.

Competency

The learner should be able to explore number patterns and sequences.

Learning Outcomes	**Sample Teaching and Learning Activities**	**Sample Assessment Strategies**
The learner: a. draws and identifies the patterns. b. describes a general rule when a pattern is given. c. describes a sequence. d. determines a term in a sequence. e. finds the missing numbers in a given sequence.	A. Make a 1 to 100 number square. i) Shade in all the multiples of 3 on the number square. ii) Describe the pattern you have shaded on the number square. iii) Sulai wants to shade some multiples to make a pattern of vertical lines. Which set of multiples could he use? Find as many different sets as you can. iv) 3, 6 and 9 are the 1st, 2nd and 3rd multiples of 3. • Which position in the multiples of 3 is 93? • Which position in the multiples of 3 is 3n?	• Observe the learners in groups as they draw two different double machines that could be used to generate two different sequences, each with '3' as its first outcome number. • Observe the following: collaboration, harmony amongst the members of the groups and willingness to do the activity. • In their exercise books, task the learners to write a formula for the *n*th term in a sequence starting

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
	• Put the numbers 1, 2, 3, 4, 5...into this number machine to generate a sequence.  • Write down the first five members of the sequence. • What is the formula for the nth term in the sequence? • Sharon wants to shade some multiples on 1 to 100 square to make a pattern of horizontal lines. Can she do this? Explain your answer. • Draw a double machine that could be used to generate the sequence 5, 8, 11, 14, 17....	$1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}$

Hints to the Teacher

1. Emphasis should be put on number patterns.
2. Guide the learners to develop number patterns.
3. Relate patterns to sequences.

References

1. Mathematics for Secondary Schools Book 1 p.168.
2. General Mathematics for Secondary Schools Book 1 p. 132.
3. Mathematics for East Africa Book 1.
4. Secondary School Mathematics Students Book 1 p.112 (NCDC).

Topic 4: Fractions, Percentages and Decimals

Duration: 8 Hours

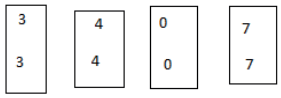
Overview

This topic looks at numbers which are not whole but parts of whole numbers. These parts can be fractions or decimals. There are relationships between whole numbers, fractions and decimals.

Competency

The learner should be able to understand and use fractions.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. describes different types of fractions (u). b. converts improper fractions to mixed numbers and vice versa (u). c. adds, subtracts, divides and multiplies fractions. d. applies fractions to solve real-life situations (u). e. adds, subtracts, divides and multiplies decimals. f. converts fractions to decimals and vice versa (u). g. identifies and	i) Let the learners use paper strips to determine equivalent fractions. ii) The learners use paper strips to divide fractions by fractions. Leading question should be 'how many fractions are within a given fraction. E.g. how many quarters (1/4) are within a half?	• Let the learners explain to the group members how Moses would carry out the activity below. • Observe the learners as they give the explanation. Find out whether the learners can listen to one another, collaborate, cooperate, learn from one another, each can contribute to the explanation. • Ask the learners to individually write their explanation in their exercise books. Moses has the following cards.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
classifies decimals into terminating, non-terminating and recurring decimals (u). h. converts recurring decimals into fractions (u s). i. converts fractions and decimals into percentages and vice versa (u). j. calculates the given percentage in a given quantity (u). k. works out real-life situations involving percentages (u, s).		 He also has a card with a decimal point.  1. What is the smallest number Moses can form using all the five cards he has? 2.How many 0.01s are there in: a) 1 b) 0.1 c) 10

Hint to the Teacher

1. Guide the learners to understand the meaning of fractions.
2. Guide the learners to identify different types of fractions.
3. Guide the learner to relate percentages and decimals to fractions and vice versa.

References

1. Mathematics for Secondary Schools Book 1 p.70.
2. General Mathematics for Secondary Schools Book 1 p. 27.
3. Mathematics for East Africa Book 1.
4. Secondary School Mathematics Students Book 1 p. 37.
5. Mathematics for Kenya Schools Book 1 pp. 34 & 94.

Topic 5: Rectangular Cartesian Coordinates in 2 Dimensions

Duration: 8 Hours

Overview

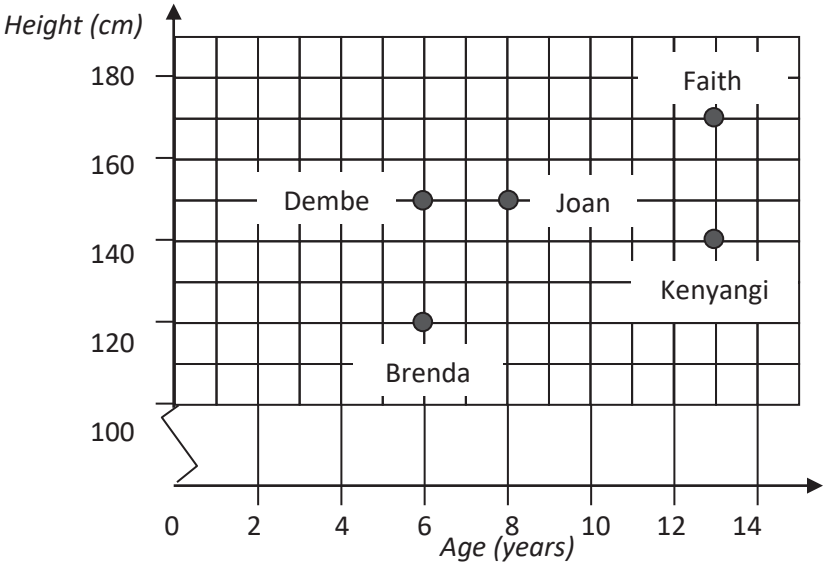
In this topic, the learner shall understand how to locate the position of a point, object, and place from a given starting point which may be called a point of origin.

Competency

The learner should be able to read, plot and interpret coordinates in a range of contexts.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies the x and y Axes. b. draws and labels the Cartesian plane. c. reads and plots points on the Cartesian plane. d. chooses and uses appropriate scale for a given data set. e. identifies and locates places using coordinates.	i) The learners should arrange their classroom in terms of rows and columns ii) Let each learner describe the sitting position of the other students in the class by using rows and columns. The teacher's seat is the starting position.	• Observe the learners as they try to do the activities below. Find out whether they are cooperating in the process of getting solutions for the question below, and how they are sharing information. • Let the learners discuss how they will get the solution for the activities. • The learners should write down their solutions in their exercise books. **Activity 1.** The heights and ages of five girls have been plotted on the graph. (see graph next page). a) Who is the tallest and how tall is she? b) Who has the same age in years as Dembe? c) How much taller is Faith than Joan? **Activity 2.** Two corners of a square are at the points (2, 1) and (6, 3).

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
f. applies coordinates in real life situations.		What are the coordinates of the other two corners of the square? There are three possible answers. Find all three. **Activity 3.** Two corners of a square are at the points (5, -2) and (2, -9). Find all the possible pairs of coordinates for the other two corners of the square.



Hint to the Teacher

1. Guide the learners to understand the position of negative and positive numbers on the axes (Cartesian plane).
2. Emphasis should be put on choosing suitable scales.

References

1. Mathematics for Secondary Schools Book 1 p.106.
2. General Mathematics for Secondary Schools Book 1 p. 57
3. Mathematics for East Africa Book 1 p. 37.
4. Secondary School Mathematics Students Book 1 p. 63.
5. Mathematics for Kenya Schools Book 1 p. 176.

Topic 6: Equation of Lines and Curves

Duration: 7 Hours

Overview

In this topic, the learner will explore the relationship between points and variables and will differentiate a line from a curve. The learner will understand how to form linear equations and draw their corresponding graphs.

Competency

The learner should be able to understand and use linear equations and curves.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. forms linear equations with given points. b. draws the graph of a line if the equation of the line is given c. differentiates between a line and a curve.	i) Using a measuring scale, measure the masses of the learners in you class. **ii)** Observe what happens when mass is put on one side of the scale. What do you do in order to balance the two sides of the measuring scale?	• Solve the following equations: a) $2x + 1 = 3x - 2$ b) $3p - 2 = 8$ • Thirty books are bought for UGX. 10,800. Some cost UGX 400 each and the others UGX 300 each. How many books of each value are bought?

Hint to the Teacher

1. Emphasis should be put on the use of suitable grid paper (graph paper).
2. Emphasize the use of a cross (X) when plotting.

References

1. Mathematics for Secondary Schools Book 1 p. 324.
2. General Mathematics for Secondary Schools Book 1 p. 161.
3. Mathematics for East Africa Book 1 p. 155.
4. Secondary School Mathematics Book 1 p. 83.
5. Mathematics for Kenya Schools Book 1 p. 150.

Topic 7: General Angle Properties of Geometric Figures

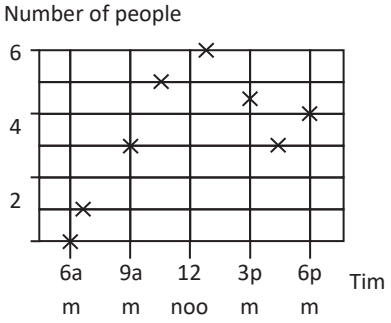
Duration: 7 Hours

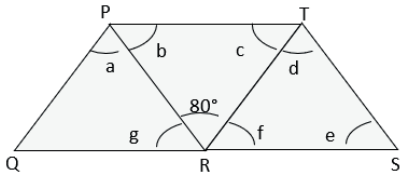
Overview

In this topic, the learner will draw, form and identify different angles. The learner would be able to understand how to use angle properties of polygons to solve problems in real situations. This is a hands on topic, so, the learner is encouraged to be practical.

Competency

The learner should be able to use the angle properties of lines and shapes to solve problems.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. draws and measures lines. b. forms angles using lines. c. identifies and measures different angles formed. d. draws parallel lines and transversal lines. e. solves problems involving	i) Pick mushrooms around an anthill. Walk right around the anthill three times. Find the angle in degrees you have moved through. ii) Cut out three identical isosceles triangles from scrap card. Arrange them to form a trapezium PQST. R is the midpoint of	Let the learners study the graph below: The graph shows the number of people in a shop at different times one day. One of the points must be wrong.  a) Which point must be wrong? b) Explain why the point in part a)

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
angles on a straight line, angles on transversal and parallel lines (u). • states and uses angle properties of polygons in solving problems.	the line QS. PQ = PR = TR = TS. Note: the drawing is not accurate iii) Explain why PQ = PR b) Find two more lines which are equal to PQ and PR. iv) Find the values of the labelled angles a, b, c, d, e, f, g v) Can a pair or a set of the labelled angles be combined to form: • an acute angle? • an obtuse angle? • a reflex angle? • a straight angle? If so, list a pair or a set for each one.	must be wrong, and why the other points may be correct. During the process of doing the above task, observe the learners' creativity, presentations, collaboration and respect for another. 

Hint to the Teacher

1. Encourage the learners to acquire and use mathematical sets.
2. The schools should provide chalk and mathematical chalkboard instruments for demonstration.

References

1. Mathematics for Secondary Schools Book 1 p. 229.
2. General Mathematics for Secondary Schools book 1 p. 180.
3. Mathematics for East Africa Book 1.
4. Secondary School Mathematics Students Book 1 p. 86.
5. Mathematics for Kenya Schools Book 1 p. 197.

Topic 8: Geometric Construction Skills

Duration: 7 Hours

Overview

This topic is a continuation of the previous topic. Learner should be able to develop construction skills. It is also a hands-on topic.

Competencies

i) The learner should be able to use the construction skills and loci to handle geometrical shapes.
ii) Learners should be able to relate construction skills and loci to manipulate geometrical shapes.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. draws perpendicular and parallel lines (without using a pair of compass). b. constructs parallel lines, perpendicular lines and angle bisectors (mediators). c. defines and describes common types of loci. d. relates the construction of parallel lines, perpendicular lines and angle bisectors (mediators) and circle (circumscribing and inscribing) to Locus. e. uses a pair of compasses and a ruler to construct special angles 30^0, 45^0,60^0, 90^0	i) The learners should identify perpendicular parallel items from the environment. ii) Let the learners identify situations in which perpendicular and parallel lines are used. iii) In groups, let the learner stretch his/her hand, touch a tree, and try to move around. Now the learner should describe the movement of their	• Observe the learners as they select correct instruments to use. Observe their interaction, attitude towards what they are supposed to do. Do they differentiate drawing from constructing? • Let the learners explain or describe the procedure of constructing angles. • In their exercise book, let the learners construct the following

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
(Hint: all other angles which can be constructed using the special angles are implied) f. constructs polygons such as triangle, square, rectangle, rhombus, parallelogram.	colleague.	angles by using a compass and pencil only. a) 30^0 b) 45^0 c) 60^0 d) 75^0 e) 90^0

Hint to the Teacher

1. Emphasize the difference between construction and drawing of angles and other shapes.
2. Emphasize the difference between sketching and accurate drawing in construction.
3. Emphasize practical work in construction.

References

1. Mathematics for Secondary Schools Book 1 p. 101, book 4 pp. 180 & 153.
2. General Mathematics for Secondary Schools Book 1 p. 210.
3. Secondary Mathematics for East Africa Book 4
4. Secondary School Mathematics Students Book 1 p. 173 and Book 4 pp. 300 & 156 (New edition).
5. Mathematics for Kenya Schools Book 1 p. 217.
6. General Mathematics for Secondary Schools Book 2 p. 177.

Topic 9: Bearings

Duration: 6 Hours

Overview

The learner will not find challenges in this topic if he/she is well-grounded in the two topics on Geometry. The learner will understand and describe the bearing of a point from a given point.

Competency

The learner should be able to differentiate between bearing and direction.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. reviews the compass directions. b. describes the direction of a place from a given point using cardinal points. c. describes the bearing of a place from a given point. d. draws suitable sketches from the given information. e. chooses and uses appropriate scale to make accurate drawings. f. differentiates between a sketch and a scale. g. draws and applies bearings in real life	i) Alex is facing North. He turns clockwise to face West. What angle has he turned through? ii) Henry's school is 4km away from his home on a bearing of 070°. The market is 1km away from the school on a bearing of 250°. The hospital is 6km away from the market on a bearing of 310°. Make a scale drawing to find the distance and bearing of the hospital from Henry's home. Remember to state the scale you use	• In groups, let the learners discuss and explain how they will accomplish the following task: Two ships leave Port bell port at the same time. One ship sails 80km on a bearing of 030^0 to position A. The other ship sails 160km on a bearing of 110^0 to position B. Using a scale drawing find: a) the distance AB b) angle MAB, c) the bearing of B from A • During the process of accomplishing the task, observe the communication skills

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
situations.	on your drawing, and give your answer appropriate degree of accuracy.	of individual learners, creativity, respect for one another, sharing of information amongst themselves and other values and skills.

Hint to the Teacher

1. Emphasize the difference between sketching and accurate drawing.
2. Emphasize practical work in bearings.

References

1. Mathematics for Secondary Schools Book 1 p. 206.
2. General Mathematics for Schools Book 1.
3. Secondary Mathematics for East Africa Book 1 and Book 4.
4. Secondary School Mathematics Students Book 1 p. 112.
5. Mathematics for Kenya Schools Book 1 p. 231.

Decoder

1 2 3 4 5

⇩ ⇩ ⇩ ⇩ ⇩

Topic 10: Algebra

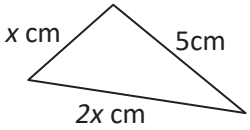
Duration: 12 Hours

Overview

In this topic, the learner will understand how to manipulate mathematical expressions involving unknowns.

Competency

The learner should be able to form, use and expand algebraic expressions.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. uses letters to represent numbers. b. writes statements in algebraic form. c. simplifies algebraic expressions (to include algebraic fractions). d. expands simple algebraic expressions (of polynomial one). e. evaluates algebraic expressions by substitution. (Do not include quadratic equations.) f. forms simple algebraic equations. g. works out simple algebraic	Akibu sent this message to his wife: C4M2 1ND V3S3T M2 F4R 21ST2R. BR3NG Y45R D4C5M2NTS. Decode the message with the decoder. Find the missing input and output numbers in these double number machines: a) 6 → [× 2] → [– 3] = ? c) 20 → [÷ 4] → [– 8] = ? b) ? → [× 2] → [– 3] = 15 d) ? → [÷ 4] → [– 8] = – 6	• In groups, let the learners draw a triangle on a manila like the one below.  • Suppose perimeter of the triangle is 26cm. • Let the learners discuss how they can get the value of x in the triangle shown above. • As they discuss, observe participation in each group, presentations, methods used in getting the value of x. • Let the learners critique each group's work.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
equations. h. forms and simplifies simple linear inequalities. i. works out simple linear algebraic inequalities in one variable and expresses the answer in a set form. j. differentiates between an equation and inequality.		

Hints to the Teacher

1. Use real-life situations in order not to make algebra abstract.
2. Guide the learners to understand the difference between linear and non-linear expressions.

References

1. Mathematics for Secondary Schools Book 1 pp. 125 and 289, Book 2 p. 167.
2. General Mathematics for Schools Book 1 and Book 2.
3. Secondary Mathematics for East Africa Book 2 p. 226 and Book 4.
4. Secondary School Mathematics Book 1.
5. Mathematics for Kenya Schools Book 1p. 65 and Book 2 p. 178.

Topic 11: Commercial Arithmetic 1

Duration: 7 Hours

Overview

The learner should understand the day-to-day mathematics being used at home. This topic should draw experience from the learner's environment. Let it be practical.

Competency

The learner should be able to understand and apply commercial arithmetic.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. describes and calculates profit and loss (includes all expenses incurred). b. describes and calculates commission, interest, insurance and discount. c. expresses profit and loss as percentage. d. express commission, interest, insurance and discount as percentage. e. differentiates and calculates simple interest and compound interest using step-by-step method.	i) In groups, let the learners set up imaginary shops in the classroom. Let the learners set the cost and selling prices of items. ii) The learners should calculate the profit and losses for each item. Discuss causes of losses	• After setting up imaginary shops as indicated in the Learning Activity, let the learners individually work out the following numbers in their exercise books. • Observe the learners whether they are doing the work as instructed (integrity); are willing to do the work (positive attitude towards work). Observe whether their presentation the shows that creativity and innovation. **Activity 1.** In a certain day and boarding school there are 100 boarders, each of whom is given 3 litres of milk per week. If a half-litre Tetra pack costs UGX.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
		1,500, find their monthly milk bill (1 month equals to 4 weeks). **Activity 2.** A trader marked the prices of his goods 20% above the cost price and allowed customers a discount of 10% on the marked price. If Okot paid UGX. 54,000 for a shirt, what was the marked price on the shirt? What was its cost price?

Hint to the Teacher

The formula for compound interest should not be used here.

References

1. Mathematics for Secondary Schools Book 1 p. 186 and Book 2 p. 43.
2. General Mathematics for Secondary Schools Book 1 p. 103.
3. Secondary School Mathematics Students' Book 1 p. 125 and Book 3 p. 137.
4. Mathematics for Kenya Schools Book 1 p. 162 and Book3 pp. 88 & 239.

Topic 12: Time and Time Tables

Duration: 7 Hours

Overview

Time management is a skill; and therefore, in this topic the learner should develop her/his personal timetable.

Competency

The learner should be able to understand, manage and use time.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Activities
The learner: a. identifies and uses units of time. b. uses and interprets different representations of time (12 and 24hour clock). c. applies the understanding of time in a range of relevant real-life contexts. d. reads, interprets and draws timetable.	The following subjects with their number periods per week are to S1 class. Subject Periods 1. English Language - 6 2. Local Language -3 3. Kiswahili -3 4. Mathematics - 6 5. Integrated Science - 5 6. Social Studies -5 7. Religious Studies -3 8. Integrated Production -3 9. Agriculture -4	• After setting up a timetable for S1 as indicated in the Learning Activity, let the learners individually work out the following numbers in their exercise books. • Observe the learners whether: ❖ they are doing the work as instructed (integrity). ❖ they are willing to do the work (positive attitude towards work). ❖ the presentation of their work show creativity and innovation. 1. A Senior One Mathematics lesson starts at two o'clock and lasts for

<table>
<tr><th>Learning Outcomes</th><th>Sample Teaching and Learning Activities</th><th>Sample Assessment Activities</th></tr>
<tr><td></td><td>10. PAPE - 3

In groups, develop a timetable showing how the S1 class subjects are distributed throughout the week (i.e. Monday to Friday).</td><td>80 minutes.

At what time does the lesson end? Give your answer in as many different forms as you can.

Look at the bus timetable below.

<table>
<tr><th>Bus Station</th><th>Arrive</th><th>Depart</th></tr>
<tr><td>Soroti</td><td></td><td>20:30</td></tr>
<tr><td>Kumi</td><td>22:00</td><td>22:15</td></tr>
<tr><td>Mbale</td><td>23:30</td><td>24:00</td></tr>
<tr><td>Iganga</td><td>01:30</td><td>01:45</td></tr>
<tr><td>Jinja</td><td>02:05</td><td>02:55</td></tr>
<tr><td>Kampala</td><td>04:00</td><td></td></tr>
</table>

a) Where does the bus start?

b) Where does it travel to?

c) How long does the whole journey take from start to finish? Give your answer in hours.

d) The bus travels half the total time for the journey. Find the nearest station.

e) Rona lives in Kumi. She wants to travel to Mbale. It takes 40</td></tr>
</table>

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Activities
		minutes to walk from Rona's house to Kumi bus station. What is the latest time that Rona should leave her house? f) Give the time on the 12-hour clock when the bus will arrive at Mbale. g) What is the total time the bus spends at the bus stations on its journey? Give your answer in hours and minutes.

Hint to the Teacher

1. This topic should be taught practically.
2. Emphasis should be put on duration of time when changing from AM to PM and vice versa.
3. Make this topic enjoyable and relevant by using the learner's experience.

Topic 13: Mappings and Relations

Duration: 8 Hours

Overview

In this topic, the learner will understand how to determine a relationship between objects. The learner will also develop logical skills.

Competency

The learner should be able to understand and use mappings and relations.

<table>
<tr><th>Learning Outcomes</th><th>Sample Teaching and Learning Activities</th><th>Sample Assessment Strategies</th></tr>
<tr>
<td>The learner:

a. describes a mapping and a relation.
b. draws arrow diagrams and Papygrams.
c. differentiates between a Papygram and an arrow diagram.
d. identifies domain and range of a mapping.
e. describes and differentiates a function and non-function mappings.</td>
<td>The learners to write ordered pairs out of this activity.

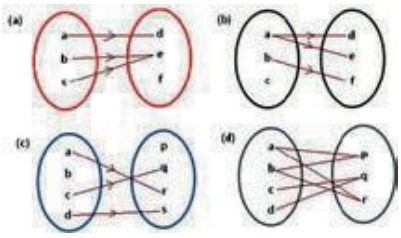
i) Group the following objects in such a way that they have common property/ characteristics.

ii) Describe the relation of an object to its common name.

Fork, liquid eraser, grater, pencil, knife, iPod, laptop, ball pen, pot, digital camera, tablet, cell phone, ladle, notebook, paper

<table>
<tr><td>Kitchen utensils</td><td>School supplies</td><td>Gadgets</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td>
<td>• Observe the learners in their groups as they carry the activity below. Find out the learners' attitude towards group work and their integrity. Are they doing the work in harmony?
• During the process of the description, are learners communicating effectively? Are they learning from one another? Are they creative and critical?
• Let the learners give their group reports.

Activity:
Describe the mapping diagram below by writing the set of ordered pairs.

1. How did you make a set of ordered pairs?</td>
</tr>
</table>

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
		2. How many elements are there in the set of ordered pairs you have made? 3. What elements belong to the first set? Second set? 4. Is there a repetition on the first coordinates? 5. How about the second coordinates? 6. Does the set of ordered pairs represent a relation? 7. How is a relation represented?

Hint to the Teacher

Leave out composite function and inverse function.

References

Mathematics for Secondary Schools Book2 p. 13.
Secondary Mathematics for East Africa Book 2 p. 52.
Secondary School Mathematics Students' Book 4 p. 39 and Book 1 p. 180.

Topic 14: Numerical Concepts

Duration: 16 Hours

Overview

In this topic, the learner will be able to understand how to write numbers in various forms for easy manipulation.

Competency

The learner should be able to understand the convention of index notation, and explain and apply the laws of indices.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Activities
The learner: a. estimates answer to calculations (u). b. writes and differentiates numbers to a given number of significant figures, decimal places and place values (u, s). c. identifies base number and index (u). d. expresses numbers in standard form (k). e. states and applies the laws of indices in calculations (k, u, s). f. expresses the nth root of an integer in index	The learners are put in three groups and are to evaluate the numerical expression $16^{½}$. Group A wrote: $16^{½} = 16 \times ½$. Group B wrote: $16^{½} = (4 \times 4)^{½} = (4^2)^{½}$. Group C wrote: $16^{½} = \sqrt{16}$ Which group gave the best answer? Explain why it is the best.	• In groups, let the learners discuss the following activity. • Observe them as they discuss the activity. Assess the learners on the core values and generic skills. • The learners should write reports and present them to the class. **Activity1**: In 2013 the National Social Security Fund had assets of about Ush. 3.4 trillion. a) How many millions are there in 3.4 trillion? b) How many ten thousands are there in 3.4 trillion?

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Activities
form (u). g. uses laws of indices in calculations of fractional indices (u). h. applies rules of indices to compute nth root of numbers (u, s). i. relates indices to logarithms and rules of logarithms (u). j. relates any other base to logarithms base ten (u). k. reads logarithms using mathematical tables or a calculator (k). l. computes numbers using logarithms from mathematical tables or logarithms from a calculator (u). m. reads and works out squares and square roots with/without mathematical tables (k, u, s). n. uses logarithm tables to		Akumu said: "$5^3 = 5 \times 3 = 15$." Burango said: "$5^3 = 5 \times 5 \times 5 = 225$." Who was correct? Justify your answer. **Activity2** The population census of 1969 found that the population of Uganda was 9,500,000. The population census of 2011 found that it was 32,900,000. Tushabe said: "The population rose by 23,400,000." Mariam said: "The population rose by 2.34×107." Who was correct? Justify your answer. **Activity3:** Explain why any number raised to the power of 0 is equal to 1. Copy and complete the following: (i) $3^2 = \square$ (ii) $3^{-2} = 1/3^{\square} = 1/\square$

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Activities
calculate large and small numbers involving powers and roots (u). o. describes surds (k). p. simplify expressions with surds (u). q. rationalizes the denominator with surds (u, s).		(iii) $3^4 \times 3^{-2} = \square \times 1/\square = \square$ (iv) $3^4 \times 3^{-2} = 3^{\square} = \square$

Hints to the Teacher

1. School should acquire standard mathematical tables.
2. Guide the learners on the use of mathematical tables.
3. Guide the learners to use scientific calculators to read logarithms.

References

1. Mathematics for Secondary Schools Book2 pp. 32,125 and 298.
2. General Mathematics for Secondary Schools Book 1 pp. 95 and 13. Secondary Mathematics for East Africa Book 2 p. 92.
3. Secondary School Mathematics Students' Book3 p. 1 and Book 4 pp. 14 and 109.
4. Mathematics for Kenya Schools Book 2 p. 11.

Topic 15: Translation and Vectors

Duration: 8 Hours

Overview

In this topic, the learner will be able to understand that translation and Vectors are forms of transformations in given direction.

Competency

The learner should be able to appreciate translations and their use in vector manipulations.

Learning Outcomes	Sample Assessment and Learning Activities	Sample Assessment
The learner: a. describes translation as a transformation (u). b. differentiate between scalars and vector quantities (u). c. uses vector notation(k). d. represents vectors both single and combined geometrically (u s). e. applies vectors is real-life situations (u s). f. describes position vector geometrically and as a column vector (u). g. finds out the vector of a directed line segment and its magnitude when position vectors of the end points are known (u).	In groups, study and perform the following instructions: a) From your classroom move 500m towards the Head teacher's office. b) From your classroom move 500m Do the above two statements mean the same? Discuss their difference(s)	• In groups, let the learners discuss the following activity. • Observe them as they discuss the activity. Assess the learners on the core values and generic skills. • The learners should write reports and present them to the Class. **Activity**: Isabirye wants to swim directly across a river. The river flows at a speed of 1.5 metres per second. Isabirye can swim at a speed of 2.5 metres per second. a) At what angle to

Learning Outcomes	Sample Assessment and Learning Activities	Sample Assessment
h. finds out the position vector of the mid-point of the line segment (u).		the river bank should Isabirye face in order to swim directly across the river? b) What will his velocity be?

Hint to the Teacher

1. Leave out collinearity

References

1. Mathematics for Secondary Schools Book2 p. 60.
2. General Mathematics for Secondary Schools Book 2 p. 47; Book 4 p. 355 and Book 3 p. 104.
3. Secondary Mathematics for East Africa Book 2 and Book 3.
4. Secondary School Mathematics Students' Book 3 p. 136.
5. Mathematics for Kenya Schools Book 2 P. 261 and Book 3 p. 194.

Topic 16: Graphs

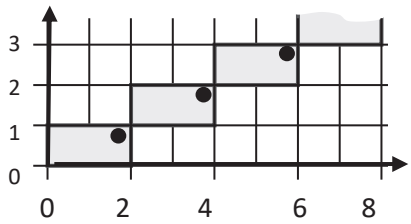
Duration: 12 Hours

Overview

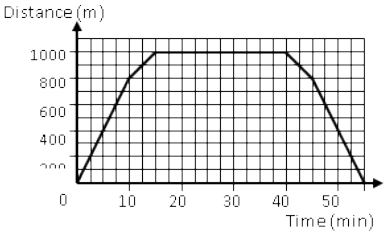
This topic helps the learner to understand that graphs are one of the forms of displaying information for easy analysis, interpretation of information and making decisions or drawing conclusions based on what is displayed on the graphs.

Competency

The learners should be able to plot and interpret speed-time/distance-time graphs.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. tabulates values from given relations (u). b. chooses and uses appropriate scales (u). c. plots and draws lines through given points (u, s). d. draws, reads and interprets the graph (e.g. Distance-Time Graph) (u, gs). e. uses the speed-time/distanc	i) Visit the classes in your school to mark the learner by sex and record the number of those either present or absent in each class. ii) In groups present your finding to school (Learners, Teachers and school Administrators). iii) Is each group using the same approach of presenting the information?	• Let the learners carry out the following activities in groups. • Observe them as they discuss the activity. Assess the learners on the core values and generic skills. • The learners should write reports and present them to the class.  **Activity 1**: Prima lays some rectangular tiles on a square grid. She marks the top

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
e-time graph to interpret and calculate distance, speed and time (u, s, gs).		right corner of each tile with a dot. The diagram shows the beginning of Prima's grid. 1. What are the coordinates of the top right corner of the first five tiles? 2. What are the coordinates of the top right corner of the tenth tile? 3. The first coordinate of the top right corner of a tile is t. What is the second coordinate of this tile? 4. Prima draws a line joining up the top right corners of all the tiles. Write the coordinates of three different points that are **below** Prima's line. 5. Tom says the point (20, 12) is **below** the line. Is he correct? Write 'Yes' or 'No', and justify your answer. **Activity 2**: Atim visited her friend. The distance/time graph shows her journey.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
		 a) How far did Atim walk to reach her friend's house? b) How long did Atim stay at the house? c) How long did it take Atim to walk back from her friend's house?

Hint to the Teacher

1. Emphasis should be put on use of suitable grid paper (graph paper).
2. Emphasize use of the cross (X) when plotting.
3. Guide the learners on choosing the suitable scale to use.

References

1. Mathematics for Secondary Schools Book1 p. 106 and 257 Book 2 p. 90.
2. General Mathematics for Schools Book 1.
3. Secondary school Mathematics Students' Book 3 p. 83.

Topic 17: Equation of a Straight Line

Duration: 6 Hours

Overview

In this topic, the learner will understand how to manipulate mathematical expressions, involving unknowns and equal signs.

Competency

The learner should be able to understand and use linear equations and their graphs.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. determines the midpoint and length of a line between points (k). b. describe and determines the gradient of a straight line (u). c. uses the gradient to write the equation of the straight line. [Relate the written equation to the general equation: y= mx and y= mx + c.] (u, s). d. understands the relationship between a linear equation and its graph (u). e. determines the x and y intercepts of a given linear graph (u). f. states the gradient of a straight line when given the equation	i) Make a ladder of length of 10m. ii) Place the foot of the ladder 10m from the wall of a Building and lean it against the wall iii) Place the ladder at i) 8m, ii) 5m, iii) 2m, lean the ladder against the wall iv) Climb the ladder in (b) and (c) v) Observe what happens to angle between the ground and the ladder as the foot of the ladder moves closer to the wall. vi) How easy is it to climb the ladder as its foot moves closer to the wall? vii) Relate the steepness of the ladder with the distance between the	• Make a ladder of length of 10m. • Place the foot of the ladder 10m from the wall of a building and lean it against the wall • Place the ladder at i) 8m, ii) 5m, iii) 2m. Lean the ladder against the wall. • Climb the ladder in bullets 2 and 3. • Observe what happens to the angle between the ground and the ladder as the foot of the ladder moves closer to the wall.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
(k). g. applies the relationship of gradients of parallel and perpendicular lines to get the equation of a straight line (u, s).	wall and the foot of the ladder. Explain this relationship.	

Hint to the Teacher

Guide the learners to identify intercepts.

References

1. Mathematics for Secondary Schools Book1 p. 324 and Book 3 p. 19.
2. General Mathematics for Schools Book 1.
3. Secondary Mathematics for East Africa Book 1 p. 155 and Book 4.
4. Secondary School Mathematics Students' Book 4 p. 319 and Book 3 p. 47.
5. Mathematics for Kenya Schools Book 1 p. 150, Book p. 33.

Topic 18: Inequalities and Regions

Duration: 10 Hours

Overview

This topic is intended to help the learner to differentiate equations from inequalities, to manipulate inequalities and draw and show the required regions.

Competency

The learner should be able to represent and manipulate inequalities.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies and explains the inequality symbols used (u). b. illustrates inequalities on the number lines (u). c. solves the linear inequalities in one unknown (u). d. represents the linear inequalities graphically (u s). e. forms simple linear inequalities from inequality graphs (u). f. finds the required region (u s).	i) In pairs, let the learners measure the height of each member. ii) Each pair presents its heights to the rest of the class. Find out who is: ❖ taller ❖ shorter, in each pair? iii) Identify the tallest or shortest learner in your class.	• Observe the learners in their groups as they carry out the activity below. Find out the learners' attitude towards the group work and integrity. Are they doing the work in harmony? • During the process of the description, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity1**: The area of a circle is less than 750cm^2 but greater than or equal to 250cm^2. Find the inequality that the radius, r, must satisfy.

Hint to the Teacher

1. Emphasis should be put on use of suitable grid paper (graph paper).
2. Emphasize use of a cross (X) when plotting.
3. Guide the learners on identification of wanted and unwanted regions.

References

1. Mathematics for Secondary Schools Book3 p. 228 and Book 4 p. 42.
2. General Mathematics for Secondary Schools Book 2 p. 133.
3. Secondary Mathematics for East Africa Book 1p. 223 and Book 2 p. 226.
4. Secondary School Mathematics Students' Book 3 p. 188 and Book 4 p. 263.
5. Mathematics for Kenya Schools Book 2 p. 209.

Level 2

Topic 1: Data Collection and Presentation

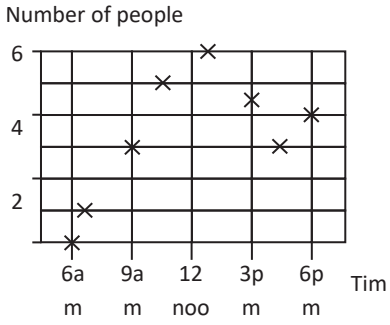
Duration: 20 Hours

Overview

This topic is intended to guide the learner to develop the skills of collecting data, display it in various forms, interpret, analyse and make conclusions.

Competency

The learner should be able to collect and present different sorts of data.

Learning Outcomes	Sample Teaching And Learning Activities	Sample Assessment Strategies
The learner: a. describes and understands the differences between the types of data (u). b. collects and represents data from local environment using bar chart, pie chart and line graph (u, s, gs). c. describes and works out range, mode, mean and median from ungrouped data (k). d. draws and uses frequency table for ungrouped data and works out the range, mean, mode and median (u, s, gs). e. draws and uses	i) Students: Mukasa and Aminah disagreed about the size of their classmates' feet. ii) Mukasa said: Most learners in Senior One have feet which are 15 centimetres long. iii) Aminah said: No, most of them have feet that are shorter than that. iv) Measure the lengths of each learner's feet and record it. v) Make a tally chart to sort the data.	• Let the learners study the graph below: • The graph shows the number of people in a shop  at different times on a single day. One of the points must be wrong. a) Which point must be wrong? b) Explain why the point in part a) must be wrong, and why the other points must be correct. • While the learners are doing the above task,

Learning Outcomes	Sample Teaching And Learning Activities	Sample Assessment Strategies
the frequency table for grouped data and works out the mean, mode and median (u, s). f. works out the mean for ungrouped and grouped data using assumed mean (u, s). g. draws a histogram and uses it to estimate mode (u, s). h. draws a cumulative frequency curve(o-give), and uses it to estimate the median. (u, s).	vi) Represent the data in a suitable way. vii) Who was correct? Explain your answer. • Measure the heights or weights of all the members of your class or year. • Group data (data collection and presentation that you could use). • Group the results to give four or five classes. Display the results on a bar chart.	observe for creativity, presentations, collaboration and respect for another. • Observe the learners in their groups as they carry out the activity. Find out the learners' attitude towards the group work, integrity. Are they doing the work in harmony? • During the presentation, observe whether the learners are communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports.

Hint to the Teacher

1. Emphasis should be put on use of suitable grid paper (graph paper)
2. Emphasize use of the appropriate scale.

References

1. Mathematics for Secondary Schools Book1 p. 266 and Book 3 p. 69. General Mathematics for Secondary Schools Book 2 p. 22.
2. Secondary Mathematics for East Africa Book 2 and Book 4.
3. Secondary School Mathematics Students Book 3 p. 213 and Book 4. 143. Mathematics for Kenya Schools Book 2 p. 22 and Book 4 p. 42.

Topic 2: Set Theory Periods

Duration: 7 Hours

Overview

In this topic, the learner will be able to categorize items according to the given characters, rules or relationship.

Competency

The learner should be able to use sets to solve real-life situations.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: i) describes a set and identifies elements of a set (u). ii) identifies different types of sets and their symbols (k). iii) expresses a set in algebraic terms (u). iv) represents and shows different operations of a set by shading the different regions in a Venn diagram (u s). v) applies practical situations using two and three sets (u, s).	i) Let the learners collect data from one of the streams of S.2 to find out the number of learners that belongs to Arts Club, a Science Club, and a Mathematics Club. ii) Each of the learners in that class should belong to at least one of the clubs. From the data gathered: • How many learners are in the class? • How many learners belong	• Observe the learners in their groups as they carry out the activity below. Find out the learners' attitude towards the group work and integrity. Are they doing the work in harmony? • During description, observe if the learners are communicating effectively. Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity:** Ozo hosted a party of 300 guests. He served a meal with chicken (C) and meat (M). 200 guests had chicken. 130 guests had only chicken. 6 guests did not eat a meal. a) Represent this

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
	to the Arts Club, belong to the Science Club, and belong to the Mathematics Club. • What is the maximum number of learners that could belong to all the three clubs?	information in set notation b) Represent the information on a Venn diagram. c) How many guests ate both meat and chicken? d) How many guests had meat?

Hint to the Teacher

1. Guide learners to write information from word problems into set language.
2. Guide the learners to begin with two Venn diagrams and continue to three Venn diagrams.

References

1. Mathematics for Secondary Schools Book1 p. 1 and Book 3 p. 1.
2. Secondary Mathematics for East Africa Book 1 p. 18 and Book 3 p. 1.
3. Secondary School Mathematics Students' Book 1 p. 1 Book 3 p. 1 and Book 4 p. 1.

Topic 3: Circle

Duration: 10 Hours

Overview

In this topic, the learner shall understand the characteristics of the circle and their relationship.

Competency

The learner should be able to understand, justify and apply the formulae for the area, circumference, and use circle properties to solve problems.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies and names various parts of the circle (k). b. states and uses the formulae for circumference and area of the circle (u). c. calculates area of sector and segment (u, s). d. relates and computes angles subtended by an arc at the centre and the circumference (u, s). e. determines the tangent, chord and angle properties of the circle (u). f. determines the properties of a	Collect a number of circular objects of different diameters, such as bottle tops, plates, drums, etc. For each object: a) Measure the diameter with a ruler; the circumference with a string. b) Demonstrate with the string how many times the circumference is greater than the diameter. c) Halve your value of the diameter to find the radius.	• Observe the learners in their groups as they work out the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners hand in their group reports. 1. The wheels of a bicycle have a diameter of 70cm. Taking π = 22/7, find the distance travelled by the

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
cyclic quadrilateral (u). g. finds out the length of the common chord (u). h. states the theorems of symmetry (u).	Use the relationship between the circumference, diameter and radius to estimate the area of the circular objects you collected. d) Trace around the circle and use a square grid to check your estimate.	bicycle when the wheels turn through 300^0 2 (a) Given that A cm^2 is the area of a circle of a diameter d cm, show that $A = \pi d^2/4$. (b) Use the formula in (a) to find the diameter of a circle of area $25cm^2$.

Hint to the Teacher

1. Encourage the learners to acquire and use mathematical sets.
2. Guide the learners to discover the circle properties.

References

1. Mathematics for Secondary Schools Book 1 p. 162 and Book 3 p. 280.
2. General Mathematics for Secondary Schools Book 3 p. 49 and p. 122.
3. Secondary Mathematics for East Africa Book 4.
4. Secondary School Mathematics Students' Book 1 p. 106 Book 3 p. 216.
5. Mathematics for Kenya Schools Book 3 p. 111 and Book 2 p. 247.

Topic 4: Similarities and Enlargement

Duration: 10 Hours

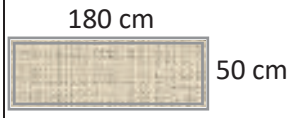
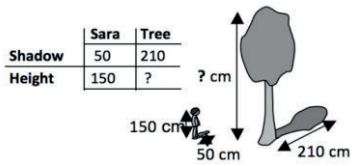
Overview

In this topic the learner shall be able to understand that similarities and enlargement are forms of transformation.

Competency

The learner should be able to understand and apply relationship between lengths, areas and volumes of similar shapes and objects.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies similar figures (u). b. states and uses the properties of similar figures (k, u). c. defines enlargement as transformation (k). d. state the properties of enlargement to construct objects and images (k). e. states the relationship between linear, area	Provide the learners with two mats with those dimensions as shown in the diagrams below. The two mats are rectangular in shape. i) What is the linear scale factor of the enlargement? ii) What is the length of the larger mat? iii) What can you deduce from the larger mat and the smaller mat? ? cm  60 cm	• Observe the learners in their groups as they discuss the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During description, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity:** Bayo and Sara want to find the height of a tree. They cannot climb the tree. Instead, they measure Sara's own height, the length of Sara's shadow, and the length of the shadow of the tree. The table shows their results.

and volume scale factors (u). f. applies scale factors in real-life situation (u, s). (Hint include map extracts.)		 What is the height of the tree? Give your answer as accurately as possible.

Hint to the Teacher

1. Teach similarity first before enlargement.
2. Emphasis should be put on use of suitable grid paper (graph paper).
3. Guide the learners on how to choose the suitable scale to use.

References

1. Mathematics for Secondary Schools Book2 pp. 215 and 257.
2. General Mathematics for Secondary Schools Book 2 pp. 18 and 199.
3. Secondary Mathematics for East Africa Book 2 p. 207.
4. Secondary School Mathematics Students' Book 4 p. 250.
5. Mathematics for Kenya Schools Book 2 p. 80.

Topic 5: Reflection and Rotation

Duration: 8 Hours

Overview

The learner shall be able to understand that reflection and rotation are forms of transformation.

Competency

The learner should be able to reflect and rotate shapes in a range of contexts.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. identifies lines and planes of symmetry for different figures (k). b. states and uses properties of reflection as a transformation. c. makes geometrical deductions using reflection [distinguish between direct and opposite congruence] (u). d. applies reflection in the Cartesian plane (u, s). e. describes and states the order of rotational symmetry of	i) Write down numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 on a paper. Place a mirror at number 9. ii) Try to read the image of the numbers. iii) Write down the image of these numbers. iv) Comment on the image of 0 in comparison to the 'object' 0. • The learner should cut shapes from scrap card and trace the different shape on a plain sheet of	• In groups, the learners should carry out the activity below. Observe them as they do the activity. Is there harmony in the groups? Is each learner's attitude towards the activity positive? How are they communicating to each other? Are they learning from each other? • Let them make their presentations. • Let each group explain to the other groups on how they have carried out the activity. • Let the groups use manila to present their work. **Activity**: Plot the points A (1, 2), B (-1, 1) and C (-4, 3) on a Cartesian plane. Join

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
plane figures (k, u) f. identifies the difference between clockwise and anti-clock wise rotation (u). g. states properties of rotation as a transformation (u). h. determines the centre and angle of rotation (u). i. applies properties of rotation in the Cartesian plane (u, s).	paper. v) Rotate the shapes about an identified centre of rotation through an angle. vi) Trace out the images and let them discuss the characteristics of the object and image being rotated at different centres and angles of rotation. vii) Let the learners draw the different shapes with their images.	up the points. a) What is the mathematical name of the polygon you have drawn? (b)Draw the line y = -x on the Cartesian plane. Reflect the polygon in this line. What are the coordinates of the image of ABC under the reflection? • Let the learners discuss the following activities. • Observe them as they discuss the activities. Assess the learners on the core values and generic skills. • The learners should write reports and present them to the class. **Activity1**: Plot the points P (-2, 1), Q (0, 2) and R (1, 2) to form the triangle PQR on a square grid. Rotate PQR about the point (0, 0) through an angle of 90^0. What are the coordinates of the image of triangle PQR after the rotation?

Hint to the Teacher

1. Emphasis should be put on use of suitable grid paper (graph paper).
2. Guide the learners on how to choose the suitable scale to be used.
3. Teach reflection before rotation.
4. Guide the learners to do the work practically.

References

1. Mathematics for Secondary Schools Book1 p. 304 and Book 2 p. 243.
2. Secondary Mathematics for East Africa Book 1 p. 188 and Book 2 p. 1
3. Secondary School Mathematics Students' Book 3 p. 163.
4. Mathematics for Kenya Schools Book 2 pp. 49 and 68.

Topic 6: Matrices

Duration: 12 Hours

Overview

This topic is intended to help the learner understand that Matrix is one way of keeping information. The information is kept in terms of rows and columns.

Competency

The learner should be able to understand and use the matrices in real-life situations.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. describes a matrix (k). b. states the order of a matrix (k). c. states types of matrices (k). d. determines compatibility in addition and multiplication of matrices (u). e. finds determinant of a 2 x 2 matrix (u). f. finds the inverse of a 2 x 2 matrix (u).	Visit your school store for food. i) Arrange the food items found in the store in lines e.g. lines of beans, posh etc. ii) What does each line represent? iii) State the number of horizontal and vertical lines you have formed	• Observe the learners in their groups as they carry out the activity to find the order of the matrices below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. i) $\begin{bmatrix} 2 & 1 & 5 \end{bmatrix}$ ii) $\begin{bmatrix} 3 \\ 4 \\ 2 \end{bmatrix}$ iii) $\begin{bmatrix} a & c \\ b & d \end{bmatrix}$

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
g. applies the knowledge of matrices in solving problems from real-life situation (u, s).		

Hint to the Teacher

1. Guide the learners to identify and understand columns and rows in class.
2. Relate the sitting arrangement in class to order of matrices.

References

1. Mathematics for Secondary Schools Book3 p. 173.
2. General Mathematics for Secondary Schools Book 3 p. 135.
3. Secondary Mathematics for East Africa Book 3.
4. Mathematics for Kenya Schools Book 3 p. 135.

Topic 7: Quadratic Equations

Duration: 10 Hours

Overview

In this topic, the learner shall differentiate between linear and quadratic equations. In quadratic equations, the highest power for the unknown is two (2) whereas the highest power for the unknown in linear equations is one (1).

Competency

The learner should be able to understand factorise and solve quadratic equations.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. builds a quadratic expression from the word problems (u). b. expands algebraic expressions [consider the three identities] (u). c. identifies a perfect square. d. manipulates expressions to get a complete square (u, s) e. factorises quadratic expressions. f. determines the roots of quadratic equations using factorization, completing square and formula (u, s). g. forms the quadratic equation using the given roots (u). h. makes a table of values for a quadratic	Your school has a rectangular garden with an area of $1000m^2$. Its length is 30m greater than its width. Find the dimensions of the garden.	• Observe the learners in their groups as they work out the exercise below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. 1. A room p metres long and (p- 3) metres wide has an area of $40m^2$. Obtain an equation in p. Find the value of p.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
equation (u). i. plots and draws the graph (u, s). j. solves quadratic equations using graphs (u, s).		2. Try to solve $x^2 - 3x + 4 = 0$ by: i) factors ii) completing the square iii) formula (a) For each method, state briefly the difficulty you encountered. (b) What do you conclude about the solution set of $x^2 - 3x + 4 = 0$

Hint to the Teacher

1. Emphasis should be put on use of suitable grid paper (graph paper).
2. Emphasize use of a cross (X) when plotting.
3. Guide the learners on how to choose the suitable scale to be used.
4. Guide the learners to form linear equations from quadratic.

References

1. Mathematics for Secondary Schools Book3 p. 255.
2. General Mathematics for Secondary Schools Book 2 pp. 102 and183.
3. Secondary Mathematics for East Africa Book 2 and Book 4.
4. Secondary School Mathematics Students' Book4 p. 340, Book 1 p. 32 and Book 3 pp. 186 and 197.
5. Mathematics for Kenya Schools Book 3 p. 7 Book 2 p. 178.

Topic 8: Simultaneous Equations

Duration: 12 Hours

Overview

This topic is intended to guide the learner to appreciate simultaneous equations as types of equations which involve two variables or unknowns.

Competency

The learner should be able to form, understand and use simultaneous equations.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. forms algebraic equations in two variables to describe simultaneous equations. b. draws graphs of simultaneous equations and finds the solution (u, s). c. solves simultaneous equations using substitution (u, s). d. solves simultaneous equations using elimination (u s). e. uses matrices to solve simultaneous equations (u, s). f. states the	i) Maureen buys 3 tins of peanut butter and 5 tons of margarine for UGX. 32,000. ii) Zulaika buys 6 tins of peanut butter and 8 tons of margarine for UGX. 59,000. iii) Musisi buys one tin of peanut butter and one tin of margarine. How much does he pay?	• Observe the learners as they work out the exercise below. Find out each learner's attitude towards group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners hand in their work for marking. **Activity 1**. Solve the following pairs of simultaneous equations using elimination method. (a) 7x + 3y = 32 3x + 12y = 78 (b) 6y + 14 = 7x

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
difference between linear equation and quadratic equation (u). g. solves a linear and quadratic equation by substitution method (u, s). h. draws the graph of the line and the curve and solves the two equations from the graph (u, s).		$5x - 12 = 4y$ **Activity 2**. Use graphs to solve the simultaneous equations: $3x + y = -2$ $4x + 2y = 0$ 3. Draw the curve $y = x^2 + 3x - 1$ and lines $y = 3x + 10$ and $y = -3x + 20$. Use your graphs to solve three pairs of simultaneous equations. Give the equations together with the solutions.

Hint to the Teacher

1. Guide the learner to handle one method at a time. Don't mix up methods.
2. Emphasis should be put on use of suitable grid paper (graph paper).
3. Emphasize use of a cross (X) when plotting.
4. Guide the learners on how to choose the suitable scale to be used.

References

1. Mathematics for Secondary Schools Book 3 pp. 193 and 346.
2. General Mathematics for Secondary Schools Book 1 p. 203.
3. Secondary Mathematics for East Africa Book 4.
4. Secondary School Mathematics Students' Book 4 p. 72.
5. Mathematics for Kenya Schools Book 3.

Topic 9: Matrix Transformations

Duration: 8 Hours

Overview

The learner shall be guided to understand that Matrix transformation is form of transformation in which the matrices are used.

Competency

The learner should be able to understand and use matrices to transform shapes in a range of context.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. determines matrices for the transformation: reflection, rotation and enlargement using the unit square (u, s). b. relates image and object under the given transformation on a Cartesian plane (u, s). c. identifies the matrix of transformation when the object and its image are given (u). d. determines the inverse of a transformation matrix (u). e. uses the inverse matrix to find the object when the	Plot the following five triangles on the grid paper. $\mathbf{T_1}$ (1,1), (5,1), (5,3), $\mathbf{T_2}$ (1,1), (1,5), (-1,5) $\mathbf{T_3}$ (-1,1), (-5,1), (-5,3) $\mathbf{T_4}$ (-1, -1), (-5, -1), (-5, -3) and $\mathbf{T_5}$ (1, -3), (1, -5), (5, -3) i) Use the diagram to name: • a triangle that is directly congruent to $\mathbf{T_1}$ • two pairs of oppositely congruent triangles • a pair of triangles in	• Observe the learners as they carry out the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their work for marking. **Activity 1**. Find the matrix corresponding to the transformation by considering the images of the point I (1,0) and J

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
image is given (u, s). f. identifies the relationship between area scale factor and determinant of the transformation matrix (u). g. determines and identifies a single matrix for successive transformations (u).	which one triangle is the image of the other under reflection ii) Describe a single transformation which would map: **(a) T_3 onto T_1.** **(b) T_4 onto T_5** **(c) T_1 onto T_2** **(d) T_4 onto T_3** **(e) T_1 onto T_4** **(f) T_4 onto T_2**	(0,1): (a) reflection in the line $X + y = 0$ (b) a 90^0 clockwise rotation about the origin (c) an enlargement, centre the origin, scale factor -1 **Activity 2.** O (0, 0), A (3, 0), B (3, 3) and C (0, 3) are the vertices of a square OABC. A_1 (4, 2), B_1 (6, 6) and C_1 (2, 4) are the vertices of $OA_1B_1C_1$, the image of OABC such that the origin is invariant. Find: (a) the matrix of transformation

Hint to the Teacher

1. Guide the learners to discover some of the transformation matrices using a unit square.
2. Guides the learners to always use transformation matrix as a pre-multiplier.

References

1. Mathematics for Secondary Schools Book1 pp. 106 and 257.
2. General Mathematics for Secondary Schools Book3 pp. 60 and 135.
3. Secondary Mathematics for East Africa Book 3 and 4.
4. Secondary School Mathematics Students'Book3 p. 272 and Book 4 p. 198.
5. Mathematics for Kenya Schools Book 3 or 4.

Topic 10: Ratios and Proportions

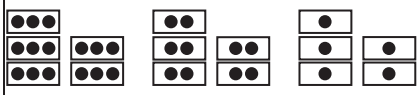
Duration: 8 Hours

Overview

In this topic, the learner shall be guided to understand sharing in the given proportions and differentiate the various proportions.

Competency

The learner should be able to understand ratio and proportion, and use them in a range of contexts.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
The learner: a. understands and uses equivalent ratios (u). b. understands and uses direct proportion (u). c. understands and uses sharing in given proportions (u, s). d. understands and uses inverse proportions (u, s). e. understands and uses ratio and proportion and scale (u, s). f. understands and applies direct, indirect, joint and partial	Look at the diagrams:  9:6 = 6: ___ = ___:2 a) Use the diagrams to fill in the gaps and complete the equivalent ratios. b) Draw diagrams to show some ratios that are equivalent to 5:3. c) Simon says, "12:15 is equivalent to 3:4". Is he right? d) Draw diagrams to justify your answer.	• Observe the learners in their groups as they carry out the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity 1.** In a Technology and Enterprise lesson, the learners had a recipe to make small cakes. 8 cakes needed 400 grams of flour. • Hadijah wants to make 20 of the cakes.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
variations. (u, s). g. applies joint and partial variations in solving problems (u, s).		How much flour does she need? • Denis has 750 grams of flour. How many of the cakes can he make? **Activity 2.** Mrs Mukasa is a small scale poultry farmer. It costs her UGX. 250,000 to buy the feeds to raise 70 broilers. Mrs Mugisha wants to raise 300 broilers. • How much will the feeds needed to raise these broilers cost her? **Activity 3.** Day old broiler chicks cost UGX. 2000 each. Mrs Opio has UGX. 1,000,000 (one million shillings). She wants to buy and raise as many chicks as she can. • How many should she buy?

Hint to the Teacher

Guide the learners to handle each sub-topic at a time.

References

1. Mathematics for Secondary Schools Book2 pp. 193 and 257.
2. General Mathematics for Secondary Schools Book 3 p. 71.
3. Secondary Mathematics for East Africa Book 4.
4. Secondary School Mathematics Students' Book 3 p. 124 and Book 4 pp. 85 and 199.
5. Mathematics for Kenya Schools Book 1 p. 84.

Topic 11: Trigonometry

Duration: 18 Hours

Overview

The learner shall be guided to understand that trigonometry is geometry only that trigonometry deals with three-sided figures.

Competency

The learner should be able to understand, justify and apply the three basic trigonometry functions.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
The learner: a. identifies the sides of right-angled triangle with a given angle (k). b. describes sine, cosine and tangent ratios from right-angled triangles (u). c. reads and uses mathematical tables and calculators to find trigonometrical ratios (u). d. uses sine, cosine and tangent in calculating lengths of sides and angles of right-angled triangles (u). e. applies trigonometric ratios to calculate angles of elevation, depression and length (u, s). f. draws a unit circle (k). g. determines trigonometric ratios of angles greater than	1. Use a ruler and protractor to accurately draw three differently sized triangles with angles of 30^o, 60^o, and 90^o. 2. Use your triangles from (a) to do the following: i) Measure the length of hypotenuse, opposite and adjacent side of the triangles. ii) Find the value of opposite side length/adjacent side, opposite side length/ hypotenuse and adjacent side length / hypotenuse for each of the	• Observe the learners in their groups as they carry out the activity below. Find out the learners' attitude towards the group work, integrity, are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
900 (u). h. applies the unit circle to solve trigonometric equations (u). i. draws graphs of y = sin θ, y = cosθ interval of 00 to 3600. j. uses the graphs to read ratios of sine and cosine for any triangle (u, s). k. applies sine and cosine rule in solving real-life problems (u, s).	triangles. 3. What do you notice about the values calculated in (b) (ii)? 4. The three triangles drawn in (a) are of different sizes but have the same angles. They are similar triangles. What do you know about the side lengths in similar triangles? 5. In groups, use mathematical tables to read the cosine and sine of the following angles: 00, 80, 200, 350, 650, 950, 1350, 1900, 2250, 2600, 2850, 3300, 3500. 6. What do you observe about the cosine and sine of the above angles as the angles increase from 00 to 3600? 7. Repeat the activity using angles which are bigger than 360^0 but less than 720^0 i.e.	their group reports. **Activity 1.** The Uganda national football team is playing a match. A player is ready to kick the ball from the corner of the football ground to the striker standing near the goal posts. • Draw a diagram showing the position of the player and the striker. a) How far must the player kick the ball to reach the striker? b) In the problem above, at what angle to the touchline must the player kick the ball? **Activity 2.** Atim sees a ripe mango at the top of a tree growing in the bush. The mango Is 12 m above the ground. Atim is 1.6 m tall. She stands 10 m away from the base of

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
	(360 $^0 \leq x^0 \leq 720^0$). 8. What can you say about the cosine and sine of angles as angles increase from 0^0 to 720^0?	the tree. She aims a stone the mango to bring it to the ground. • Estimate the angle at which she should aim the stone.

Hint to the Teacher

Guide the learners to identify the signs of the trigonometrical ratios using the unit circle.

References

1. Mathematics for Secondary Schools Book 3 p. 44 and Book 4 p. 145.
2. General Mathematics for Schools Book 3 pp. 10 & 26.
3. Secondary Mathematics for East Africa Book 2 p. 256 and Books 3 & 4.
4. Secondary School Mathematics Students' 4 p. 116, Book 3 p. 62.
5. Mathematics for Kenya Schools Book 3 p. 50 & 91 and Book 2 p. 109.

Topic 12: Nets, Areas and Volumes of Solids (Mensuration)

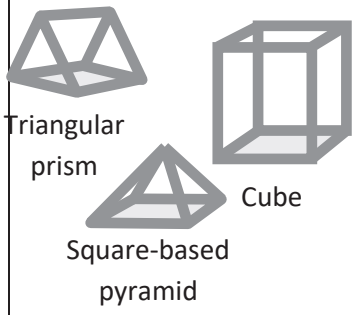
Duration: 10 Hours

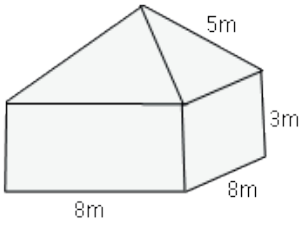
Overview

The learner shall be guided to understand the nets of various solids. This will enable the learner to calculate the area and volume of various solids.

Competency

The learner should be able to apply area and perimeter formulae for 2-D, make nets of 3-D shapes and explore their properties.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
The learner: a. describes the length of two-dimensional geometrical figures (u). b. develops, understands and states Pythagoras theorem(u) c. d. applies Pythagoras theorem to right angles and isosceles triangles (u s). e. understands the meaning of area and perimeter in two dimensional geometrical figures (triangles, rectangles square, parallelogram)	a) The learners should explore the number of different nets of the following solids they can draw: i) Cube ii) Cuboids iii) square based pyramid b) They should describe the characteristics of the nets drawn.  	• Observe the learners in their groups as they carry out the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the description, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity 1.** A tent has a cuboid base and a right pyramidal roof. a) Sketch a net of the tent

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment
(u s). f. identifies common solids(k). g. forms nets of common solids (u). h. sketches common solids emphasizing the three dimensional aspect (u s). i. states units of measures (k) j. converts units from one form to another(u) k. alculates surface areas and volumes of three dimensional figures (u s).	c) Put learners in groups to make these three shapes out of strips of wood which are all of the same length. How many strips have you used for the a) cube? ii) square-based pyramid? iii) Triangular prism?	and indicate the lengths of its edges. b) Calculate the surface area of the tent. c) Sketch as many different nets as you can for the tent.  *Note: The learners may discuss whether the floor of the tent is covered. Such an observation would indicate that they are applying theoretical mathematics effectively.*

Hint to the Teacher

Encourage learners to make nets of different 3-D shapes.

References

1. Mathematics for Secondary Schools Book2 pp. 268 & 290, Book 3 p. 310.
2. General Mathematics for Secondary Schools Book 2 p. 153.
3. Secondary Mathematics for East Africa Book 4 and Book 4.
4. Secondary School Mathematics Students' Book 3 p. 251
5. Mathematics for Kenya Schools Book 1 p. 246, Book 2 p. 154.

Topic 13: Lines and Plane in Three Dimensional Geometrical Figures

Duration: 14 Hours

Overview

The learner shall understand the characteristics of lines and planes in 3-D geometrical figures.

Competency

The learner should be able to understand and apply lines and planes in3-D shapes.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. applies Pythagoras theorem to calculate the distance between two points (u, s). b. identifies a common point between a line and a plane (k). c. describes projection of a line to a plane (u, s). d. finds the angle between a line and a plane (u). e. describes an intersecting line between planes (u). f. finds the angle between two planes (u).	i) In groups, let the learners collect various 3D shapes. ii) Open the figures you have collected. iii) Identify: apexes, edges, number of sides, angles, lines and planes of the figures. iv) Identify the number of the above for each figure you are dealing with. v) Determine the relationship between the apexes, edges, angles and number of sides	• Observe the learners in their groups as they discuss how to work out the activity below. Find out each learner's attitude towards the group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners hand in their group work for marking. **Activity 1.** A wireless mast is held vertically by four stays 10m long,

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
	for each of the figure you have.	fixed to the mast at the same height and joined to the four corners of a square on level ground. • If each stay is inclined at 60^0 to the horizontal, calculate the height of the top of each stay and the length of a side of the square.

Hint to the Teacher

1. Encourage the learners to make nets and models of different 3-D shapes.
2. Emphasis should be put on the use of right-angled triangle.

References

1. Mathematics for Secondary Schools Book 4 p. 195.
2. General Mathematics for Secondary Schools Book 3 p. 154.
3. Secondary Mathematics for East Africa Book 3.
4. Secondary School Mathematics Students' Book 4 p. 327.
5. Mathematics for Kenya Schools Book 4 p. 122.

Topic 14: Commercial Arithmetic 2

Duration: 10 Hours

Overview

The learner shall be guided to understand the day-to-day mathematics being used at home and business places like banks. This topic shall draw experience from the learner's environment.

Competency

The learner should be able to understand and apply commercial arithmetic in real-life situations.

Learning Outcomes	Sample Teaching And Learning Activities	Sample Assessment Strategies
The learner: a. applies the compound interest formula for calculating interest up to 3 years (u). b. understands depreciation and appreciation using the formula (u). c. understands and converts local or foreign currencies (u). d. understands and calculates hire purchase (u). e. describes and determines mortgage of assets (u). f. calculates income tax given income tax bands (u).	Explain the meaning of the following terms: buying, selling, profit, loss, commission, discount, interest, mortgage, currency, income tax, appreciation and depreciation.	• Observe the learners in their groups as they carry out the activities below. Find out each learner's attitude towards group work and integrity. Are they doing the work in harmony? • During the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners give their group reports. **Activity 1.** A piece of sculpture and painting together cost UGX. 21, 000. The painting costs twice as much as the piece of sculpture. Find the cost of the painting

Learning Outcomes	Sample Teaching And Learning Activities	Sample Assessment Strategies
		Activity 2. The marked price of a set of curtains is UGX. 75 000, but there is a cash discount of UGX. 12.50 on every sh100. Find the cash price for the curtains. **Activity 3.** If a forex bureau in Uganda buys Kenya shilling at the rate of UGX. 42 per Ksh., find: (a) the amount in Uganda shillings paid out by the bureau in exchange for Ksh. 625. (b) the amount in Kenya shillings that can be exchanged or Uganda shillings 5, 460

Hint to the Teacher

Guide the learners to use step-by-step approach to derive the compound interest formula.

References

1. Mathematics for Secondary Schools Book 3 p. 161.
2. General Mathematics for Schools Book 3.
3. Secondary School Mathematics Students' Book 4 p. 56 and Book 3 p. 137.
4. Mathematics for Kenya Schools Book 3 pp. 88 & p. 239.

Topic 15: Probability

Duration: 14 Hours

Overview

This topic helps the learner to use the happenings of something in the past in predicting the happenings in the future. The learner shall be able to bring out the relationship between the patterns and probability.

Competency

The learner should be able to apply his/her understanding of probability to solve a wide range of problems in real-life situations.

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
The learner: a. understands the terms random, experiment, outcome, sample space, event and probability (u). b. constructs the probability space of an event (u). c. determines probability from experiment and real-life [theoretical] (u, s). d. differentiates between theoretical and experimental probability (u, s). e. states laws of probability (u).	In pairs, get a coin. i) Mark one side of the coin as a 'HEAD' and the second side as a 'TAIL' ii) Toss the coin 5, 10, 15, 30, 50, 100, 150, 500, 1000 times. iii) Note down what side of the coin that appears on top each time the coin is tossed. iv) Comment on the number of times each side appears. v) What do you notice as the number of tosses	• Observe the learners as they work out the activity below. Find out each learner's attitude towards group work and integrity. Are they doing the work in harmony? • During the presentation, are the learners communicating effectively? Are they learning from one another? Are they creative and critical? • Let the learners hand in their work for marking. Activity 1. Sara has the following coins in her pocket bag: UGX. 50, UGX. 100, UGX. 200, UGX. 500, UGX. 1000. She selects a coin at random to put into a charity collection box. What is the probability that she:? a) gives more than UGX. 200?

Learning Outcomes	Sample Teaching and Learning Activities	Sample Assessment Strategies
f. identifies and understands mutually exclusive and independent events (u). g. uses probability tree to differentiate between mutually exclusive and independent events (u, s). h. solves mutually exclusive and independent events (u, s). **i.** calculates the probability of compound events using Venn diagrams (u. s).	increase (in terms of appearances of the coin)?	b) has less than UGX. 800 left in her bag? c) has more than UGX. 300 left in her bag? d) gives at least 10% of the money in her bag? e) gives more than one-fifth of the money in her bag? **Activity 2.** A class has 30 girls and 40 boys. The probability that a boy selected at random is wearing stockings is 0.3. The probability that a girl selected at random is wearing stockings is 0.9. Calculate the probability that a learner selected at random from the whole class: a) is a boy b) is a girl wearing stockings c) is not wearing stockings!

Hint to the Teacher

Guide the learners through one concept at a time.

References

1. Mathematics for Secondary Schools Book3 p. 201.
2. General Mathematics for Secondary Schools Book 3 p. 154.
3. Secondary Mathematics for East Africa Book 3.
4. Secondary School Mathematics Students' Book 3 p. 160 and Book 4 p. 289.
5. Mathematics for Kenya Schools Book3 p. 219.

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