

E-LEARNING PROJECT

MATH SEMINAR AT OLD K'LA SS

HELD ON 23RD. JUNE, 2024



O-LEVEL MATHEMATICS
QUESTION BOOKLET



**E – Learning Teachers’ Project Uganda****O & A Level Mathematics Seminar at Old Kampala S.S****Held on 23rd - June – 2024****Call: 0759-271390, 0705655497 0773-241666 (WhatsApp)****O- LEVEL 456/1 MATHEMATICS QUESTION PAPER**

This paper will contain six (6) items with a duration of 2hours 15 minutes.

SECTION	ELEMENT OF CONSTRUCT	Number of items	
A (Both items are compulsory)	NUMBERS	1 ITEM	Both items MUST be done
	PATTERNS	1 ITEM	
B (Attempt only one item of your choice from parts I and II respectively)	DATA COLLECTION & PROBABILITY	2 ITEMS	Part I: <i>Choose Only One</i>
	GEOMETRY & MEASUREMENTS	2 ITEMS (<i>Choose Only One</i>)	Part II: <i>Choose Only One</i>
TOTAL NUMBER OF ITEMS TO BE PRESENTED BY THE CANDIDATES			4 items

SECTION A**THEME 1: NUMBERS**

✓ Number bases
✓ Working with integers
✓ Fractions, percentages and decimals
✓ Numerical concepts (indices, surds and logarithms)
✓ Ratios and proportions

Item 1:

A certain region in Uganda is facing a severe drought, and the local community is struggling to access clean water. The regional government office has decided to distribute water among the affected villages. A simple regional population census is carried out, and it discovered that Village X has a population of 1500 people, village Y has 2000 people, and village Z has 1200 people. The government has 9000 litres of water to distribute amongst the villages.

Task:

If the government wants to distribute the water in the ratio of 3:4:2 among the villages, how many litres of water will each village receive?

Item 2:

In a certain district in Uganda, the Red Cross Society discovered that the average monthly expenditure on food by a family consisted of two parts:

One-part constant and the other part varying as the square of the number of children in the family. It was noted that a family of three children needed Shs. 17000 while that of seven children needed Shs. 21000.

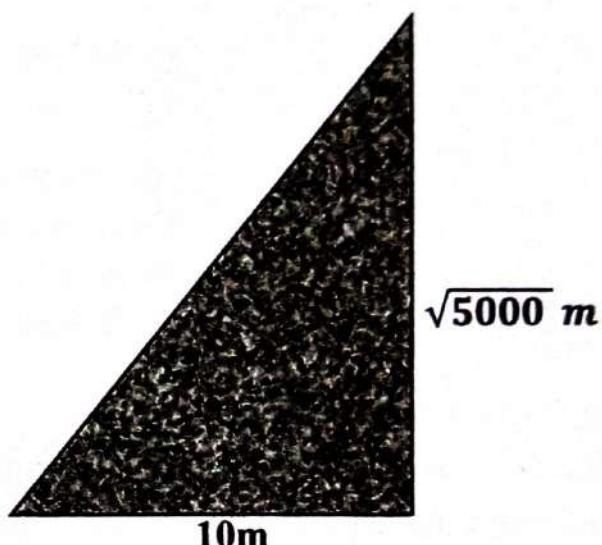
Task:

- (a) Determine the expression for the total amount of money, C, spent per month on food by a family with n children
- (b) Determine the monthly food bill for
 - (i) a childless family
 - (ii) a family with five children
- (c) A family with $(n - 1)$ children is expecting another child. Help them determine the *extra cost of food*, per month, that will have to be met for the n^{th} child.
- (d) Determine n such that the ratio of the average extra food cost per child in a family of n children is $\frac{5}{9}$ of the extra cost of food for the n^{th} child

Item 3

Juma has four plots of land in his village. He intends to give them out to his four sons, but unfortunately the plots do not relate in terms of size. Juma's close friend has accepted to give out an equivalent consolidated piece of land to enable Juma to distribute it to his children.

The surveyor's records indicate that there are 3 rectangular plots measuring $\sqrt{3200} \text{ m}^2$, $\sqrt{1800} \text{ m}^2$ and $\sqrt{9800} \text{ m}^2$. The third plot has the structural map below.



Juma wants to reserve $\frac{1}{2}$ of the land for himself and distribute the remaining portion equally among his children.

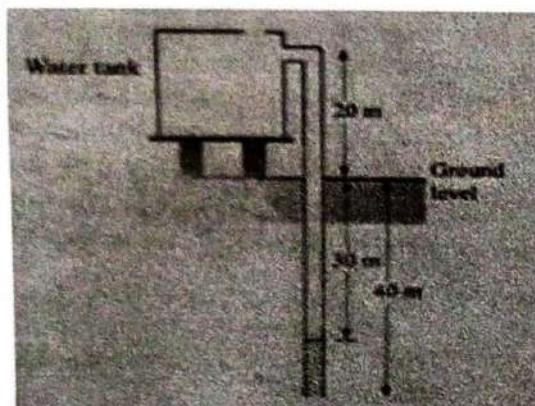
Task:

As a mathematician, help

- Juma prepare a sharing plan for the piece of land.
- Draw an abacus and illustrate this expression $4 \times 8^4 + 2 \times 8^2 + 4 \times 8^0$ on it.
- Using the abacus only, work out the following;
 - $332_{\text{six}} + 25_{\text{six}}$
 - $52_{\text{eight}} - 23_{\text{eight}}$

Item 4:

A school in a semi – arid region sunk a bore hole 40m deep. The water was to be pumped into an overhead tank whose top is 20m above the ground. The level of water in the pipe when pumping started was 30m below the ground and it rose by 5m every second as shown below.



Task:

Basing on your knowledge of integers,,

- determine the vertical length of the pipe
- Ignoring the horizontal distance travelled by the water, determine how long will it take for the water to start entering the tank.
- State the height of the water levels at intervals of 2 seconds after the pumping started.
- How long will it take for the water level to rise from $-30m$ to $10m$ above the ground?
- If a hot water tap can fill a tank in 5 minutes while the cold water tap can fill the same tank in 3 minutes, the drain pipe can empty the full tank in $3\frac{3}{4}$ minutes. The two inlet taps and drain pipe are fully opened for $1\frac{1}{2}$ hours , after which the drain pipe is closed. Determine how much longer it will take to fill the tank.

Item 5:

In 2021, the total cost of manufacturing an article was Sh.1250 and this was divided between the cost of material, labour and transport in the ratio 8: 14: 3. In 2023 the cost of the material was doubled, labour cost increased by 30% and transport costs increased by 20%. Given that the cost of manufacturing the same article in 2024 was sh. 1981 as a result of increase in labour costs only.

Task:

- determine the cost of manufacturing the article in 2023.
- What would be the percentage increase in labour cost in 2024?

Item 6 :

Mr. Mukasa is a reknown shop keeper. He sells all kinds of grocery. Every Monday, he mixes two types of rice A and B in a ratio of 3 :2. Type A rice costs Shs. 6000 per kilogram and type B costs Shs. 5000 per kilogram.

He also has type A sugar that costs Shs. 5000 per kilogram and type B sugar costs Shs. 6000 per kilogram.

Mr. Mukasa supplies maize flour to three different neighboring schools all at once to cut down on the transport costs. He only does this when the bells of the schools are rung at the same time. Every Monday, Mr. Mukasa supplies these schools at exactly 8:00am. The schools have their time tables drafted following the following time intervals;

The first school has change of lesson interval every after 35 minutes

The second school has change of lesson interval every 40 minutes and

the third school has a change of lesson interval every 45 minutes

Task :

- If you want to buy 23kg of the mixture, what would be the cost?
- determine the ratio in which type A sugar will be mixed with type B sugar in order to produce a blend costing Shs. 5600.
- If Mr. Mukasa's shop operates 24 hours throughout, determine the time in the week when the three bells will ring together again to have Mr. Mukasa's supply

THEME 2 : PATTERNS AND ALGEBRA

⇒ Sequences and patterns
⇒ Equations of line and curves
⇒ Algebra 1 and 2
⇒ Mapping and relations
⇒ Inequalities and regions
⇒ Equation of a straight line

⇒ Rectangular Cartesian plane
⇒ Simultaneous equations
⇒ Linear programming
⇒ Loci

Item 8:

The Ministry of Health in Uganda is concerned about the spread of malaria in the country. They have collected data on the number of malaria cases in different districts, and the amount of insecticide used for mosquito control. the data is shown in the table below:

District	Malaria cases	Insecticide used in litres
Kampala	500	200
Mukono	300	150
Wakiso	400	180
Jinja	200	120
Mbale	350	160

Task:

- (a)(i) Using the data above, create a relation between the number of malaria cases and the amount of insecticide used.
- (ii) determine the function that models this relation
- (b) Using the function in (a)(ii) above, determine how much insecticide should be used in a district with 600 malaria cases.

Item 9:

In a certain school the school fees were increased by Shs. 400000 per child. Because of this increase, 50 children left the school. Given that the total fees collection rose from Shs. 150,000,000 to Shs. 200,000,000.

Task: *You are the school bursar, and you've been tasked to*

- (i) determine the number of children in the school
- (ii) determine the school fees that each of the remaining children paid
- (iii) give a logical conclusive statement from your observation and advise the school director accordingly.

Item 10:

A certain company has undertaken a contract to supply a customer with at least 260 units in total of products X and Y, during the next month. At least 50% of the total output must be units of X. The products are each made by two grades of labour, as follows:

	Grade A labour	Grade B labour
Grade A labour	4	6
Grade B labour	4	2
Total	8	8

Although additional labour can be made available at short notice, the company wishes to make use of 1200 hours of Grade A labour and 800 hours of Grade B labour which has already been assigned to work on the contract next month. The total variable cost per unit is 120 Pound sterling and 100 Pound sterling for Y. The company wishes to minimize the expenditure on the contract next month.

Task:

Help the company determine how much of X and Y should be supplied in order to meet the terms of the contract.

ITEM 11:

An owner of a certain furniture company wishes to transport at least 600 desks from its stores to your school. The company has two types of trucks P and Q. Truck P can carry 50 desks at a cost of Sh. 40,000 per trip. Truck Q can carry 75 desks at a cost of Shs. 50,000 per trip. There is Shs. 600,000 available for transport. The number of trips made by truck P should not exceed 7. The number of trips made by truck Q should not exceed the number of trips made by truck P.

Task:

- If x and y are the trips made by P and Q respectively, write down four inequalities satisfying the given conditions.
- On the same axes, draw the graphs of the inequalities and shade the unwanted regions.
- Using your graph to determine the number of trips each truck should make so as to minimize the transport cost. Hence, find the amount of money served on transport.

Item 12

A certain organization used lorries for transportation of building materials during the month of March and April 2024. The same amounts of diesel and oil were used. The amount of money spent on fuel are in the table below;

Month	Price of diesel per litre (Ushs.)	Price of oil per litre (Ushs.)	Total cost of fuel (Ushs.)
March	2500	5000	800,000
April	3000	8000	1,200,000

Taking x and y to represent the number of litres for diesel and oil respectively.

Task:

- Write the matrix equation to show the cost of the purchase.
- Solve the equation to determine the number of litres used on both diesel and oil.

Item 13 :

In designing wedding deco box handler, a rectangular sheet of metal 8m long and 6m wide is used. Equal squares of side x m are cut from the corners of the sheet. The remainder is bent to form an open rectangular box. The volume, y m^3 of the box is given by $y = 4x(4 - x)(3 - x)$

The table below shows how the cut sides correspond to the volume of the box.

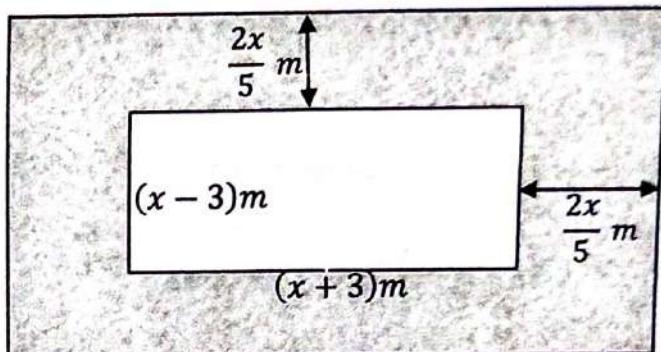
x (m)	0	0.25	0.5	0.75	1.0	1.25	1.5	2.0	2.5
y (m^3)		10.3	17.5	21.9		24.1	22.5		7.5

Task:

- Using the information given, you are required to copy and complete the table, and draw a graphical representation of the curve $y = 4x(4 - x)(3 - x)$ by using a scale of 2: 0.5 on the x – axis, and 1:5 on the y – axis.
- Using your graph, find the
 - two possible values for the depth of box when its volume is $15\ m^3$
 - greatest possible volume of the box.

Item 14 :

Your school has organized a S.4 candidates' prom party. In order to have a good prom party, the floor of the dancing hall is designed with a carpeted margin all-around of $\frac{2x}{5}$ m wide leaving a dancing space of $(x - 3)m$ by $(x + 3)m$ as shown below.



Task: You are required to compute the following, and hand your calculations to your class teacher.

- If the total area of the entire room is 315m^2 , calculate the value of x .
- Determine the area of the carpeted margin.
- If the carpet cost shs. 25000 per m^2 . Calculate the total cost of the sealed margin.

Item 15 :

In a certain district, a plot of land has been designated for construction of a health facility to help the citizen access medical treatment. The plot is in the form of a trapezium with sides $AB = 74\text{m}$, $BC = 48\text{m}$, $CD = 56\text{m}$, Angle $ABC = 81^\circ$ and AB parallel to DC .

Task: As a mathematics learner, work out the following;

- Using a scale 1cm to 10m, **construct** the plan of the plot.
- On the plan **construct** locus L_1 , of points equidistant from sides AB and AD and locus L_2 of points equidistant from sides DC and DA
- If L_1 and L_2 meet at M , a TV mast, **locate** M
- Shade** the region inside the plot where trees can be planted such that they are at least 25m away from the mast.

Item 16 :

In a scientific investigation, the variables x and y are known to satisfy a law of the form $y = kt^x$ where k and t are constants. The data collected from an experiment was recorded as in the table below.

x	1	2	2.5	3	4
y	9.6	19.2	27.1	45.4	76.8

Task:

- obtain a linear equation connecting x and y .
- Suppose one of the recorded values of y is wrong, draw a suitable graph and identify the wrong value of y .
- Use your graph to estimate the values of k and t .

Item 17:

In Term 2, a certain S.3 student from one of the streams at his school picked a piece of paper bearing the following information.

A straight road L_1 has a slope $-\frac{1}{2}$ and passes through a point $P(-1, 3)$.

Another straight road L_2 passes through two points $Q(1, -3)$ and $R(4, 5)$.

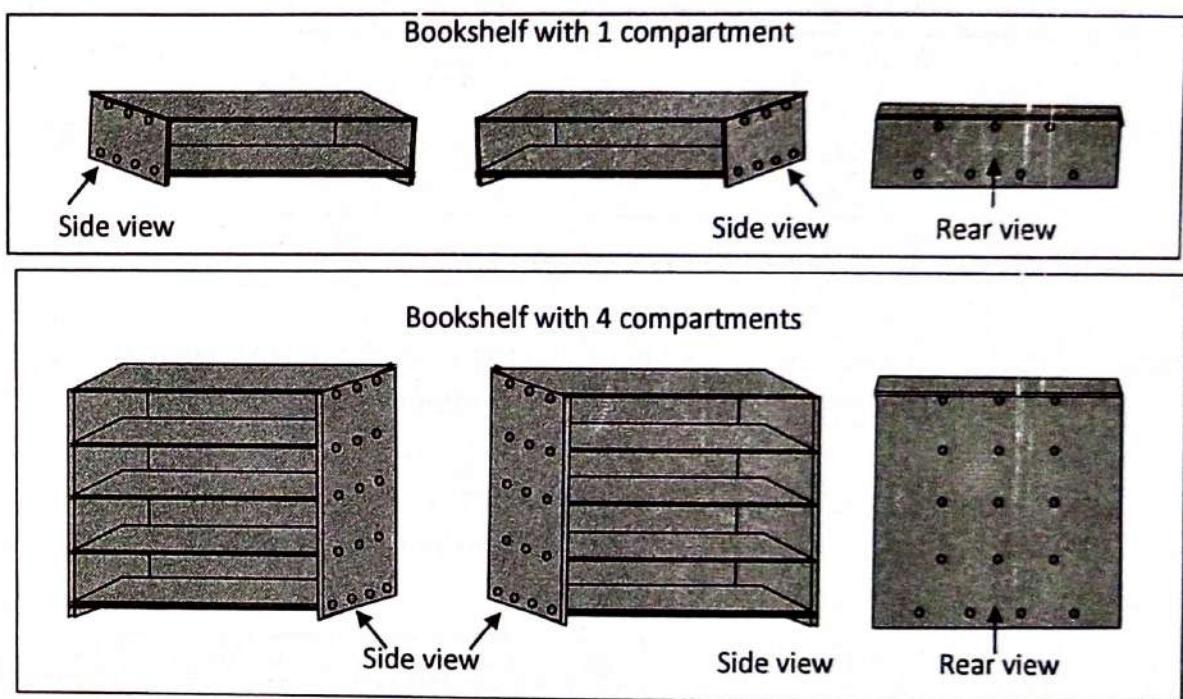
- The equation of road L_1 is
- Road L_2 has an equation given by,
- The two road cross each other at the point
- The equation of another straight road that passes through R and is parallel to L_1 is given by
- The equation of another straight road that passes through point $S(0, 5)$ and is perpendicular to L_2 is given by

The student discovered that their stream had not yet covered the that learning area in mathematics, and his stream Mathematics teacher wasn't available to guide him.

Task: You are one of the students from the stream that had covered that area, and you had actually achieved all the learning out comes. By showing your working help the student to determine all the missing information.

Item 18:

Mbeiza is a carpenter. She specializes in making bookshelves with different numbers of compartments. She uses 12 nails for the base of a bookshelf, and 9 more nails for each compartment in the bookshelf.



Waiswa ordered a bookshelf with 1 compartment, Ami ordered a bookshelf with 2 compartments, Kidha ordered a bookshelf with 3 compartments and Moesha ordered a bookshelf with 4 compartments.

Task:

- a) Complete the table to show the number of nails that Mbeiza used to make each of the four bookshelves.

Number of compartments	1	2	3	4
Number of nails				

- b) Mbeiza realised a pattern in the number of nails she used to make the bookshelves with 1, 2, 3 and 4 compartments.
- (i) Write two numbers to complete this algebraic expression to show the number of nails (y) that Mbeiza needs to make a bookshelf with p compartments.
- $$\underline{\quad} + p(\underline{\quad}) = y$$

- (ii) What does the first number in the algebraic expression represent?
- (iii) What does the second number in the algebraic expression represent?
- c) Mbeiza received a new order, for 4 bookshelves with 6 compartments. She has to buy nails. Nails are sold in kilograms. In a kilogram there are 32 nails. Each kilogram costs UGX 5,000. Determine how much Mbeiza paid for the nails for the new order.

❖ Data collection and presentation
❖ Graphs
❖ Set theory
❖ Data collection and display
❖ Matrices
❖ Probability

Item 19:

The Director of studies of a certain school needs to improve the performance of the Physics department of his school. He can either add another teacher, buy more books, or both. He has decided that he will do both if the average performance for this year's performance for the 40 students is lower than that of the previous year which was 50. He then instructs the Physics department to give an assessment test. These were the student's marks.

60	62	30	50	48	65	44	48	54	45
51	30	28	24	45	40	40	71	70	48
50	25	55	25	32	61	60	63	45	30
38	35	50	48	50	28	65	45	48	30

He also visited the library and found out that the previous year's candidates had used three books for their revision, and these were Fielder (F), Broom Brock (B) or Vermont (V). From the librarian's records it is clear that all the candidates who did not use any of the books failed the subject greatly. Out of the **35** candidates this year **13** used F, **20** used B and **17** used V. **9** used F and V, **3** used F and B while **8** used B and V only. The records show that an unknown number of candidates used

all the three books. He observed that he should replace one book type of the three with Lion Hunt publisher since no student read it only alone.

Task:

- (a) (i) Help the Director of studies group the marks to make an informed decision on the fate of the department and defend it.
(ii) Display the students marks in groups on a simple statistics diagram.
- (b) (i) Help the head teacher identify the book he should replace and explain why?
(ii) Find the probability that a student selected from the class failed.
- (c) If the Director of studies intends to purchase more books to be used in the school library; He uses two stationery shops A and B and intends to purchase as shown below;

Option 1 : 3 copies of Fielder publishers, 12 of Broom Brock publishers and 15 of Lion Hunt publishers

Option 2 : 10 copies of Fielder publishers, 5 of Broom Brock publishers and 20 of Lion Hunt publishers.

He discovers that at shop A each copy of Fielder, Broom Brock and Lion Hunt would cost Shs. 20,000, Shs. 22,000 and Shs. 15000 respectively. And at shop B Lion Hunt would cost Shs. 20000, Fielder costs Shs 18000 and Broom Brock would cost Shs. 17000.

Given that the school has only Shs. 550000 to spend, use your knowledge of matrices to advise your school Director of studies on the right shop to purchase from, and the quantities to be purchased.

✓ **Item 20 :**

The caterer of a school located in Makai division -Kana city is required to buy food stuffs for a school party. The foodstuffs to be bought include: 100 kg of rice, 150kg of meat and 200kg of Irish potatoes. The cost is UGX 3500, UGX15,000, and UGX1500 per kg of rice, meat and Irish potatoes respectively in Maaro farmers' market. The same items cost UGX. 3000, UGX. 12,000 and UGX. 1,100 per kg of rice, meat and Irish potatoes respectively, in Kaleewa farmers' market. To hire a pick-up from Maaro farmers' market to school costs UGX 60,000 while a pick-up hire from Kaleewa farmers' market is UGX95,000.

Task:

- (a) What would be the easiest way to display the information provided above?
- (b) Using the information provided above, how would the caterer decide on where to do the shopping from? Justify your answer.

Item 21:

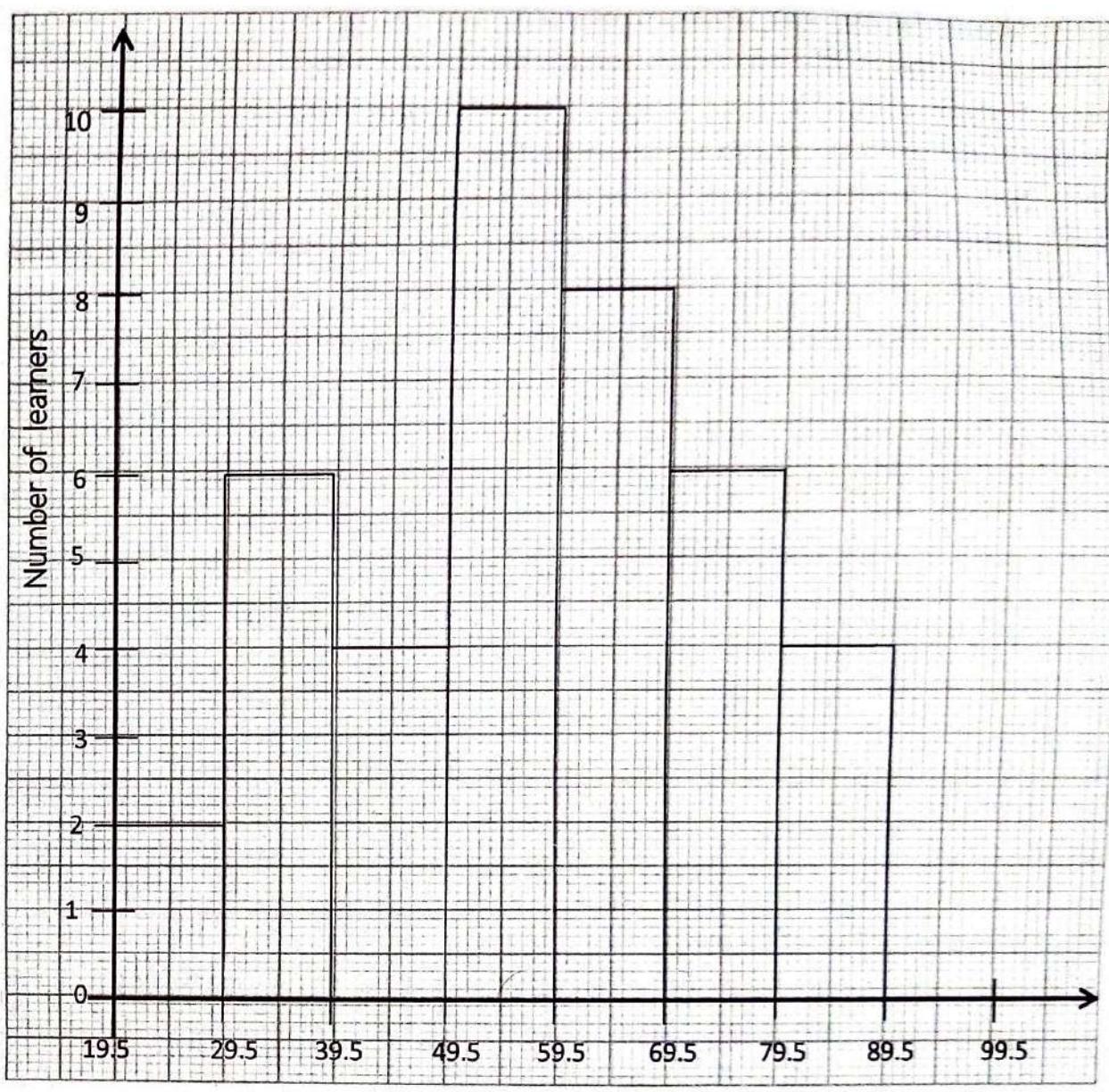
In order to improve on the livelihood among the community, the government has embarked on distribution of improved seeds to boost the yield of agricultural product in a certain **sub-county** which has 4 wards. The wards are W, X, Y and Z. Basing on the size of land in each ward, for every 100 packets of seed, ward **W** gets 40 packets, ward **X** gets 10 packets, ward **Y** gets 30 packets and ward **Z** gets 20 packets. The government has procured 45,000 packets which are to be shared equitably according to the community.

Task:

- a) By using a statistical graph, help the local leaders to distribute these seeds to the community in wards.
- b) Basing on your observation, how best would you advise the government in terms of distribution.

Item 22:

A certain mathematics teacher assessed his learners in some learning areas to really discover whether his learner were achieving the learning outcomes. In his analysis, he decided to present the results graphically as shown below.



Class boundaries

Task: Help your teacher to ;

- (a) determine the;
 - (i) number of learners
 - (ii) dominant class
 - (iii) Class width

- (b) Use the graphical representation above, to construct a table and hence find the
 - i. average mark

- ii. peak mark
 - iii. middle class.
- (c) Construct a curving graph for the given data and use it to
- i. estimate the central value and semi-interquartile range
 - ii. If a learner has to achieve an identifier of 2.4 in order to be considered to have achieved the learning outcomes, and that the teacher is set to re do the learning areas if at least 60 % of his class scores below the indicated identifier, otherwise, he proceeds to another learning area by analyzing the graph, draw a suitable conclusion on what should be done
- (d) Candidates in a Mathematics (456) examination are required to answer 10 questions from section A and 5 questions from section B for full marks. Five candidates A, B, C, D, and E answered questions as follows.

Candidate	Section A	Section B
P	05	04
Q	07	03
R	04	04
S	09	04
T	08	02

The mark awarded are 4 for each question of section A and 12 for each question of section B.

Write down a:

- i. 5×2 matrix for questions answered
- ii. 2×1 matrix for marks awarded
- iii. Determine the mark for each candidate scored in the Mathematics (456) examination.

Item 23:

Research was made in a certain school to discover the number of science teachers who teach Physics(P), Chemistry(C), and Mathematics(M). The research findings summarized that; $n(P)=13$, $n(M)=16$, $n(\Sigma)=25$, $n(C)=15$,

$$n(P \cap C)=9, n(P \cap M \cap C^I)=3, n(M \cap C)=11, n(M \cap C \cap P^I)=3n(M \cap C^I \cap P^I).$$

Task: As a mathematics learner, help your head teacher understand all about the research made by;

- (a) Showing the given information on a Venn diagram and using it to find the number of teachers who teach;
 - (i) All the three subjects

- (ii) None of the subjects
- (b) Given that a teacher is picked at random, what is the probability that he/she teaches at least one subject?

PART II

THEME 4 : GEOMETRY AND MEASUREMENTS

➤ Geometrical construction
➤ Bearings
➤ General and angle properties of geometric figures
➤ Reflection
➤ Business arithmetic
➤ Time and tables
➤ Similarities and enlargement
➤ Circle
➤ Rotation
➤ Length and area properties of two dimensional geometrical figures
➤ Nets, areas and volumes of solids
➤ Trigonometry 1 and 2
➤ Vectors
➤ Business mathematics
➤ Matrix transformation
➤ Circle properties
➤ Lines and planes in three dimensions

Item 24 :

Maria is a landscape designer who wants to create a triangular-shaped garden bed in a park. She wants to inscribe a circle within the triangle and plant a tree at the center of the circle. The park authorities have given her a rectangular plot of land with dimensions 15 meters by 20 meters. Maria wants to use the entire plot to create the triangular garden bed.

Task:

- (a) Construct a triangle using the entire rectangular plot (15m x 20m) as the

base and height.

- (b) Inscribe a circle within the triangle, touching all three sides and determine the radius of the inscribed circle.
- (c) Find the distance from the center of the circle (where the tree will be planted) to each vertex of the triangle.

Item 25:

Recently, Mr. Elau discovered that he needed to keep track of all expenses on utilities at his home. He normally pays for water, electricity, Netflix, and Garbage collection. He asks UMEME to send him a voucher showing his electricity bill for the months of December 2023 to May 2024. The table below shows Mr. Elau's electricity bill sent as required.

Meter readings		End of Month	Units	Charges (Shs.)	
Previous	Present			Due	Credited
Bal. B/F		December 2023		16998.25	12403.25
60057	60722	January 2024	665	5320.00 532.00	5000.00
60722	62885	May 2024	2163	17304.00 1730.40	19500.00

- CTL - Commercial Transactions Levy
- B/F - Balance carried forward

Task:

Upon receiving the bill, Mr. Elau fails to understand it, and asks you to help him

(a) find

- (i) the total amount due at the beginning of June 2024
 - (ii) the percentage used to compute the CTL
 - (iii) his average monthly consumption of power in terms of units of electricity using the months of January, February, March, April and May.
- (b) Represent this consumption in terms of money payable, including the CTL.

Item 26:

You have a cylindrical tank whose capacity is 30000m^3 at your home. During holidays, your father decides to paint the tank since its colour has faded due to the effects of weather. It is also known that the diameter of the tank is 10% smaller than its height, and that the outer surface (top and curved surface) should be painted.

Your father sends you to a nearby hardware shop to purchase the tins of paint required. You discover that every 5litres tin of paint costs Shs. 40,000 and can paint 60m^2 of the surface.

Task:

As a mathematician, advise your father on the cost of paint needed for the repair of the tank.

Item 27:

One night, two prisoners escaped from the prison cell while the ground night guards were asleep. A guard at the top of the tower of height 78m saw the two prisoners approaching the exit gate due East of him. The angles of depression of the prisoners are 12° and 19° . He quickly picked his phone to call and alert the guards at the exit gate to be on standby. The prisoners were running at a distance from each other and the prisoner ahead was about 20m away from the exit gate. The guards at the exit gate were alerted that in 2 minutes, one prisoner would be reaching the exit gate. They wanted to know in how many minutes the second prisoner would arrive so that they take cover.

Assuming both running at the same speed.

Task:

You are one of the guards. Help the other guards to ascertain the

- (a) distance between the prisoners
- (b) how many minutes it took the second prisoner to reach the exit gate.

Item 28:

Sarah bought a 4-inch mattress. She then went to John, a tailor, to buy a cloth for a cover to fit the mattress exactly. John sold her 4.6m^2 of a cloth which he advised was exactly enough to cover the mattress quickly. John noted that the length of the cloth was twice its width, and that one inch was approximately 2.5m. Sarah paid for the mattress and cover cloth in Uganda Shillings, where the mattress cost Shs. 252500, and the cloth cover cost Shs. 36500.

Being a business woman, Sarah decided to sell the mattress by setting two options, where the cash price of a mattress is Shs. **350,000**, while Its hire purchase price is **12%** higher than the cash price. A buyer pays **10** monthly installments of **shs. 24,000** each after paying a deposit.

Task:

Supposing you are a business analyst, help Sarah to;

- a) determine the actual dimensions of the cloth.
- b) Calculate in pound sterling
 - (i) The price of the mattress
 - (ii) the total cost of the mattress and its cover,
(1US dollar is equivalent to Shs. 3500, and that 1-pound sterling = 1.8 US dollar)
- c) (i) the amount paid as a deposit by a certain customer who decides to buy the mattress by hire purchase rather than cash,
(ii) the savings the customer would make had he bought the mattress with cash rather than on installments
(iii) Sarah's percentage profit if the mattress is bought through hire purchase.

Item 29:

Your neighbor wants to sell a tree in his compound to a furniture making factory owner, who negotiates prices depending on the tree's height. For every 10m of the desired tree, the factory owner pays Shs. 50,000.

Being that the tree is very tall, your neighbor cannot easily ascertain its height so that he can determine how much he will earn when he accepts to sell it.

From the top of his house, the angle of elevation of the tree top is 34° and the angle of depression of its foot is 62° . The tree is found to be 250m from the base of his house.

Task:

As a mathematician,

- a) come up with a diagram that will help to determine the height of the tree.
- b) help your neighbor to know the height of the tree by calculation.
- c) Determine how much your neighbor should expect from the factory owner.

Item 30:

Mr. Walakira owns a construction company. He has been contracted to drain a swamp and have it prepared for rice planting project. He discovers that the swamp containing 4158m^3 of water can easily be drained by a pump.

The pump is to be connected to a cylindrical pipe of diameter 7 cm, and can be operated for 8 hours per day. The rate at which the water flows out of the pipe is 1.5 metres per second.

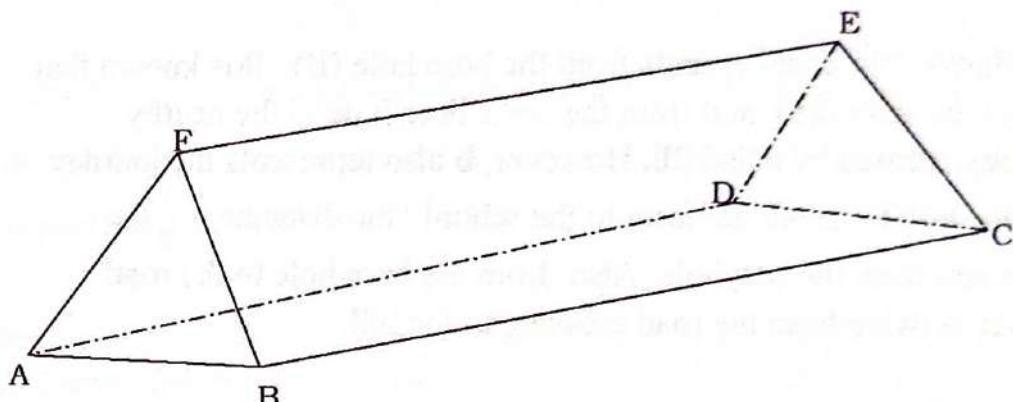
Given that the cost of hiring the pump is Shs. 12000 per day excluding the cost of diesel. The pump can consume 10 litres of diesel per hour, and the cost of diesel is Shs. 4700 per litre.

Task: Mr. Walakira has hired you as a mathematician to help him determine the following

- the number of days it takes to drain the swamp
- the total cost of draining the swamp.

Item 31:

The structure of the roof for the new dormitory at your school is as shown below.

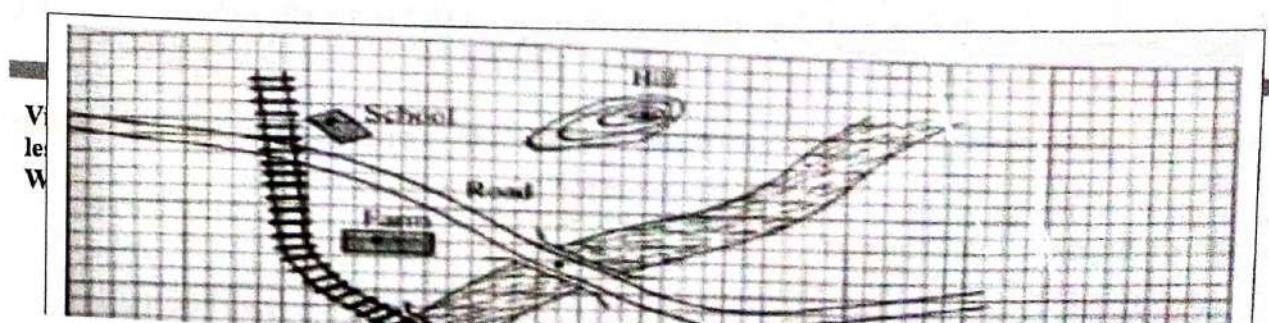


Given that the dimensions $AB = 5\text{m}$, $\overline{AF} = \overline{BF} = 3\text{m}$ and $\overline{BC} = 12.5\text{m}$.

Task: You have been task to help determine to one decimal place the;

- total surface area of the roof.
- volume occupied by the roof.
- angle between the planes BCEF and ABCD
- Basing on your calculations, what advice would you give the builders of the roof.

Item 32:



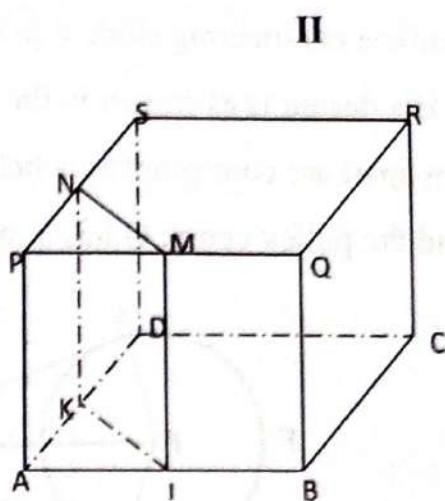
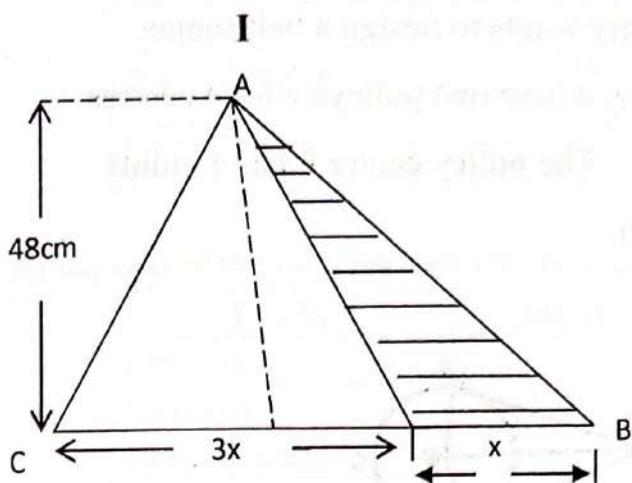
The picture above shows your usual errands from the bore hole (B). It is known that from the bore hole to the school(S), and from the same bore hole to the nearby hospital(H) can be represented by \mathbf{a} and $2\mathbf{b}$. However, \mathbf{b} also represents the journey from the school to the hill(T). From the farm to the school , the distance is $\frac{1}{3}$ the journey along that route from the borehole. Also, from the bore hole to the road crossing (R) the river is twice from the road crossing to the hill.

Task:

- a) using your knowledge of vectors, draw a mathematical diagram from the picture and description given to you.
- b) In terms of \mathbf{a} and \mathbf{b} , how would you present:
 - i. \mathbf{BT}
 - ii. \mathbf{TR}
 - iii. \mathbf{SR}
 - iv. \mathbf{SH}
- c) “S, R and H are such that they are all in a straight line”, using vectors show that the statement is true.
- d) Given that $\mathbf{a} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 11 \\ 10 \end{pmatrix}$ and that $\rho\mathbf{a} + \sigma\mathbf{b} = \mathbf{c}$, find the scalars ρ and σ hence determine $|\sigma\mathbf{a} - \rho\mathbf{b}|$

Item 33:

Your family intends to start up a poultry farm. Structure I below shows part of a roof for a chicken house. It is noted that the area of shape ABC is 1440cm^2 .



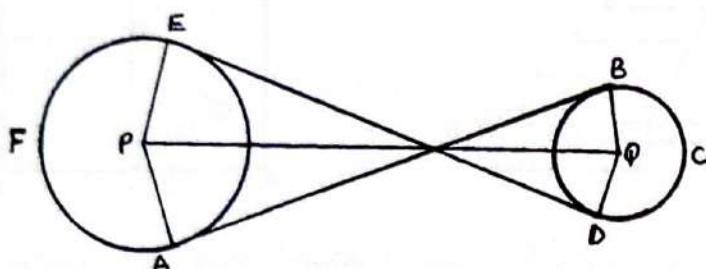
Structure **II** shows a cuboidal shape of the building with sides $AP = 10 \text{ cm}$, $AB = 20 \text{ cm}$ and $BC = 8 \text{ cm}$. The points K, L, M and N are the midpoints of AD, AB, PQ and PS respectively.

Task:

- Determine the
 - area of the painted region in structure **I**.
 - A standard corrugated iron sheet is to be used to shelter the shaded region. If the iron sheet covers approximately 51.4 cm^2 . determine how many iron sheets are needed, and work out the amount required if each iron sheet costs shs. 45000.
- In Building structure **II**, determine the length $|KL|$
- What is the angle between the faces?
 - $ABQP$ and the plane $KLMN$.
 - BDR and the base $ABCD$
- If Point O is the point of intersection of the diagonals AC and BD . Find $|RO|$.

ITEM 34:

A mechanical engineering student in one university wants to design a belt runner system. His design is as shown in the figure below where two pulleys whose centres are 30cm apart are connected by a belt ABCDEF. The pulley centre P has a radius 13cm and the pulley centre Q has a radius of 4cm.



Task: Suppose you are interested in discovering more about the design, by carrying out some calculations, work out the;

- (a) length AB
- (b) reflex angles EPA and BQD.
- (c) arc length AFE and BCD.
- (d) total length of the belt.

Item 35:

During inter- house Games & Sports competition, a trader brought the following items to sell to parents and learners in a tent.

ITEM	UNIT AMOUNT (Shs.)
Samosa	500
Cassava	200
Bottled water	1000
Chapatti	1000
G.nuts	500

The trader stocks as follows and wants his capital back in one day plus some profits in queue to raise fees for his son.

ITEM	UNIT COST (Shs.)	Quantity
Samosa	1000	1700

Cassava	900	900
Bottled water	2000	2000
chapatti	700	700
G.nuts	500	500

At the end of the day, the sales records are as follows;

ITEM	Quantity sold (Shs.)
Samosa	1312
Cassava	900
Bottled water	1349
chapatti	528
G.nuts	500

In the evening, the trader wants to know if he made a loss or profit but he is not good at mathematics.

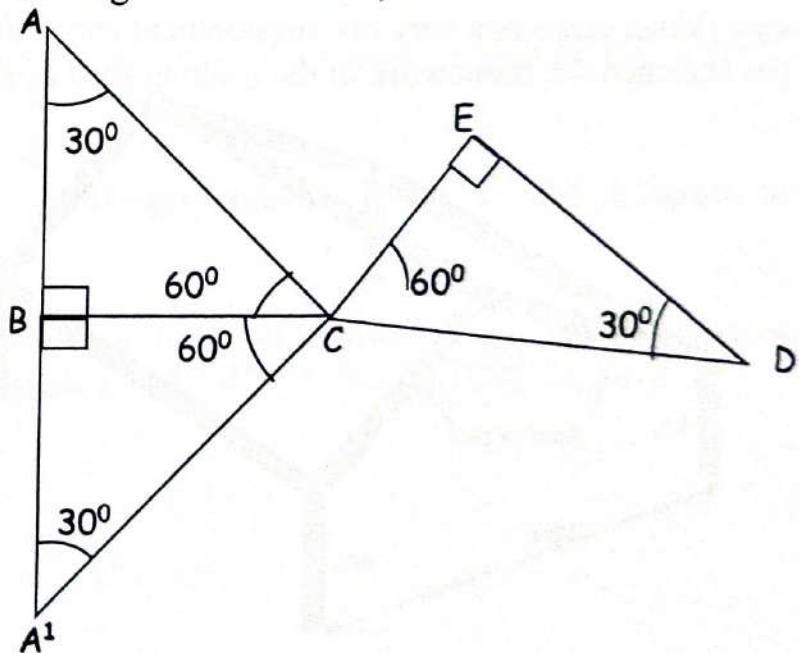
Task:

Help the trader to calculate the;

- profit or loss for each item
- Total profit or loss for the day's sales, hence express the total profit or total loss of the day's capital as a percentage.

Item 36:

Below is triangle ABC whose interior angles are 30° , 90° and 60° respectively. Triangle DEC is congruent to triangle ABC. Point B, C and D lie on the same line.



Task:

- (a) Which point would help you be able to map triangle ABC onto triangle DEC?
- (b) What special geometrical name is given to that point identified in (a)
- (c) How many degrees does triangle ABC have to undergo in order to fit onto triangle DEC?
- (d) Describe the transformation that would completely map triangle ABC onto triangle DEC.
- (e) What geometrical name would you use to describe line BC in relation to triangles ABC and A'BC?
- (f) Describe fully the transformation that maps ABC onto A'BC.

Item 37:

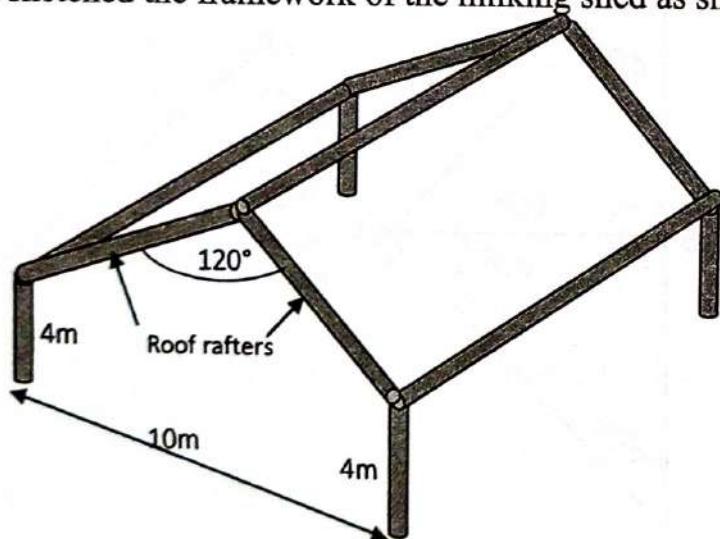
A regular pyramid with a square base, has a circle inscribed on the base of the pyramid. The edges of the square base of the pyramid are tangent to the circle. If the radius of the circle is 5cm, and each of the slant edges of the pyramid is 13cm;

Task: As a mathematician,

- (a) Sketch a diagram represented by the information provided.
- (b) Work out the height of the pyramid.
- (c) determine the volume of the pyramid.
- (d) Find the area of the part not covered by the circle on the base of the pyramid.

Item 38:

Labong a small-scale farmer stays in a very hot environment and wants to build a shed for his cows. He has sketched the framework of the milking shed as shown below.



Given that the walls are 10 metres apart and the top of the roof is halfway

between the walls. The sloping roof rafters meet at an angle of 120° .

Task:

- (a) construct a scale drawing of the cross-section of the milking shed.
- (b) What scale have you used?
- (c) What is the length of the roof rafter?
- (d) What is the angle of inclination of the roof?
- (e) Sketch the same roof if the angle of inclination is more than what you obtained in (d) without changing the dimensions of the milking shed.

Item 39:

An insect walking on a piece of graph paper catches Musa's attention. He notices that it moves from coordinates A (2,0) to B (6,0) to C (6,4) and then to D (2,4). The polygon so formed from the insect's path is reflected in the mirror

$y = -x$, to form the path image $A'B'C'D'$. Musa enjoys this outcome, and thus decides to rotate $A'B'C'D'$ through $+90^\circ$ about the origin to attain the final image $A''B''C''D''$.

Task: As a mathematics learner,

- (a) Write down the matrices that would represent the:-
 - (i) reflection
 - (ii) rotation
- (b) Using your knowledge of matrices, determine the coordinates of:
 - (i) $A'B'C'D'$
 - (ii) $A''B''C''D''$
- (c) Draw a graphical representation of $ABCD$ and its images on the same graph.
- (d) determine a single matrix of transformation which would directly make $ABCD$ appear as $A''B''C''D''$ and describe it fully.

Item 40:

Mukasa leaves town B at 1.06pm for village A riding non stop at a steady speed of 15kmh^{-1} and arrives in village A at 3.06 pm. Okot leaves village A at noon for town B. From town A Okot rides at a steady speed of 20km for 45 minutes. He then rests for 30 minutes and then continues with a steady speed of 15km/hr and reaches town B at 2.15 pm.

Task: You are tasked to analyse their journeys

- Represent Mukasa and Okot's motion on a distance time graph. (Use a scale of 1cm: 15minutes on the X-axis, 2cm: 5km on the y-axis)
- Use your graph to determine when the two cyclists passed each other and how far from B they were at this time.
- How far apart were the two cyclists at 2:00 pm?

Item 41.

A school was to buy a truck at a cost of sh180 million. The head teacher decided to go in for a 4 years' loan from a bank at an interest of 24% per annum, simple interest. The loan processing fee was 2% of the loan. The loan was to be paid termly of equal installments.

Task: As a mathematician, you are required to determine;

- the interest to be paid in 4 years
- the total amount to be paid on completion of the loan
- amount to be paid termly
- the percentage extra cost incurred by going in for a loan to buy the bus.

BONUS ITEMS:**✓ Item 41.**

Lubinga owns a taxi business, and mainly transport passengers from Kampala to Mukono and vice versa depending on where he is. One morning, he set off from Mukono on a bearing of 060° at a steady speed of 200 Km/hr for $1\frac{1}{2}$ hrs to Kampala. Since there was traffic jam, he decided to change the course and travelled to Luzira on a bearing of 155° at an average speed of 720 Km/hr for 40 minutes;

Task: By using a scale of 1 cm to represent 50 km; draw an accurate diagram to show routes of the taxi,

- From your diagram, find the;

- (i) distance between Mukono and Luzira
- (ii) bearing of Luzira from Mukono
- (iii) time it will take to travel from Luzira to Mukono using the direct route at an average speed of 250 km/hr.

Item 42:

Ms. Aisha, an employee of Crown beverages earns a gross annual income of Shs. 8.4 million and the company offers a family allowance of only three children and the monthly allowances are spelt as follows;

- Medicine Shs. 30,000 per month
- Electricity Shs. 360,000 per annum
- Marriage is $\frac{1}{20^{th}}$ of the monthly gross income
- Rent Shs 120,000
- Insurance $\frac{1}{100^{th}}$ of the gross annual income
- Un married Shs. 10,000

Given that a child under 12 years of age is given shs.8,000, a child between fourteen and twenty inclusive is given Shs. 5,000, a child above 20 years but not exceeding 25 years is given Shs 4,000. Ms. Aisha is married with five children of whom three are aged less 10 years and others aged 14 and 26 respectively. The table below show the taxable income ranges with their respective rates (%);

Taxable income (Shs)	Rate
30,001 – 80,000	5
80,001 – 120,000	10.5
120,001 – 245,000	15.6
245,001 – 370,000	26.5
370,001 – 480,000	34.6
480,001 – 640,000	48.4
Above 640,000	45.5

Task:

You are the company accountant, how best would you determine

- a) the taxable income and income tax paid by Aisha during the month of August.
- b) the percentage of tax paid as his taxable income

- c) the actual amount of money Ms. Aisha goes with.
- d) Suppose Ms. Amina decides to purchase a Bluetooth player which depreciates at a rate of 20 % per annum. Three years later, she decided to sell it at a discount of 30% of the original cash price. If its valued at Shs. 80,000 after 3 years, how much did she get after three years.

Item 43

In a certain game, a player can only go to the next level after satisfying the current level. In this, the player is presented with three inverted cards each having a number 5,3, and 2 drawn and used to form a three digit number without repeating a digit. When the number formed is more than 400, the player goes to the next level in which he is presented with a box containing 6 Red and 5 Blue identical marbles. He is required to pick a marble randomly, note its colour, and pick a second marble without replacement.

In order to go to the third level, the player must have picked marbles of the same colour. Given that on the third level he is presented with a coin and a die, he is required to toss the coin and throw a die. the final win only comes when a head shows and a prime number is obtained.

Task: You are tasked to compute the following accurately.

- a) determine the probability of going to level 2 of the game
- b) What would be the probability of ;
 - (i) proceeding to the final level
 - (ii) obtaining marbles with different colours on level 2.
 - (iii) obtaining the second marble Red.
- c) determine the chance of one player
 - (i) winning the entire competition
 - (ii) losing at level 2

ITEM 44

You are a heavy sleeper and without the aid of an alarm clock, you never wake up before 7:30 am. The probability then that you arrive punctually at school is $\frac{1}{5}$. If the alarm clock has been set the previous night, it rings at 7am, which gives you ample time, but the probability that it wakes you up is only $\frac{4}{5}$. You are also forgetful, and the probability that you remember to set the alarm is $\frac{1}{3}$.

Task: Calculate the probability that on any one morning,

- a) you are awakened at 7am by the alarm clock
- b) you forgot to set the alarm clock, but reached school punctually
- c) you set the alarm, it fails to wake you up, yet you reach school punctually you are late for school.

ITEM 45

In one of the practical assessment scheduled to begin shortly, the laboratory attendant discovered that there are some chemical reagents missing, yet very crucial for the smooth running of the examination. The examination cannot start unless these reagents are available. Musiime is sent to quickly go and get them from a certain supplier in town Q. Musiime cycles as he leaves the school P, and takes 2 hours to reach town Q, 10km away. At Q, he rests for 30minutes and later returns to school P at a steady speed of 8 kmh^{-1} . When Musiime delays, Mwesigwa who happens to be at Q, is given a phone call to help pick the reagents and deliver them quickly. Mwesigwa leaves town Q at the same time as Musiime, towards town P, travelling at $2\frac{1}{2}\text{ kmh}^{-1}$ but midway in his journey, Mwesigwa discovers that he had been given a package containing apparatus for a different subject. He thus decides to return back the package to the supplier. He returns back to Q at a steady speed of 4 kmh^{-1} .

Task:

Using a scale of 1cm to represent 15 minutes on the horizontal and 1cm to represent 0.5km on the vertical axes respectively,

- a) draw distance - time graphs to represent the two different journeys of the men.
- b) how far from town Q did the two men by pass each other on the return journey?
- c) determine Mwesigwa's average speed for the whole journey if he travels nonstop.

END.

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871

1870-1871



- ★ Download shule.tv App
- ★ Watch Videos of Primary & Secondary in different subjects & topics
- ★ Watch from anywhere around the world
- ★ Study using your phone, laptop, ipad, computer etc
- ★ Learn ahead of others

WhatsApp: 0773241666

Call: 0705655497 / 0759271390

Email: elearningproject45@gmail.com