Item	Element of Construct	Topics
Item one	Numbers	1. Number bases 2. Working with Integers 3. Rectangular Cartesian Coordinates in 2-Di-mensions 4. Fractions,percentages and decimals 5. Numerical concepts 1 and 2 (a) Indices (b) Surds 6. Ratios and Proportions
Item two	Patterns and Algebra	1. Sequence and patterns 2. Equation of lines and curves 3. Algebra 1 and 2 4. Mappings and relations 5. Vectors and translation 6. Inequalities and regions 7. Equation of a straight line 8. Simultaneous equations 9. Quadratic equations 10. Composite functions 11. Equations and inequalities 12. Linear programming 13. Loci
Item three and four	Data and Probability	1. Data collection/display and presentation 2. Graphs 3. Set theory 4. Matrices 5. Probability
Item ve and six	Geometry and Measures	1. Geometric Constructions Skills 2. Bearings 3. General and angle properties of geometric gures 4. Re ection 5. Business mathematics 6. Time and time tables 7. Similarities and enlargement 8. Circles 9. Rotation 10. Length and area properties of two-dimensional geometrical gures. 11. Nets, areas and volumes of solids 12. Trigonometry 13. Vectors 14. Matrix transformations 15. Circle properties

		16. Lines and planes in three dimensions

Item	Area of construct	Topics covered
SECTION A: compulsory		
Item one	**Numbers** Learner appreciates and uses computationalskills to solve problems in real- life situations.	✓ Number bases
		✓ Working with integers
		✓ Fractions, percentages and decimals
		✓ Numerical concepts 1 and 2
		✓ Ratios and proportions
Item Two	**Patterns and algebra** Learner appreciates and uses analysis to solve problems in real-life situations	✓ Sequences and patterns
		✓ Equations of lines 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
SECTION B		
PART I (choose one question)		
Items 3 and 4	**DATA AND PROBABILITY**	✓ Data collection and presentation
		✓ Graphs
		✓ Set theory
		✓ Data collection and display

	Learner appreciates and uses logical reasoning to solve problems in real-life situations	✓ Matrices
		✓ Probability
PART II (choose one question)		
Items 5 and 6	**GEOMETRY AND MEASURES**	✓ Geometric construction skills
		✓ Bearings
		✓ General and angle properties of geometric figures
		✓ Reflection
		✓ Business arithmetic
		✓ Time and time tables
	Learner appreciates and uses spatial reasoning to solve real-life situations	✓ Similarities and enlargement
		✓ Circles
		✓ 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

SECTION A

(Numbers, Patterns and Algebra)

ITEM 1

The new farm manager who started work at Sugar Corporation of Uganda Limited's Lugazi farm on Monday was unable to access the farm store, which held critical records, due to password–protected locks. He reached out to the farm owner, who replied with a message revealing that the password was a two-digit base eleven numeral. The pin had the characteristic that the total of its digits equaled 17, with the first digit being 4 greater than the second.

He gained entry to the store and obtained access to the records, revealing that the farm had a sizable amount of land available for crop cultivation. He intended to allocate 14% of the land for corn, 30% for wheat, and the remainder for soya beans, with a specific focus on planting corn on 42 – acres. Meanwhile, he discovered that his 12 farm workers could cultivate 15 acres every 4 days.

TASK

a) Educate the new manager on the pin‟s decimal representation.
b) Ascertain the farm‟s total land area and the remaining acres suitable for soybean growth.
c) Help the farm manager understand how long it will take workers to get the land ready for planting.

ITEM 2

At the beginning of term two, Kumasi secondary school's administration faced a pressing issue: - a shortage of dormitory space for students. To address this sleeping accommodation deficit, the school's management developed a plan to construct new hostels with a rectangular design, where the length is $\sqrt{3}$ times the width, resulting in a perimeter of $(14+6\sqrt{3})$ units. To fund this project, the administration required a 97% collection rate of school fees from students

By the end of the first week of the term, two-thirds of the student body had settled their fees. In the subsequent week, an additional 100 students paid their fees, resulting in a significant increase in the proportion of students who had paid their fees, reaching three-quarters of the total student population.

TASK

a) Guide the school management to ascertain the land area, ensuring a surd form solution with rationalized numerals and simplified radicals.
b) Ascertain the precise number of students in the school.
c) Guide the school administration on whether the construction can be undertaken, withsupporting reasons.

ITEM 3

Mr. Alex, a seasoned bus driver at the New Taxi Park, was hired to transport 377 students for a field trip from Mukono to Entebbe. When the geography teacher inquired about the best route, Mr. Alex expertly outlined two alternative routes, ensuring a smooth and informed journey from Mukono to Entebbe. The shorter route takes 2 hours and 26 minutes to complete, with the driver maintaining an average speed of 54km/h for the first **x** kilometers and 37.5km/h for the last **y** kilometers. The longer route, which is 5km longer than the shorter route, takes the driver 2 hours and 12 minutes to complete at an average speed of 60km/h. The driver also charges a fare of Shs 1000 per student per kilometer.

TASK

a) Create two mathematical models involving **x** and **y** which can be used to help in the analysisof the two routes.
b) Help Mr. Alex by revealing the hidden values of x and y from the equations in (a) above.
c) Guide the geography teacher on the best route, highlighting the benefits of your proposedoption.

ITEM 4

Garden City Shopping Mall in Kampala is experiencing a massive turnout of customers, leading to acritical shortage of parking spaces. To address this challenge, the mall's management has planned aninnovative solution: - a triangular rooftop parking design, exclusively designed for compact cars, each spanning an area of 0.2 square units, to cater for the growing demand of space. The parking area is bounded by the following constraints; $x + y < 3$, $x - y + 3 \geq 0$, and $y + 1 \geq 0$. To capitalize on the high demand for parking, the mall plans to impose a parking fee of Shs 2500 per vehicle, with calculations indicating that on peak days, the cars will occupy a total area of 12.4 square units, yielding a significant income source.

TASK

a) (i) Create a graphical representation on paper to help Garden City management accuratelyvisualize and understand the layout and boundaries of the new parking design.
(ii) Assist the management in identifying the accurate coordinates and size of the new parkingarea in square units.

Will the new design accommodate the expected maximum number of vehicles? If so, determine the maximum number of cars that can be accommodated in the new parkingarea at full capacity.

b) Forecast the mall‟s daily highest revenue on a peak day.

ITEM 5

Following the passing away of your cousin's father, the family convened a month later to settle his estate and read his will, to which you were invited. However, a surprise revelation emerged when the youngest child revealed a mysterious envelope left by their father, containing a secretive message. The envelope contained a piece of paper with the number 31, which needed to be converted to a ternary numeral system (**base three**) to unlock the secret code to gain access to his office strongbox. But, to their dismay, **none** of the family members recalled how to perform the conversion, and they turned toyou for assistance. the secret code to gain access to his office strongbox.

Upon opening the safe, they discovered a staggering **349 million** shillings and **a will** outlining the distribution of the wealth. The will stipulated that the wife was to receive 40% of the total, the eldest son was to receive one-third of the remaining amount, and the two younger children were to share the balance in a 2:3 ratio according to their birth order. To ensure a fair and impartial distribution, your expertise was sought once again to calculate the exact share for each beneficiary, preventing any potential disputes or biases.

TASK;

a) Show how you helped your cousins unlock the safe, showing each step clearly
b) Show, with step-by-step calculations, how you helped the family allocate the funds among its members, and share your thoughts on the distribution's fairness.

ITEM 6

The Uganda Women's Finance and Credit Trust has arranged a group outing for its members, using two vehicles; a bus and a van. with 171 participants having paid the required fees, a total of UGX 400,000 has been allocated for transportation costs. Your sister, who is responsible for managing thetransportation, needs your mathematical expertise to optimize the vehicle hire strategy. She wants tominimize transportation costs while ensuring the van, which is faster and can carry 19 people at UGX 50,000 per trip, makes more trips than the bus, which can carry 57 people at UGX 80,000 per trip.

TASK;

(a) Express the information as mathematical statements

(b) Help your sister **minimize** transportation expenses by determining the number of trips eachvehicle should make, using the mathematical statements in (a) above.

ITEM 7

Molly started a wholesale business while still at her parent‟s home. Below is how she plans to useher net profits.

- 20% of the net profits to be re-invested in the business.

- Part of the balance is to be saved in her savings account and the rest is to be for her major personal expenses. This will be in the ratio of 1:3 respectively.

She plans to move out of her parent‟s house if the portion of her net profits that she plans to spendon her major personal expenses can cover all of them. Her major expected personal expenses are; house rent of about UGX.300,000, and groceries of about UGX. 200,000 and transport of about UGX. 100,000. The business made a net profit of one million five hundred thousand Uganda shillings in the first month.

She bought 36 bars of bathing soap and 18 packets of detergent that were all to be packed by her worker in such a way that each package contained the same number of both items. The packages were to be given to those who bought goods in plenty as gifts. All packages were given out beforeMolly got to know the highest number of packages that her worker was able to make out of the bought items.

TASK:

a) (i) How much of her net profit does she plan to re-invest in the business?
b) (ii) How much of her net profit does she plan to spend on personal expenses?
(ii) Will Molly move out of her parents' house? Justify your answer.
c) Help Molly to know the highest number of packages her worker was able to make out of theitems she bought.

ITEM 8:

James is starting a baking business, selling cakes and cookies. To estimate profits, he consulted a friend in the industry. The friend shared data from their own experience: Initial phase: 40 cakes, 30 cookies, total profit UGX 29,000; Later phase: 50 cakes, 20 cookies, total profit UGX 31,000.

James aims to start by producing at least 120 items (cakes and cookies combined). Since cakes sell more, he wants to make at most 80 cakes and at most 60 cookies. He needs to determine the optimal number of cakes and cookies to produce initially.

TASK;

a) What are the expected earnings from each cake and cookie, based on his friend's experience?
b) (i) What mathematical inequalities are making decision-making hard for James?
(ii) Use the inequalities to help him decide on the highest number of cakes and cookies he canstart with.

SECTION B: PART I (DATA AND PROBABILITY)

ITEM 9

To enhance the yields of Rice, Beans, Sugarcane, and Peas in Iganga district, the Ministry of Agriculture's Farmer Training and Capacity Building program conducted a survey, yielding the following findings; Among the 80 rice farmers surveyed, 45 also grow beans, 60 cultivate sugarcane, and 5 focus solely on peas and rice. Additionally, 5 farmers dedicate their land solely to rice. The number of farmers who grow beans, sugarcane, peas, and rice is equal to those who grow peas,

sugarcane, and rice. Moreover, the farmers who cultivate rice, and sugarcane only are equal in number to those who grow rice, peas, and beans, and are 5 fewer than those who grow all four crops.

The ministry plans to provide support to these farmers as follows:

- A farmer who cultivates all four crops (beans, sugarcane, peas, and rice) will receive a package consisting of 4 tractors and a cash grant of UGX 3,000,000.
- One who plants only three crops will receive 3 tractors and UGX 2,000,000.
- A farmer who grows two crops only will receive 2 tractors and UGX 1,500,000.
- For a single crop will receive 1 tractor and UGX 1,000,000.

This support aims to motivate farmers to diversify their crops and boost their productivity.

The ministry needs to calculate the total cost of **tractors** for farmers, based on the number of tractors needed for each group, with each tractor costing UGX 68,000,000.

TASK

a) Assist the ministry in determining:
   (i) The total number of farmers cultivating all four crops
   (ii) The number of farmers growing only three crops
   (iii) The chance of selecting a farmer who grows only two crops in Iganga district
   (iv) The likelihood of selecting a farmer who does not grow Peas
b) Set the total funding required for the ministry's farmer support initiative.

ITEM 10

To address concerns about battery durability, Uganda Batteries Limited (UBL), a trusted manufacturer since 1967, conducted a thorough test on a random sample of 50 batteries. Their experts carefully selected and examined these batteries, yielding the following results (rounded to the nearest minute):

423	369	387	411	393	394	405	369	372	410
371	377	389	409	392	408	409	396	431	391
431	401	363	391	405	382	396	381	438	422
400	381	399	415	428	422	397	399	401	398
396	372	410	419	386	390	362	373	391	402

The director has decided to withdraw batteries with a life equal to or less than the average lifespan of the tested samples and has directed the experts to manufacture only batteries that achieve at least 99 % of the median life of the 50 tested batteries.

TASK

a) (i) Organize the data into intervals of 10 using a statistical table and analyze the trends to recommend the most effective battery replacement strategy to the director
   (ii) Elaborate on the reasoning that led to your conclusion in a) i)
b) (i) Develop a graphical display to illustrate the data, allowing the director and their team toestimate the median, visualize and analyze the information
   (ii) Identify the target battery lifespan for manufacturing, as recommended by the director.
   (iii) Analyze the graph and explain the situation, backing your argument with data and logical reasoning.

c) Aid the manager in recognizing the chance of selecting a battery with a lifespan greater thanor equal to the median value.

ITEM 11

The recently concluded Uganda Secondary Schools Sports Association (USSSA) tournament was largely dominated by schools from the western region, prompting head teachers of participating schools to request detailed reports from their games‟ teachers on transportation and prize monies received during the football competition

The four schools that dominated include; Fort Porto SS, Tororo SS, Nyakasura HS, and Kyogera HS. Due to limited funds, the four schools decided to use two buses; Fort Portal ss and Tororo ss used the Tausi bus which charges UGX. 24,000 per Km while Kyogera HS and Nyakasura HS used Global coaches that charge UGX. 28,000 per Km.

On the tournament day, Tausi Bus embarked on its journey from Mbarara to Kampala at 4:30 a.m., cruising at a steady 80 Km/hr and arriving in Kampala at 9:00 a.m. Simultaneously, Global Bus set off from Sanga town, 50 Km from Mbarara, at 4:30 a.m. and traveled at a constant 50 Km/hr for 3 hours and 30 minutes before pausing for 30 minutes. It then resumed its journey at a steady 67.5 Km/hr until it reached Kampala, with the bus fare being equally distributed among the participating schools that used the bus.

Upon arrival in Kampala, the four schools competed in a two-round football tournament 1st

round

	Win	Draw	Loss
Fort Portal	1	3	2
Tororo	2	2	2
Nyakasura	3	2	1
Kyogera	0	2	4

2nd round

	Win	Draw	Loss
Fort Portal	1	2	3
Tororo	2	1	3
Nyakasura	2	3	1
Kyogera	1	4	1

The tournament followed a standard point system: three points for a victory, one point for a draw, and zero points for a defeat. Additionally, the four teams shared a prize pot of UGX 24,000,000, allocated proportionally to their points tally

TASK

a) (i) Assist the games teachers in plotting the buses' routes on a graph, enabling a more helpful evaluation of their journey.
(ii) Provide the games teachers with the information needed to determine each school's transportation expenditure.
(iii) Ascertain the first bus to arrive in Kampala and the time gap between its arrival and the subsequent bus.
b) Ascertain the winning and last teams and amount given to each team that participated in the tournament.

ITEM 12

The school administration aims to enhance the mathematical abilities of senior 3 students. Last year, the students achieved an average score of 64% by the end of term one, and this year's performance at the same stage is as follows;

30	47	26	86	64	87	49	25	26	43
38	52	44	45	56	59	76	46	27	89
57	89	73	90	48	58	51	88	32	56
62	68	52	66	67	69	49	95	92	66
74	36	32	54	39	35	69	92	50	71

The school administration is contemplating either adding **another teacher**, **buying more books,** or **both**. The school administration will **do both** if the average for this year‟s performance at the end of term one is lower than that of the previous year.

According to the library survey report, last year's students primarily utilized three mathematics textbooks: Longhorn (L), Baroque (B), and Active Mathematics (A). Notably, students who did not use any of these three textbooks struggled significantly in the subject, resulting in poor grades. This year, out of 35 students, the textbook usage breaks down as follows: 13 students used Longhorn, 20 used Baroque, and 17 used Active Mathematics. Additionally, 9 students used both Longhorn and Active Mathematics, 7 used both Longhorn and Baroque, and 8 used both Baroque and Active Mathematics. Notably, 5 students did not use any of the three textbooks;

The school administration has a budget to double the number of students who utilize all three textbooks.

TASK:

a) Provide a data-driven analysis to inform the school administration's decision on whether tohire an additional teacher, purchase more books, or implement both solutions.
b) (i) Guide the school administration on the number of books they can purchase, consistent withtheir initial budgetary framework.
(ii) Do you have any other recommendation to the school administration regarding the book purchase? Explain your reasoning.

ITEM 13.

A non-governmental organization aims to teach French, German, and English to lower primaryschool children in its community schools.

The organization intends to offer language instruction in French, German, and English to students in their schools. They plan to offer permanent positions to candidates who can teach all three languages, while those who can teach one or two languages will be hired on a contract basis. To fill these positions, they are soliciting applications from qualified teachers. Out of the applications received, 29 candidates can teach French, with 7 able to teach French only and 22 able to teach French plus one or both of the other languages. 27 candidates can teach German, with 9 able to teachGerman only and 18 able to teach German plus one or both of the other languages. 30 candidates canteach English, with 11 able to teach English only and 19 able to teach English plus one or both of theother languages. The organization will only consider candidates who are proficient in at least two languages for oral interviews. Your friend has been tasked with identifying the eligible candidates

and needs your assistance in analyzing the data to determine the number of candidates who meet thecriteria.

TASK

(a) Apply your mathematical expertise to help your friend know the number of candidateseligible for an oral interview.

(b) The organization has a program for teachers who can teach all three languages (French, German, and English). They'll be rotated among schools and paid more. What's the likelihood of a random applicant being in this program?

ITEM 14

In a certain town, there is a section of the road where many accidents occur and the residents believeit is due to over speeding so they have requested the authorities to build humps along that section, the chairperson of the roads committee has decided to do some research so a checkpoint has been putat that section to measure the speed of 50 vehicles passing that point. They will put humps if the research shows that the percentage of vehicles passing that point at a speed greater than the speed limit is greater than those who abide by the speed limit. The road sign shows a speed limit of 55km/hr for that section. The results for the 50 vehicles sampled are shown in the table below.

Speed(km/hr)	20-30	30- 40	40- 50	50- 60	60- 70	70- 80	80- 90	90- 100
Number of vehicles	5	8	7	9	6	5	4	6

TASK;

(a) Assist the chairperson in determining the average speed at which vehicles pass that point.

(b) Present a graphical analysis to guide the committee's choice of implementing traffic calming measures.

ITEM 15

The headteacher of a certain school wants to hold a meeting on one of the following days: Monday,Tuesday, or Wednesday. The purpose of the meeting is to communicate something important.

The headteacher wants to schedule the meeting in a way that the probability of some teachers (out of70) not attending the meeting is less than 0.5 (or 50%).

The following information shows which teachers attend school on Monday, Tuesday, and Wednesday and which teachers are absent:10 teachers come on Monday only.

Ten teachers attend school only on Tuesday, twelve teachers attend school only on Wednesday, eightteachers attend school on both Monday and Wednesday, and Seven teachers attend school on both Monday and Tuesday. Nine teachers attend school on both Tuesday and Wednesday. Three teachers attend school on all three days. Some teachers do not attend school on any of the three days

TASK:

a) Is it advisable for the headteacher to hold the meeting on any of the days he has chosen?Support your answer with a reason.
b) Which day would you recommend out of the three options, and what is the basis for your recommendation?

ITEM 16.

A sports organization is selecting team members to participate in marathon competitions from a group of 60 individuals. The selection process will occur in two phases. In Phase One, participants who complete the race within 137 minutes or less will qualify for Phase Two. Then, in Phase Two, those who finish within 122 minutes or less will be selected to participate in the actual competitions,which is the ultimate goal.

The following is a breakdown of the times achieved by the participants in Phase One;

Finish time (mins)	120 - 124	125 -129	130 -134	135 -139	140 -144
Number of people	15	14	13	11	7

TASK:

a) (i) How many participants advanced to Phase Two?
(ii) What is the likelihood that some of the qualifiers from Phase Two will go on to participate in the final competitions?
(iii) Based on the probability value, what is the likelihood of the organization finding suitable participants for the competitions from the group?

ITEM 17.

Maria, a surveyor, embarks on a journey from Mukono to a Kampala construction site to perform crucial soil testing, as the soil's sand content plays a critical role in ensuring foundation stability and preventing potential settlement or foundation failure due to excessive sand. Maria's journey begins with a 30 Km stretch on a bearing of 080° to Kalagi, followed by a 330° turn and a 40 Km drive to Gayaza. Finally, she heads on a bearing of 30° to reach the construction site in Kampala which is on a bearing of 020° from her starting point in Mukono. Upon arrival, she collects soil samples at variousdepths and records the sand content percentage in the table below:

Soil depth (x)	35	65	55	25	45	75	20	90	51	60
Percentage of sand (y)	86	70	84	92	79	68	96	58	86	77

Maria needs to create an appropriate graph to visualize the relationship between depth and sand content and calculate the total cost of surveying materials; including 50 meters of measuring tape at UGX. 10,000, 20 soil sampling bags at UGX. 5,000 each, and fuel at UGX. 6,000 per Km that she traveled. She will submit the calculations to apply for funding from her company.

TASK

a) Help Maria draw a precise diagram illustrating her journey, including bearings and distances.

b) (i) Develop a scatter plot to illustrate the relationship between depth and sand content, aidingMaria in her data analysis.

(ii) Describe the relationship between soil depth and sand percentage, including any trends orpatterns you observe.

(iii) Plot a line of best fit through the scatter diagram data, and use it to:

- Predict the sand percentage at a depth of 31 cm
- Estimate the depth at which the sand percentage is 54%.

c) Assist Maria in preparing a budget proposal to fund her project activities, including her returntrip to Mukono via the same route. (20 marks)

SECTION B: PART II GEOMETRY AND MEASURES

ITEM 18.

The school club is holding a fundraiser by selling chappattis, which they've made and packaged in special containers. Each chapatti is 14 cm in diameter, has a uniform thickness of 6 cm, and is divided into six slices. The containers, shaped like a chapatti slice, each have a marked price of UGX 1000 and can hold 14,784 cubic centimeters. The cost of making each slice is UGX 140. By the end of the day, they had sold 2,000 chapattis at UGX 400 per slice, and the seller of the containers gives a 10% discount to whoever buys by cash terms. (take $\pi = \frac{22}{7}$)

TASK

a) (i) Help the members of a school club to know the number of slices that can be loaded intoeach container.

(ii) Ascertain the number of containers needed to pack the entire batch of slices.

b) (i) How much money was generated from the fundraising event?

(ii) Provide a calculation-based recommendation to the club on whether to continue this business venture in the future, given that the containers were bought on cash terms.

ITEM 19

Stanbic Bank, a prominent African financial institution, seeks to revamp its logo to align with its values and appeal to a newer, younger demographic generation. The current logo, a triangle with

coordinates A(2, 3), B(4, 1), and C(1, 2) on a white rectangular background, is due for a refresh. Thebank's graphic designer has suggested the following design modifications to enhance the logo;

Keep the original triangle in place, but turn it 90 degrees counterclockwise around the origin. Then, mirror the resulting triangle across the horizontal axis. Next, scale up the new triangle by a factor of3 about the center (-5, -2), creating a logo with four triangles. Paint only the enlarged triangle with ared-to-white ratio of 3:5, using red paint that costs UGX 20,000 per square centimeter and white paint that costs UGX 15,000 per square unit. The bank has set a budget limit of UGX 205,000 per logo for painting.

TASK

a) (i) Assist the designer in creating a precise layout of the logo, showcasing the exact placementof the four triangles on the same material.

(ii) Specify the exact vertices of the new triangles.

b) Using data-driven insights, recommend to the bank owners whether to adjust their allocationfor logo painting expenses.

ITEM 20.

Uganda Crop Care Limited (UCCL) has secured a contract to supply liquid fertilizer in Kenya, with a requirement to package it in cylindrical tanks measuring 15 meters in height and 4 meters in radius.Currently, the company stores its liquid fertilizer in metallic buckets with dimensions of 10 meters inheight, 1 meter in lower radius, and 3 meters in upper radius. To fulfill the order, UCCL needs to determine the number of buckets required to fill 100 tanks. Each metallic bucket costs UGX 8000 to manufacture, and the company sells the fertilizer at UGX 3600 per liter. The manager at UCCL needs to calculate the number of buckets needed and evaluate the cost implications.

TASK

a) Ascertain the number of buckets needed to fill all the required tanks.
b) Establish the total cost that will be required to manufacture the required metallic buckets.
c) Based on calculations, evaluate UCCL‟s potential for success.

ITEM 21.

In Mukono town, a mobile vendor, previously operating outdoors, has been hindered by inclement **weather conditions** affecting their seating area. To combat this, they have decided to acquire four „three-sided table surfaces‟, identical in size, to provide a shielded space. Each table will feature **a central hole** to accommodate a circular umbrella, covering the **tabletop's vertices**. With a side that is distinct from the two equal sides, measuring 4.5 meters, the tables will form isosceles triangles with two equal angles of **65** degrees each. The furniture maker quotes a price of Shs. 300,000 per table, offering a 5% discount for cash payments, providing a more conducive and protected environment forthe vendor's operations.

The mobile vendor requires the tables to be fabricated within a tight 48-hour deadline. The furniture maker began working on the tables on Monday at 7: 30 am, with a schedule of 7:30 am to 4: 00 pm, including a 30-minute break from 1:30 pm to 2:00 pm. Each table surface requires 5 hours of work tobe completed.

TASK

a) Assist the furniture maker in drafting designs for the **tabletop surfaces** that meet the mobile vendor‟s requirements.
b) How much will the mobile vendor pay in cash for the four tables?
c) When will the tables be ready for delivery?
d) Recommend the minimum umbrella radius to the mobile vendor for optimal table shading.

ITEM 22.

James, a petroleum engineering master's graduate from Makerere University, has landed a job at a Ugandan NGO. The organization offers a comprehensive benefits package, including.

- Housing allowance: Shs. 14,000 per month
- Marriage allowance: y
- Medical allowance: Shs. 50,700 per annum
- Transport allowance: Shs. 10,000 per month

However, James must pay an annual insurance premium of Shs. 68,900. He has five children, with three under 8, one 16-year-old, and a 20-year-old. The NGO provides a family allowance for four children, as follows: Shs. 3,400 for each child above 18 years; Shs. 4,200 for each child between 10- 18 years; Shs. 5,400 for each child below 9 years.

The tax rates for working-class citizens in Uganda are shown in the table below:

Income (Shs) per annum	Tax rate (%)
1st Shs. 80,000	7.5
Next Shs. 80,000 (80,001 – 160,000)	12.5
Next Shs. 80,000 (160,001 – 240,000)	20.0
240,001 – 320,000	30.0
320,001 – 400,000	36.5
400,001 – 480,000	45.0
Above 480, 000	52

The accountant revealed to James that his **annual income taxes** would be Shs 100,320. James was confused because he didn't understand how his income was calculated, and he didn't know how to figure out his **gross annual income**. He also learned that his annual **total tax free – income** would **exceed his taxable income by 24%.**

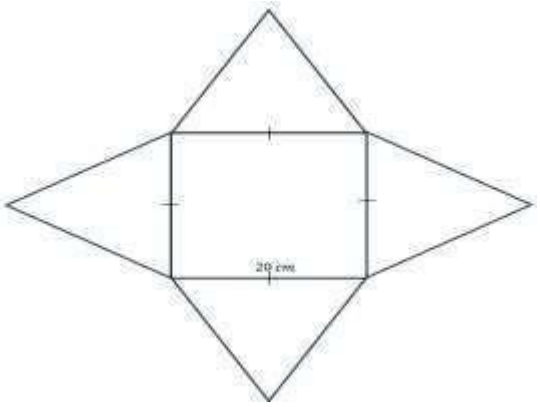
James aims to **constantly** set aside half of his annual net income to purchase **a 40 m x 22** m plot in Kayunga village within the next ten years, taking advantage of the stable land prices. The land is expected to be priced at UGX 4,000 per square meter within this time frame.

TASK

a) (i) Help James arrive at his accurate taxable income figure through careful calculation andlogical thinking.
   (ii) Assist James in understanding his annual marriage allowance compensation.
   (iii) Support James in figuring out his annual take-home pay.
b) Assist James in determining if he can reach his goal of purchasing the land within the desired timeframe.

ITEM 23

Your sister has started a new role in packaging design, and her boss has given her a new gift-wrappingdesign to assemble as a sample for a client meeting tomorrow. She's running into trouble and needs your help to get it finished overnight.



She is also supposed to determine the material that will be needed to make each for her company to plan well.

Your sister also tells you that she will be getting a salary of UGX.1,000,000 per month which includes, a transport allowance of UGX.200,000 and a lunch allowance of UGX.6000 per day only for the five days she works.

She wants to open up an insurance policy for her child that will need her to pay a premium of UGX.250,000 per month and also remain with UGX.400,000 for upkeep for the month but also has to pay tax using the rates below;

Taxable income	Tax rates %
0 - 235000	0
235000 - 335000	10
335000 - 410000	20
410000 - 1500000	30

She's uncertain if she'll have sufficient funds left to cover the insurance premium.

TASK

(a) (i) Show her what the pack will look like after it has been assembled.

(ii) Use your mathematics to help your sister determine the material required to make one pack.

(b) Will your sister be able to pay her child‟s premium?

ITEM 24

Your father is one of the organizers of a marathon they want to draw the map of the route that the participants will during the race.

At their chosen starting point they chose to take a road that turned E30^{o}S and they moved for 5km where they set up point **B** which will be used as a checkpoint, they then turned through 235^{o} moving a distance of 9km to point **C** which will be the finishing point, however on returning to the office they decided that the finishing point should be put at point **A** to cut costs of organizing the two places but they were not sure of the details of that route from **C** to A that had to be included on the map.

They want to hire a vehicle that will be used to film the racers, the vehicle available consumes 2 litres per km and a litre costs UGX.5500, the owner of the vehicle has asked for UGX.500,000 plus fueling the vehicle for the total distance to be covered but the vehicle owner plans to buy fuel from the fuel station where he is given a discount of 5% for every 100,000 worth of fuel he buys since he is a regularcustomer.

TASK;

(a) Help your father determine the direction from point C to the new finishing point A that will beshown on the map to be drawn.

(b) (i) You are required to determine the total cost of hiring the vehicle.

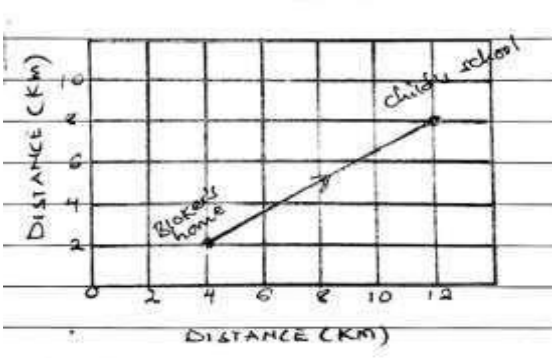
(ii) Do you think the vehicle owner will save some money on fuel if so how much?

ITEM 25

A man took out a loan of 5,000,000 Ugandan shillings from the bank at a compound interest rate of20% and was supposed to repay it within 3 years. However, with the deadline approaching, he has yet to raise the necessary amount.

He decides to sell one of his plots of land for 14,000,000 Ugandan shillings to raise the funds to payoff the loan. However, the buyer negotiates a 10% discount on the price. If he accepts the offer and sells the land, the broker will charge a 5% commission on the sale price. Additionally, the LC1 is requesting 350,000 Ugandan shillings to sign the agreements. He is uncertain whether the remainingamount will be sufficient to cover the loan he needs to repay.

He needs to pick up the child from school by 5:00 pm. However, it's currently 4:45 pm, and he's justleaving the broker's house, which is located a certain distance away from the school (as shown below). Considering he drives at an average speed of 50km/h, he's unsure if he'll arrive on time.



TASK:

a) (i) What is the outstanding loan amount he needs to settle with the bank?
   (ii) Will he be able to pay off the loan if he sells the land?
b) Will he arrive at the child's school on time?

ITEM 26

Moses, an employee at a gift box manufacturing company, has been tasked with designing a foldablegift box with square faces and a capacity of 2744 cubic centimeters. He's struggling to create a sketch that will guide him in arranging the faces of the box to fold and close, as well as determining the dimensions of each cardboard piece to cut and join to achieve the desired outcome.

He normally receives a monthly salary of 300,000 Ugandan shillings with no additional allowances. However, the company will start deducting taxes from his pay every month, and he needs to determine his new take-home pay. The company will follow the tax brackets shown below:

Monthly taxable income (Ugx.)	Rate(%)
0–100,000	0
100,001–200,000	5
200,001–300,000	10

He needs to deliver the gift box to the customer and charges a delivery fee based on the amount of fuel used. His motorcycle uses 0.035 liters of fuel per kilometer, and he travels at an average speed of 20 meters per second. With fuel priced at 5,000 Ugandan shillings per liter, he wants to calculate the delivery fee. According to the customer, the journey will take 45 minutes.

TASK:

a) Help Moses develop a sketch outlining the specifications he needs.
b) What is the new salary Moses will be receiving monthly?
c) How much will Moses charge the customer for delivery?

ITEM ONE

Mr. Karimthe head of mathematics department organized a mathematics study trip to Namanve where assembling of Toyota vehicle and manufacturing of Coca-Cola products are done, and in his report to the members of mathematics department shows the cost of hiring a school bus is constant for any a bus and other varies as the distance covered by thebus. He latviledthatifabuscovers100kmthenchargedkshs.4500andkshs.4000 for a distance of 60km. The distance between the school and Namanve is 480km and they expected to live the school at an average speed of 100 km/hr according to the school's study trip rules and procedures and after the trip they students would rest for 45 minutes and then proceed back to school.

Tasks:

a) As the treasure of the mathematics department help Mr. Karimtoknowtotal expenses for the total journey.

b) By representing the journeys on a suitable graph explain the motion of the bus to the bus to the school administrators.

ITEM 2

At Elijah‟s enterprise, a company that makes books. A machine produces the least number of books per turn, that enable packing in boxes in equal numbers of 24, 30 and 32 without any book being left out. On a given day, a school made an order of 1440 books. Determine the least number of turns the machine has to make in order to supply the school.

ITEM3

Mutebi had UGX.750,000 on his account and he wanted to buy a Washing Machine. He went at the shop and the price of the machine was UGX.960,000. He went home and waited. One month later, the price was decreased by 15% and then 9% in the second month. Was Mutebi able to buy the Machine after the decreases? If yes, was he able to remain with any balance.

ITEM3

ThepopulationofUgandaisestimatedtobethefastestgrowingpopulationinAfrica. It is estimated to be increasing by over 1,340,000 people every year Since 2020 whose population was estimated to be 49,718,000 people. The research team finds it difficult to present such big population values in 2020 and 2022 on a chart. Advise the search team on some other way they can present these big population values in a reduced way without changing the meaning.

ITEM 4

Kevin‟s goal is to find a job that provides an income of at least 40 million a year. A glass mart company offers Her a job paying a basic salary of 12 million a year plus a commissionof6%ofhersales.

Determine what Kevin‟s total sales will need to be for her to have a yearly income greater than or equal to 40 million.

ITEM5

Anengineerstandingonarampat(400ft,300ft).theramprises195feetovera horizontal distance of 3000 feet to reach the top car parking yard.

Determinetheequationthatwouldhelptheengineerknowthedisplacementforany other positiononthe ramp.

ITEM 6

In the press release by the Uganda bureau of Statistics, presented all Items Index and related Annual Inflation rates for 3 major components, between February 2015 – February 2016. The Annual Food Inflation decreased to 10.1 per cent for the year ending February2016 compared to 12.8 per cent recorded forthe year ended January 2016.Ontheotherhand,theAnnualNon-FoodInflationincreasedto6.7percentfor the year ending February 2016, compared to the 5.8 per cent recorded for the year ended January 2016. KeyDriversforhigherNon-FoodinflationwereTransport(10.7percent),Clothing and Footwear (13.1 percent) and Miscellaneous Goods and Services (6.3 per cent).

ITEM 7

Thesmallindividualfarmersinacertainvillagearebeingcheatedbythetradersfrom towns by offering them low prices for their produce. These farmers decided to form groups and sell their produce through them at better prices.

Sofar,theyhavetwogroups,Kamukamu andTweziimbe.Inthecurrentseason,they are selling milk, maize grain and beans. Last month, Kamukamu group had sales of 2,520 litres of milk, 35 bags of maize grain and 10 bags beans. Meanwhile the Tweziimbe group had sales of 2,314 litres of milk, 41 bags of maize and 9 bags of beans.

Thismonth,theKamukagrouphadsalesof3,254litresofmilk,42bagsofmaizeand 8 bags of beans while the Tweziimbe group managed to sell 2,719 litres of milk, 32 bags of maize and 11 bags of beans. The price for 1litre of milk, 1kg of maize and 1kg of beans is UGX. 700, UGX.1,000 and UGX.3,500 respectively. A bag of maize and beans is estimated to have 120kg each.

Organizetheinformationforthetwoperiodsanduseittodeterminethetotalsalesof both groups. (15)

ITEM8

On a certain village of 40 families, it was found out that 12 families keep a dog (D), 18 families keep a cat(C), 10 familieskeepahen(H),5familieskeepDand, 7 keep C and H and 4 keep D and H. 3 families keep neither of thethree dogs, cats or hens. This data was collected by learners, by use of a venn – diagram, help them to find the numberoffamiliesthatkeepallthethreeanimalsandbirds.

Ifyou aretaskedtoshare1600kgsoffeedstofamilies dependingonthenumberofhowmuchanimalsinthatgroup,showeachsectionon the venn – diagram will get.

ITEM 8

Ben and Musa went to borrow money from the same Bank. Benopted forsimple interest of 8% per annum for two years whileMusaoptedforcompoundinterest of 5% per annum for two years. If each borrowed 600,000/=. Help them to know who paid more money and by how much so they can know the cheapest alternative in case they are to borrow money for the second time.

“Get yourself a Boda – boda cycle on loan term. Pay 600,000/= cash as deposit and100,000/=perweekfor80weeks.Oneoftheboda-bodaridderhasaskedyouto help him compute the total cost of the Boda- boda cycle attheendof 80 weeks. Show how you can help him.

ITEM 8

A farmer has a metal sheet of length 12m which must be used toformarightangle. The hypotenuse of the triangle must be 5m. Help the farmer to get the measurements of the other twosides of the cage.

(b)In a certain factory the production of product T depends on the amount used of productX.thesystemofproductionisrelatedbytheequationf(x)=x^2+1.Ifduring

acertain weekvariablesofx where(3,4,5,6,7,8,9),Helpthefarmerofthe factory to determine the expected range of product T.

ITEM9

Acensusenumeratorhasbeensenttocountpeopleinyourvillage.Hehasbeengiven an i-pad that is fully charged for the exercise. Unfortunately, there is a small note of the PIN to help you access the software for the exercise. The note indicates that the pin numberisatwodigitnumberinbaseten.Thisnumberisequaltofivetimesthesum of thedigit.Itisalsoninelessthanthenumberformedbyinterchangingthedigits.The enumeratorcomesto yourhomeandseeksassistanceto to help himfindthePINfor the i-pad.

ThecensusinUgandaisheldeveryafter10years.Itwaslastheldin2014andthen previously 2004. The census in 2024 has revealed that there are , people in your village. This has increased by % as revealed by the census in 2014 having been previouslyincreasedbyby rlierin 2004.

Theenumeratorclaimsfortransportre ryafterfourdays,forthe4-day journey madeintheexercise.Hetravelsacerta tonthefirstday,thenhalfofthaton the second day, third of that the third day and finally a quarter of th e fourth day.

Theenumeratortravelledatotaldistanceof50kmduringthefour-dayexercise.Each kilometer travelled is paid UGX28,000

Task:

(a) Helptheenumeratorencryptthe**PIN.**

(b) Howmanypeoplewere inthe villagein2004.

(c) Howmuch did shereceiveon each day.

ITENM10

Yourfamilyisdesigninga arkinglotfordayandnightparkingofmotorcyclesusing the piece of land that has been just been bought in the dle of the city centre. The land is rectangular in shape with a length of 3mlonger than the width and the a a of this portion is ^{2}. The other portion of the land is a car park that will have only taxi and bus. Taxis are a owed ^{2}and buses are allowed ^{2}and there is only ofparkingspaceavailabl Notmorethan40vehiclesareallowedatatime.There are always botht fvehiclesandatmost15taxisareallo heparking fee for taxisis ,andthatofa bus is

UGX5 000

UGX8, 000

Each bus carries 78 passengers when full. The bus has a total of 30 seats, some of the seats are for passengers and the others are for passengers.

Task:

(a) Find the dimensions of the portion of the parking space for 3 motorcycles and for 2 motorcycles.

(b) How many vehicles of each type should be parked in the parking lot to maximize income?

(c) Determine the number of seats for the three passengers and for the two passengers.

(d) In your view what precautions should be taken when putting in place the parking lot.

Item11

Your father has decided to explore other options for your A-level education since the expenses at the previous school were beyond the budget. After some research, he has found another school that offers a more affordable option. He drove 30km east and 40km north to reach the school and found out that the details of the new school were as follows:

□ The school fees are Shs 750,000 per term, an admission fee of Shs 80,000 and the uniform costs is Shs 300,000. The school offers a 60% bursary on the school fees for students who scored a first grade in their O-level exams, and you qualify for this bursary.

Your father is considering the following two payment plans offered by the new school:

□ Paying the full amount (school fees, admission, and uniform) at the beginning of the term.

□ Paying the school fees in three equal instalments at the beginning of the term, on visitation day, and at the end of the term, while paying the admission and uniform fees upfront.

Tasks:

(a) Calculate the total cost of attending the new school, considering that you qualify for the bursary.

(b) Determine which payment plan would be more suitable for your father's budget and explain your reasoning.

(c) If your father chooses the three-installment plan, calculate the amount to be paid in each installment.

(d) How far is it from your home to school if you travel through the direct route?

Item12

Basoga Bainho (BABA) FM is hosting a highly anticipated concert, Ekituudha, at Kyabazinga Stadium Bugembe. The concert is expected to attract a large audience and the organizers have set two different ticket prices to cater for different income levels. The concert tickets are being sold at two different prices:

- Tickets for the VIP seating area are priced at Sh. 10,000 each.
- Tickets for the general seating area are priced at Sh. 5,000 each.

The organisers have a total of 30 tickets available for the concert. After the initial sales period, the total amount raised from the ticket sales is Sh. 800,000.

Task;

As the finance manager for the Ekituudha, determine how many tickets were sold at the price of Sh. 5,000 and Sh. 10,000.

Item 13

Walugosi is a middle-class employee working in a private company in Uganda. He earns a gross monthly income of UGX 1,200,000. Walugosi is married and has four children-twoaged6and8,oneaged15,andoneaged19.Walugosireceivesvarious allowances from his employer, including:

- Insuranceand relief:UGX222,000per annum
- Waterand electricity:UGX21,000permonth
- Medical:UGX318,000perannum
- Housingallowance:UGX55,000permonth
- Transportallowance:UGX42,000permonth
- Familyallowanceforthethree childrenunder18 years old.

Walugosiisconcernedabouttheamountofincometaxhehastopayeachmonthand wants to understand how it is calculated based on the tax structure below;

Taxableincome(UGX)permonth			Taxrate(%)
1	-	40,000	8.0
40,0001	-	100,000	16.5
100,001	-	200,000	24.0
200,001	-	350,000	32.5
350,001	-	510,000	43.0
Above510,000			48.5

Task;

Walugosiapproachesyou,anexpertintaxcalculationstohelphim determine, i)The income tax he has to pay monthly.

ii) Hisnetincome

iii) Whatpercentageofhisgross monthlyincomegoestotax?

iv) Withthehelpoftworelevantexample(s),helpWalugosiunderstand why it is important to pay tax.

NUMBERS

1. During their baking lesson , the students were given a recipe for 10 scones using the following ingredients:

   - 80g butter
   - 350g self-raising our
   - 30g sugar
   - 2 eggs

   However the student has the following ingredient and is preparing for the exhibition due to take place at school and wishes to bake 25 scones for the exhibition because he expects parents and visitors to support his entrepreneurial venuture.

   - 100g butter
   - 1kg self-raising our
   - 50g sugar
   - 4 eggs

   Task:

   (a) Determine if the student has enough of each ingredient to bake 25 scones based on the recipe.

   (b) Determine how much more of each ingredient the student needs to buy.

   (c) If the prices of the ingredients are as follows:

      - Butter: 5,000 shillings per 100g
      - Self-raising our: 6,000 shillings per kg
      - Sugar: 1,000 shillings per 50g
      - Eggs: 500 shillings per egg

      Calculate the total cost for the additional ingredients needed.

   (d) Determine how much the student should sell each scone .Electricity and other expenses are provided free by the school.

2. Your aunt is planning to enroll you in a boarding school for your O-level education. She has a budget of Shs 5,000,000 for your school expenses. To visit the school, she decides to take a boda-boda. The boda-boda travels 3 km west from your home to the main road, then 4 km south to reach the school. However, you later realize there's a shortcut path that leads directly from your home to the school. Upon reaching the school, your aunt learns that the school fees are Shs 3,000,000, boarding fees are Shs 1,500,000, and the cost of school supplies is Shs 500,000. Fortunately, the school o ers a scholarship program. Students with excellent primary school leaving exam results receive a 50% discount on school fees, a Shs 200,000 reduction in boarding fees, and a Shs 150,000 voucher for school supplies. You are

eligible for this scholarship based on your outstanding performance. The school also o erstwo payment options for school fees:

- Option 1: Two Installments - Pay two- fths of the school fees at the beginning of theterm and the remaining balance before the midterm exams.
- Option 2: Four Installments - Pay equal amounts at the beginning of the term, before midterm exams, after midterm, and before nal exams.

Task:

(a) What is the distance from your home to the school using the direct path?

(b) i. Considering the scholarship, calculate the total amount your aunt will pay for yourschool expenses.

ii. Can your aunt a ord the school expenses based on her budget?

(c) i. For those paying the full school fees amount, calculate the amount paid per installment for each payment option.

ii. Which payment option would you recommend and why?

PATTERNS AND ALGEBRA

3. Your uncle owns a small bakery and plans to bake two types of loaves of bread: whole wheat bread and white bread. Due to the bakery's oven capacity, your uncle can bake at most 15 loaves of bread in a day. He wants to bake at least 3 loaves of whole wheat bread. Additionally, he wants to bake more whole wheat bread than white bread because it is more popular among his customers. The selling prices are as follows:

   Whole wheat bread is sold at Shs 6500 per loaf.

   White bread is sold at Shs 5000 per loaf.

   To cover his costs and make a pro t, your uncle needs to earn more than Shs 30,000 fromthe sales each day.

   Task:

   (a) Write mathematical statements that show the relation between the whole wheat breadand white bread.

   (b) Show the feasible region of the relation on the Cartesian plane.

   (c) How many loaves of each type should your uncle bake in order to make the maximumpro t?

   (d) What is the minimum number of loaves he can bake and still make a pro t?

4. The company manager is organizing a party for her colleagues. The cost of renting a local hall is UGX 2,000,000 for the evening. She then has to budget for food, which will cost approximately UGX 20,000 per person. The manager needs to ensure that the total cost of the evening stays within her budget.The manager has a maximum budget of UGX 5, 000, 000

   Task:

   (a) Write down a formula connecting the total cost of the evening with the number of people attending .

   (b) Find the total cost for the evening if 25 people attend.

   (c) Find the greatest number of people she is able to invite.

   (d) In the end, only 16 people will attend. Calculate how much each person should be charged so that the manager covers her costs.

5. Your friend is shopping at a supermarket in Kampala during a clearance sale. He wants to buy a calculator that originally costs 120,000 UGX. The store has reduced the price of all calculators by 35% for the sale. Additionally, today there is an extra markdown of 40% applied to the sale price of all calculators.

   Task:

   (a) Develop a function that calculates the sale price of the calculator today, where x is the original price of the calculator.

   (b) Using the function from (a), determine the nal price your friend will pay for the calculator.

6. A manufacturer considers that men and women workers are equally e cient and so he pays them at the same rate. He has 30 units of male workers and 17 units of female workers and capital respectively, which he uses to produce two types of goods, A and B. To produce one unit of A, 2 workers and 3 units of capital are required, while 3 workers and 1 unit of capital are required to produce one unit of B. Goods A and B are priced at UGX 100,000 and UGX 120,000 per unit respectively.

   Task:

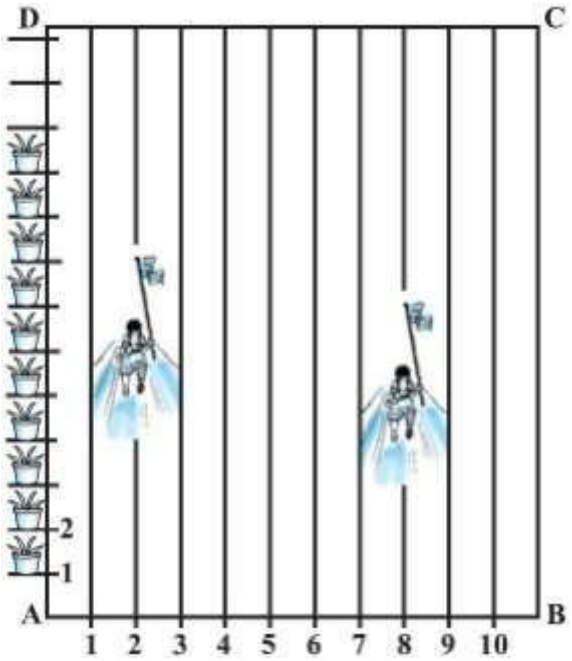
   (a) Write mathematical statements that show the relation between the units of goods A and B produced

   (b) Show the feasible region of the relation on the Cartesian plane

   (c) How should he use his resources to maximize the total revenue?

   (d) Do you agree with this view of the manufacturer that men and women workers are equally e cient and so should be paid at the same rate?

7. In preparation for the annual sports day that takes place in second term of every year , your school has marked lines with ash powder at intervals of 1 meter on a rectangular sports eld ABCD. The eld is 100 meters long (AD) and 50 meters wide (AB). To make the event more exciting, the school has set up a challenge where students need to post ags at speci c locations on the eld.



- 100 ower pots are placed at 1-meter intervals along the length AD.
- Two di erent lines (second and eighth) running parallel to AD are speci cally used forthis challenge.
- One student runs $\frac{1}{4}^{th}$ the length of the eld along the 2nd meter line and posts a green ag.
- Another student runs $\frac{1}{5}^{th}$ the length of the eld along the 8th meter line and posts a red ag.

Taking one corner of the eld (point A) as the origin, with the x-axis along the width (AB)and the y-axis along the length (AD), answer the following questions:

Task:

(a) Find the coordinates of the green ag.

(b) Find the coordinates of the red ag.

(c) Find the distance between the two ags.

(d) If a blue ag is to be placed exactly halfway between the green and red ags, whereshould it be placed?

(e) Draw the locus of points that are equidistant from both the green and red ags and nd it is equation.

8. A cooperative society of farmers has 50 hectares of land to grow two crops A and B. The pro ts from crops A and B per hectare are estimated as Shs 10,500,000 and Shs 9,000,000 respectively. To control weeds, a liquid herbicide has to be used for crops A and B at the rate of 20 litres and 10 litres per hectare, respectively. Further not more than 800 litres of herbicide should be used in order to protect sh and wildlife using a pond which collects drainage from this land. Keeping in mind that the protection of sh and other wildlife is more important than earning pro t respectively.

   Task:

   (a) Write mathematical statements that show the relation between the hectare of land tobe allocated to crop A and B respectively

   (b) Show the feasible region of the relation on the Cartesian plane

   (c) How much land should be allocated to each crop so as to maximize the total pro t?

   (d) Do you agree with the message that the protection of wildlife is utmost necessary to preserve the balance in environment?

DATA AND PROBABILITY

9. In a school survey, 200 students were asked about their internet usage habits. They were asked to choose from three activities: Social Media (like Facebook and TikTok), Academic Work (such as research and homework), and Playing Games. The results showed that 165 students use the internet for Social Media, 130 use it for Academic Work, and 100 use it for Playing Games. Among them, 70 students use it for both Social Media and Academic Work only, 60 use it for both Social Media and Playing Games, and 50 use it for both Playing Games and Academic Work. Additionally, no students exclusively use the internet for playing games. Now, the school needs to decide whether to set rules if more than 60%of students spend their internet time on Social Media.

   Task:

   (a) Calculate how many students use the internet for at least one of these activities.

   (b) Determine how many students don't use the internet at all.

   (c) Estimate the percentage of students who use the internet solely for Academic Work.

   (d) Based on the ndings, advise the school on whether to implement rules or not.

10. A certain company in Kampala is analyzing the optimal departure time for its 40 employees to ensure they reach home by 6:00 PM, minimizing their commute time and avoiding peak tra c congestion. The company conducts a survey to track the times employees typically arrive home after work, measured in minutes past 5:00 PM.

15	20	25	30	35	40	45	50	55	60
65	70	75	20	25	30	35	40	45	50
55	60	65	70	75	80	25	30	35	40
45	50	55	60	65	70	75	80	30	35

Task:

(a) Based on calculations using the collected data, suggest an optimal departure time for employees to begin their commute home.

(b) Following advice to allow employees to leave work when at least 50% of them have already arrived home, determine the optimal departure time.

(c) As the company management, which of the two suggested departure times from (a) and (b) would you choose to ensure employees reach home by 7:00 PM, and why?

11. A baker is preparing for a local community event. She needs to bake several types of cakes, however she has to ensure she has the correct quantities of ingredients for each. Below are the types of cakes she plans to bake and their required quantities of ingredients:

- Chocolate Cake: Requires 3 cups of our, 2 cups of sugar, 4 eggs, and 1 cup of mixed ingredients per cake.
- Vanilla Cake: Requires 4 cups of our, 3 cups of sugar, 3 eggs, and 2 cups of mixed ingredients per cake.
- Red Velvet Cake: Requires 5 cups of our, 2 cups of sugar, and 1 cup of mixed ingredients per cake.
- Lemon Cake: Requires 2 cups of our, 2 cups of sugar, 3 eggs, and 1 cup of mixed ingredients per cake.

The baker has been asked to bake a total of 10 Chocolate Cakes, 8 Vanilla Cakes, 6 RedVelvet Cakes, and 5 Lemon Cakes.

Task:

(a) Form a matrix to show the quantities of ingredients required for each type of cake.

(b) She wants to calculate the total quantity of each ingredient she will need for the event. Help the baker using your knowledge of matrix multiplication.

(c) If each kilogram of our goes for UGX 8000, each kilogram of sugar goes for UGX 5000, and each egg goes for UGX 300, and a cup of mixed ingredients goes for UGX 6000. Find out how much she will spend on making the cakes considering that each cup with the ingredient weighs 250grammes.

12. A layer chicken farmer decided to weigh a sample of 800 eggs on his farm and classify them according to their mass (m grams) to optimize the packing process. The frequency distribution of the egg masses is as follows:

Mass in grams	Number of eggs
40 − 44	36
45 − 49	142
50 − 54	286
55 − 59	238
60 − 64	76
65 − 69	22

The farmer's plan is to pack eggs in given weights.

Task:

(a) Determine the median mass of an egg from the given frequency distribution to under- stand the central tendency of the egg weights.

(b) What would be the percentage of eggs which would be classified as large(over 62 grams)

(c) The farmer plans to pack eggs that weigh over 62 grams, with each pack containing 12 eggs. If each pack costs UGX 12,000, calculate the total revenue the farmer will earn from selling all the large eggs and compare the revenue earned from selling the same eggs to a middle man who he is buying at UGX 9000.What advice will you o er to the farmer.

13. In preparation for the upcoming national voter registration drive in Uganda, the Electoral Commission needs to determine the optimal opening time for registration centers across various districts. This decision aims to facilitate maximum voter registration and ensure e cient processing of the data of the citizens eager to participate in the upcoming elections. Here are the arrival times of citizens at a sample voter registration center in minutes past the scheduled opening time (8:00 AM):

11	66	21	88	33	67	41	45	47	41
27	62	32	43	31	34	66	20	21	36
26	75	80	45	12	44	58	48	42	38
56	63	68	24	21	65	68	63	72	38

Task:

(a) Based on calculations using the collected data, suggest an opening time for voter reg- istration centers.

(b) Following advice to open registration centers when at least 50% of expected citizens have arrived, determine the opening time.

(c) As the Electoral Commission of Uganda, which of the two suggested opening times from (a) and (b) would you choose, and why?

GEOMETRY AND MEASURES

14. Your relative, is planning to start a small bakery business and seeks your advice on nancial matters related to her venture. She plans to invest a total of $10, 000 into the business and wants to understand the nancial implications of di erent nancing options. She has approached two money lenders and she is asking for your input before she takes on the decision.

Lender 1 : Your relative ,wants to borrow UGX 50,000,000 from a local bank to purchasebaking equipment. The bank o ers her two di erent repayment plans:

- Option 1: Simple Interest - The loan is o ered at an annual interest rate of 20% andto be paid after 2 years.

- Option 2: Compound Interest - The loan is o ered at an annual interest rate of 4% and is to be paid after 2 years

Lender 2: Your relative is considering a hire purchase agreement with a bakery equipment supplier. The total cost of the equipment is $5, 000, and the hire purchase agreement speci esa down payment of $1, 000 followed by monthly payments of $400 for 24 months.The supplier will consider a constant dollar rate at 1$ = *UGX*3, 800

Task:

(a) Calculate the total repayment amount for each nancial option over the loan term and compare them to determine which option would be more cost-e ective for your relativebakery business.

(b) Analyze the monthly cash ow implications for your relative, under each nancing option, considering her ability to manage operational expenses alongside loan repay- ments.

(c) Based on your calculations and analysis in (a) and (b), provide your relative, with a recommendation on which nancial option would be optimal for her bakery business, taking into account both total repayment amount and monthly cash ow considerations.

15. A group of tourists has just arrived at Entebbe International Airport in Uganda for a safari adventure. They are interested in reaching the source of the Nile in Jinja. The touring company has approximated the distance from Entebbe to Jinja to be about 94 km, which should take around 3 hours without tra c, assuming an average speed of 30 km/h for the whole journey. Here are the directions they are following:

- From Entebbe Airport, travel north for 35 kilometers to reach Kampala, the capital city.
- From Kampala, head east on the Jinja highway. As they approached Mukono, approx- imately 25 km from Kampala, the guide was alerted by a friend coming from Jinja to change the route and use the Kayunga road due to an accident in Mabira. The driver changed the route at Mukono and went in the northeast direction to Kayunga, approximately 45 km away.
- From Kayunga, they headed to Jinja on a bearing of 130^0, which took them 1 hour and 44 minutes as they enjoyed the scenery along the roadside.

Task

(a) Describe the direction from Jinja to Entebbe.

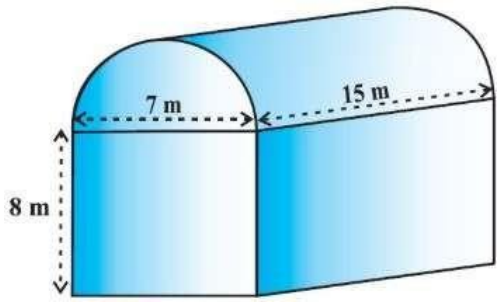
(b) How far is it from Mukono to Jinja using the direct route instead of the Kayunga route?

(c) How long does the journey from Entebbe to Kampala take?

(d) If each liter of fuel costs UGX 4900 and the car van consumes 1 liter per 10 km, how much fuel and money would they have saved if there was no accident in Mabira?

(e) How much extra time did they spend on the road due to the detour, and what recom- mendations would you make to avoid such delays in the future?

16. Your neighbor runs an industry in a shed that is in the shape of a cuboid surmounted by ahalf-cylinder. The dimensions of the cuboid base are 15 m by 7 m, and the height is 8 m.



Your neighbor wants to install air conditioning units in the shed. The installation company o ers two types of units: Type X and Type Y. Each Type X unit costs $2,500 and each Type Y unit costs $3,200. The Type X unit covers $100m^3$ of air, while the Type Y unit covers $150m^3$ of air. For bulk purchases, the company o ers a 5% discount on the total cost for every 10 Type X units purchased and a 7% discount on the total cost for every 8 Type Y units purchased. The neighbor plans to buy enough units to cover the entire volume of the shed. He intends to borrow money from a bank to buy the air conditioning units but isunsure of the amount needed.

Task:

(a) Find the volume of the air that the shed can hold.

(b) If the industry requires machinery which would occupy a total space of $300m^3$ and there are 20 workers each of whom would occupy 0.08 space on an average, how much air would be in the shed when it is working?

(c) Calculate the number of air conditioning units required for both Type X and Type Y units based on the usable air volume.

(d) Estimate the total cost and the amount of money your neighbor needs to borrow for purchasing the required air conditioning units for both Type X and Type Y.

(e) Advise your neighbor , with reasons, on the type of air conditioning units to buy.

17. The Parks Department in a Ugandan village has acquired a new sprinkler system to water their ower equilateral triangular lawn , which is essential for maintaining the village green-ery. The equilateral triangular lawn, with each side measuring 10 meters , is surrounded by pathways, and the sprinkler needs to be strategically placed to ensure e ective coverage without wasting water on the pathways.

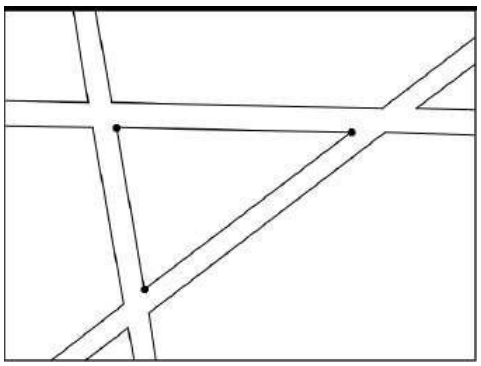


Diagram not on scale

Task:

(a) Explain whether or not you think all of the lawn in the triangle can be watered witha circular sprinkler

(b) Determine the best location inside the equilateral triangular lawn where the sprinklershould be positioned to maximize the watering coverage while avoiding the pathways.

(c) Estimate the area of the lawn that will not receive water e ectively once the sprinkleris optimally placed.

Question 1

KarynownsabakeryinKampala. Sheusesa baseeightsystemtodisplaythepricesof different prices of bread in dollars. In her display, each digit from 0 to 7 represents a specific price value as shown in the table below

Digit	Pricevalueindollars
0	2.5
1	3.0
2	3.5
3	4.0
4	4.5
5	5.0
6	5.5
7	6.0

She sells each loaf of bread at 256 base eight. Oscar is a business man who buys 100 loavesof breaddailyfromthe bakeryand sellseachloaf atUGX70000.Heisgivena discount of 5% on every loaf of bread.

Task

a) Determinethepriceof1loafofbreadindollars

b) Giventhat1USD=UGX3800,HelpOscartodeterminehispercentageprofit.

Question2

Your mathematics teacher has promised to award his best three students Maria, Monica andMariamwith126counterbooks.EachcounterbookcostsUGX12000inthe market. Maria will receive 42 counter books in base 6. Monica will receive 36 counter books in base 8. Mariam will receive the share of her counter books in base 10.To provide accountabilityto the school head teacher, the mathematics teacher intends to present the data on appropriate chart to the head teacher.

Task

a) DeterminehowmuchmoneywasspentinbuyingMariam"sCounterbooks

b) Helptheteachertopresentthedatatotheschoolheadteacher.

Question3

WilsonandRonaldarestudentsofthesameschool.Theyareworkingonamathematics assignment that involves number bases. Wilson is working in base 6 while Ronald is working in base 8. Wilsons number is 24 written on a white cardboard while Ronald‟s number is 32 written on a blue cardboard. They are all aiming at find the least number that can divide all the two numbers. Wilson′s class has 5 streams with 15 students each
whileRonald‟sclasshas2streamswith24studentseach. Theschoolwishestodetermine the minimum number of students each stream should have so that they contain the same number of students.

Task

a) HelpWilsonandRonaldtodeterminetheleastnumberthatcandivideallthetwo numbers
b) Helptheschooltodeterminethenumberofstudentseachstreamshouldhave?

Question4

Yourschoolhasreceivedanewsetofmathematicsbooksforthelowersecondaryschool curriculum from the ministry of education and sports. The school is arranging the books into boxes to hand them over to the school librarian. The school decides to arrange the books in rows on different number bases. The first box is arranged in base 2, the second box in base 3 and the third in base 5. Each box has equal number of books in each row.
Thefirstboxcontainsrowsofbooks.Thesecondboxcontains9rowsofbooksandthe third box contains 8 rows of books. The librarian is creating selves and each self will contain equal number of books. Each book costs UGX25000

Task

a) Determinethetotalnumberof booksthattheschoolreceivedfromtheministryof education and sports.
b) Howmanybookswillthelibrarianarrangeineachshelf?
c) Determinetheamountofmoneyspentinbuyingeachboxofbooks

Question5

Scovia locks her phone with a password “MATH” after using it. Each letter in the passwordrepresentsanumberinbasefive.Mrepresents13,Arepresents1,Trepresents 20 and 8 represents 8. Ruth wants to use the phone but needs to combine the numbers in base 10 to unlock the phone. Scovia bought the phone at UGX780000. She plans to sell the phone to Ruth at UGX1080000. Scovia plans to use part of the moneyto buy a crate of soda that has 24 bottles for her birthday and save the rest. Each bottle of soda costsUGX12000.

Task

a) WhatnumbershouldRuthusetounlockthephone?
b) DetermineScovia‟spercentageprofit
c) Expressthеamountofmoneythatwillbeusedtobuythecrateof sodaasa percentage of the amount of money that will be save.

Question6

A telecommunication company in Uganda offers a special promotion to all customers havingtheirbrandsmartphone.Thepromotionallowscustomerstoconverttheirloyalty points to a specific amount of money in US dollars and finally to Ugandan shillings (UGX)basingona uniquenumber basesystem. Inthis system, thedigit3intheloyalty pointsisequivalenttothedigit5inthedecimalsystem.Joshuaaccumulates243loyalty points every week. Each loyalty point can be converted to UGX 11400. The company sells each phone at a profit of 5%. They sell each phone at UGX585000.

Task

a) DeterminetheamountofmoneyJoshuareceivedforhisloyaltypointsinUSdollars for last week. Hence determine the total amount of money he will receive within 6 weeks.
b) Determinethecostpriceofeachphone.

Question7

James and Joan are students in the same school. James is holding a white card with numbers 24 and 45 written in base 6 on it. Joan is holding a blue card with the same numberswritteninbase8onit.Theyallwant tofindtheleastnumberthat candividethe two numbers on their respective cards. James claims that he will be the first to obtain the correct answer since he is 5 years older than Joan.

Task

a) DeterminethecorrectanswerJameswillfind
b) HowoldisJoanifthesumoftheagesofthetwostudentsis39.

Working with integers

Question1

YourschoolplanstoraiseUSD1100thatwillbeusedintheconstructionofanewschool library. The school organized a school carnival to raise moneythat will enable it achieve

thetarget.Thetablebelowshowstheincomegeneratedandtheexpensesforin US dollars for the school carnival.The expenses are indicated in brackets

Games	Sports	Donations	Flyers(expenses)	Decorations(expenses)
650	530	52	28	75

Theheadteacheroftheschoolplanstopresenttheabovedatatotheschoolmanagement committee in one of the meetings this Saturday.

Task

a) Didtheschoolreachits goal?
b) Usingtwodifferentcharts,helptheheadteachertorepresentthedatatotheschool management committee
c) Giventhat1USD = 3800UGX,determinethetotalamountofmoneytheschool remained with after expenses in UGX.

Question2

A football team gains 3 points on the first tournament, loses 6 points on the second tournament, loses 3 points on the third tournament and gains 4 points on the fourth tournament. Each point gained is awarded UGX54500 and each point lost is deducted UGX12500.Theteamhas40playerswho are eitherleftfootedorrightfooted.28players arerightfootedwhile17playersareleftfooted.Aplayerwhoisbothleftandrightfooted is awarded UGX 258000 by the football association.

Task

a) Determinethetotalamountofmoneythefootballteamobtainedfromthefour tournaments
b) Howmuch moneydidthefootballmanagementspendinawardingtheplayerswho are both right and left footed? (write your answer in words)

Question3

You are playing a game on your computer using a spinner. You start with the spinner at blueandscore48,andspinthespinnerfourtimestoorange,spinthe spinnerthreetimes again to green and finally spin the spinner 6 times to red. Each spin gives a score of 4.

Task

a) Writeyourtotalscoreinwords
b) Usingtwodifferentcharts,displaythescoresatblue,orange,greenandred

Question4

James bought three bags at UGX 45000 each after being given a discount of 5% on the original price of each of the bags from a shop in Kampala. He bought oranges at UGX500 each and put in the bags. Each bag contained 8 oranges. James then decided to sharethemwithhisfourfriendJoshua,Jakin,JackandJadonbydividingthemequallyin to four groups. He bought 10 more oranges later on and added them to the total number of oranges he had. James realized that he had to multiply the sum of the oranges by 2 to determine the final count. Joshua being the oldest of the other four friends by 2 years claims that he should be given more oranges. The sum of the ages of the five people when pressed on a calculator was found to be 77.

Task

a) Determinethetotalamountofmoneyofthefinalcount.
b) Whatistotaloriginalcostofthethree bags
c) Determinetheagesofthefivepeople.

Question5

Your sports teacher is organizing a sports event this Saturday. He wants to buy sports equipment sets that include basketballs and footballs for their activities. He has three different sets to choose from: Set A includes 8 basketballs and 12 footballs, Set B includes 6 basketballs and 18 footballs and Set C includes 10 basketballs and 15 footballs. Each ball in set A costs UGX80000, each ball in set B costs UGX 8000 more than that in Set A and each ball in Set C costs UGX12000 more than that in Set B.The sportsteacherwantstofigureoutthetotalnumberofeachtypeofballheneedstobuyto ensure that each activity group has the required number of balls without shortage or wastage.

Task

a) Determinethetotalamountofmoneyhemustspendinbuyingtoballstoachievehis target.
b) ThesportsteacherhasUGX7800000forbuyingtheballs,hewantstouse10%ofthe balance to purchase mineral water. Determine how much he has to spend on mineral water.

Question6

Your high school friend spent UGX15000 in buying apples. He wants to distribute the apples equallyamong his other friends. If he gives each friend x apples , he will have 3 apples remaining. Each apple costs UGX1000. Emily, Michael and Sophia are among yourbestfriendsaswell.Emilyhas18applesinherbag.Michaelhas24bagsinhisbag

whileSophiahas30applesinherbagtoo.Theywanttofindthehighestequalnumberof apples that should be put in each bag and the least equal number of apples each bag can contain.

Task

a) Determinethenumberofapples(x)eachfriendwillreceivefromyour friend.
b) HelpEmily,MichaelandSophiatoaddressthechallenge.

Question7

Your brother went to school to do mathematics practice on the chalkboard. During his practice, he pressed a number on a calculator, added the square of 5 to the number. He laterrealizedthatwhenhedividestheresultby4,hegets5timesthenumber.Afterthe practice, your brother left school and walked 5 kilometers to a trading centre to buy
water, he then walked in the north east to his friend‟s home and rested there for some hoursbeforewalking6kilometersinthewesterndirectionto asupermarkettobuysome scholastic materials for mathematics practice in the coming days. Your home is 5 kilometers due south of the supermarket.

Task

a) Helpyourbrothertofindoutthenumber.
b) Howfaris yourhomefromtheschoolusingthedirectroute?

Fractions,percentagesanddecimal

Question1

Youruncleworksasasalesagentinacementmanufacturingcompany.Heispaidabasic monthlysalaryof UGX1800000. He is paid UGX400000 for every 25 bags of cement he sells. Your uncle sells 400 bags of cement in a month. He decides to save 20% of total salaryeverymonth and share the 10% of it among his four children in the ratio of 2:3:4:1 accordingto theirages. Theeldestchildreceivesthehighestamountof money.Hisdaily expenses are UGX 20000. The rest of the money is invested in to the family business.

Task

a) Howmuch moneyisinvestedintothefamilybusinesseverymonth?
b) Workouthowmuchmoneytheyoungestchildgets

Question2

Annetboughtfruitsconsistingof mangoes,guavas,orangesandpassionfruitsintheratio of2:4:4:2fromafruitstore.Heate$\frac{1}{4}$ofthefruitsandgaveaway40%of theremaining oranges to his friends. She sold the rest of the fruits to his neighbor at UGX1500 each. Eachfruitinthefruitstorecostsa UGX800.Shebought14passionfruitsfromthefruit store.

Task

a) Determineherpercentageprofit.
b) Displaytheinformationusinganappropriatechart.

Question3

A secondaryschool consists of 24 lower secondaryschool prefects. The prefects plan to holdameetingthisSaturdayinoneoftheschoolhall.Theschoolhallcanaccommodate many people as it has single seats arranged in 8 rows and 12 columns. The school has bought 48 bottles of mineral water, 120 bottles of soda and 84 cups of juice. 17 prefects drink soda, 12.5% of the prefects do not drink soda or juice and 9 prefects drink juice.

EachbottleofthedrinkscostsUGX4000

Task

a) Usingappropriatechart,displaythecategoriesofdrinksbought
b) Workouthowmuchmoneywasusedtobuybottlesofdrinksforpeoplewhodrink both soda and juice if they will drink two bottles each.

Question4

Oscar wants to design a triangular garden in her backyard. The base of the triangular gardenis12metres longandtheheightis8metres.Heplanstodividethegarden into threeequalsectionstoplantdifferentflowers.Oscardecidestoallocate$\frac{1}{3}$ofthegardento roses,$\frac{1}{4}$totulipsandtheremainingsectiontosunflowers.Oscarrealizesthattheroses need 40% of their section to grow properly, the tulips need 25% and the sunflowers require35%.Oscardecidestoinstalladecorativeborderaroundtheperimetersothatit just touches the edges of the garden and the border costs UGX50000 per metre.

Task

a) Whatisthetotalcostofinstallingthedecorativeborder?
b) Whatistheareainsquaremetersallocatedtoeachtypeof flower?

c) Findouthowmanysquaremetresofeachflowerbedshouldbeallocatedforoptimal growth.

Question5

The village hunters standing by the roadside need to navigate through the game park to find three different wild animals, cob, rhino and porcupine resting at three different places. The village hunters need to move northeast to find the cob and turn southward to find the rhino before turning southwest to find where the porcupine is resting. The distancefromtheroadtothecobis25%ofthetotaldistanceandthedistancetotherhino is 40% of the total distance. The remaining distance to the porcupine accounts for the remaining 35%. The distance to the cob from the village hunters is 500 metes

Task

a) Workoutthetotaldistancethevillagehuntersneedtocover.
b) Whatangleshouldthehuntersturnthroughiftheyaretomovefromtheroadtothe porcupine?

Question6

Mr.Amara isavillage farmer.He ownsatriangulargardenwithsidesmeasuring $(x+2)$ metres, $x+5)$ metres and $(x+8)$ meters. Mr. Amara wants to build a circular fence around the garden in such a way that it just touches the corners of the garden without enteringittokeepoutanimals.Thefencingmaterialcosts UGX7800permeter.Hewants tofence$\frac{3}{4}$ oftheperimeterofthegardenandleavetheremainderunfencedforan entrance.Theperimeterofthegardenis45metres.Thegardenwillbeusedtogrowtrees and each tree will occupy $2m^2$ of space of the garden

Task

a) Determinethecostoffencingthegarden
b) Workoutthetotalnumberoftreesthatcanbeplantedinthegarden

Question7

Your sister, Mercy works in one of the non-governmental organizations in Uganda. She is paid a monthly salary of UGX8800000. Your sister decides to invest a portion of her totalsavingsinafixeddepositaccountthatoffersasimpleinterestrateof5%permonth. Sheinvests$\frac{1}{3}$ ofhertotalsavingswhichamountstoUGX1400000.Mercysaves30% of hermonthlysalaryandusestheremaindertopayschoolfees.

Task

a) Determinetheamountofmoneyshewithdrawsfromthefixeddepositaccountafter4 years.
b) Workouthertotalsavingsin2 years.

Coordinate plane

Question1

You and your friend have tickets to watch a football match in Kampala in which only 12500spectatorsareexpectedtoattend.YousitinsidetheVIPsectionand yourfriend sits at $(-5,-3)$. The football pitch is located at positions $(-4,-3),(4,3),(-4,3)\ and\ (4,3)$. Each unit is equal to 20 metres. The football match hasbeenorganizedbythefootballassociationtoraisefundsrequiredtofencethefootball pitch where by each spectator will pay UGX1000. UGX 20000 will be used to fence every 2 meters of the perimeter of the pitch and 40% of the balance will be distributed equally by the football association to the 46 football players that will participate the football match and the remainder will be saved in a bank account that offers a 8% simple interest rate per month.

Task

a) Usingasuitablegraph,displaythepositionofyourfriendanddeterminetheareaof the football pitch.
b) Workouttheamountofmoneythefootballassociationwillwithdrawfromthebank after 3 years

Question2

Yourschoolislocatedat$(2,-1)$,whichis2blockseastand1blocksouthof thecentre of town. To get from your house to the school, you walk 5 blocks west and 2 blocks north. The school is near the houses of four of your friends Alex, Bernard, Cathy and Dalton.Alex‟shouseis600metersnorthoftheschool,Bernard‟shouseis300metreson $60°$ east of north of the school. Cath‟s house is half kilometer on south of east of the schoolwhileDalton‟shouseissouthwestoftheschool.Dalton‟shouseis400metres from the school.

Task

a) Isyourschooloryourschoolclosertothecentreoftown?useasuitablegraph
b) Showaccuratelythepositionofthehousesofthefourfriendsanddeterminehowfar Dalton‟s house is from Alex‟s house

Question3

Three people Amon, Anthony and Mark are village friends. They decided to go hunting for wild animals in a village forest.They left their bottle of water at point A(2,4) and theirspearsatpointB(-1,1)andstartedtracingthewildanimalsfrompointC(5,3).While exploring the area the next day, they discovered a mysterious circular rock enclosing the area formed by three points just touching the tips of the three points

Task

a) Usingagraphandsuitablegeometricinstruments,showthedesignofthearea covered by circular rock
b) Workoutthe areaofthecircularrock

Question4

Jerome is a village farmer in Iganga district. He has rectangular farm land whose corners are at points $A(2,3), B(2,7), C(8,7), and\ (8,3)$. He bought the farm land from his neighbor2 yearsagoatatotalcostofUGX8400000.Jeromeplanstosellthefarmlandto his friend Destiny. He wants to sell each square meter of the farm land at UGX120000 and save the profits obtained in a fixed deposit account that offers a 2% simple interest rate per month for 2 years. Each unit of the length or width of the farm land represents 5 metres of the actual size.

Task

a) Usingasuitablegraph,presentthedesignofthefarmland
b) HowmuchmoneywillJeromewithdrawfromthebankafter2years?

Question5

Your school has designed a rectangular meal card whose corners are at points P(2,7), Q(6,7)R(6,-2)andS(2,-2)tohelpinschoolfeescollection.Themealcardisuniquewith a triangular design whose tips are at points (1,2),(3,4) and (5,6) inside it. A student in senior one has drawn a circular design that just touches the three edges of the triangular design.

Task

a) Presentthedesignofthecardonasuitablegraph
b) Workoutthe areaofthecardcoveredbythecirculardesign

Question6

A new football coach of an English premier club is designing a new style of play for his team on a coordinate plane that represents a football pitch. The goalposts are located at points $A(2,4)$ and $B(2,-4)$.Thefootballcoachwantstheteamtopracticerunninga play to facilitate counter attack against the opponent where the centre back starts the ball at point $Q(-3,1)$ and throws the ball in a straight line to the wide midfielder at point $(4,-2)$.The football club has a total of 40 players. 28 of the players can defend, 14 can attackwhile2oftheplayerscanneitherattacknordefend.Aplayerwhocanbothdefend and attack receives a weekly bonus

Task

a) Thefootballcoachwouldliketopresenthisnewstyletotheboardofdirectorsofthe club, help him to address this challenge.
b) Writeanequationthatrepresentsthepathoftheball
c) Howmanyplayersreceivetheweeklybonus?

Question7

Your school has planted trees in a rectangular pattern to beautifythe school compound. Thedesignoftheplantedtreesshowstree Aatpoint(3,5),TreeBatpoint $(-2,4)$, Tree C at point $(1,-1)$ and Tree D at point $(-3,-2)$. The school wants to create a walking paththatconnectsallthetreesinthemostefficientwaypossibleandastraightroadthat passes diagonally from a tree at one corner to the tree in the other corner.

Task

a) Usingasuitablegraphshowthedesignoftheplantedtrees
b) Findthetotaldistanceofthewalkingpaththatconnectsallthefourtrees
c) Determinethelengthofthediagonalpathandwriteitsequation.

SECTION A

Answer **all** items in this section.

Item 1 *(20 scores)*

You decided to have a joint graduation party with your family members which will cost atotal of Uganda shilling four million. You are nearing a D-day and you want to find out whether you have enough required amount of money or not. And below are the contributions.

- your parents promised to contribute **30%** of the money.
- Your friends promised **10%** more than that your parents promised.
- And since you are the owner of the party, you contributed **20%** of the requiredamount.

When you went for shopping, you moved **6*km*** due East from your home and the **8*km*** dueSouth to reach the market, but the old man on the way told you that there is a shortest route you would use to reach the market directly to save time. And you made a booking of shillings, one million, seventy five thousand for all items required for the party.

Task

a) How far is it from your home to the market if you used the shortest route as the oldman told you?

b) Make a simple budget for the party according to the booking.

c) Do you have the required amount for the party? Justify.

d) How much would you remain with according to the budget?

e) What advise can you give the party organizing committee?

Item 2 *(20 scores)*

Your friend would like to continue with his studies at A-Level. But he is challenged with raising tuition of UGX 200,000. He is gifted with a skill of making jewelry craft. He has saved some money that can only help him buy glue and strings. So moves to different homes requesting for old calendars from which he makes jewelry. A necklace takes him an hour to make and sells a profit UGX 800. The pair of earrings takes him two hours to make but he gets a profit of UGX 2000. He likes to make a variety by making at least as many necklaces as pairs of earrings. He has approximately 40 hours per week for creatingjewelry. He also knows that the crafts vender wants sellers to have more than 20 items ondisplay at the training of the show, he likes to make a variety by making at least as many necklaces as pairs of earrings. Assuming he sells all his inventory. Help your friend to find:

Task

a) How many of each of the necklace and earrings he should make so as to make asmore profits as possible?

b) How much profit he makes a week?

c) How many weeks he requires to raise his tuition?

d) Which amounts will you choose to charge amongst the above and why choosethat?

SECTION B

This section has two parts; **I** and **IIPart I**

Answer **one** item from this part

Item 3 *(20 scores)*

So as to boost the mathematics performance in your class, the head of mathematics department want to motivate learners but she wants to set a pass mark such that **most** ofthe learners are awarded the mathematics test was given and the following are the marksscored. It was noted that 60% of the students failed.

86	85	56	59	67	62	63	50	91	62
56	27	50	54	80	61	52	52	16	28
66	46	55	58	56	77	26	40	42	51
35	45	68	51	49	40	93	84	79	63
52	53	25	93	27	71	66	52	30	12

The motivates as shown in the table below.

On the day of the academic assemble, the class teacher went for shopping and he found out that it is possible to buy 5 counter books and 7 rulers at a total cost of 11,800 from thestaff stationary shop or 6 rulers and 8 counter books at a total cost 14,000 from the same the staff stationary shop. The teacher is interested in buying 5 counter books and five rulers.

Task:

a) Help the head of mathematics department determine the score to base on.

b) Assist the departmental head find the pass mark for the class.

c) help the head of department to determine the items.

Item 4 *(20 scores)*

The Ministry of Health in Uganda is conducting a survey about the existence of malaria in three districts: A, B and C. The ministry will then come up with control measures if thechance of a person testing positive having visited at least one of the districts is above 50%. The Ministry has intentionally selected a sample of people who visited the three districts and tested them for malaria. The test results have revealed that 50 people who visited district A, 60 people who visited district B and 40 people who visited district C tested positive for malaria. Additionally, 20 people who visited both districts A and B, 10people who visited districts A and C, and 15 people who visited districts B and C tested positive for malaria. The Ministry has also discovered that 20 people who only visited district C tested positive for malaria and 40 people who visited the three districts tested negative for malaria.

Task:

(a) Determine the number of people that were tested for malaria by the ministry ofhealth.

(b) Calculate the probability of a person testing positive having visited at least one ofthe three districts.

(c) Advise the Ministry of health, with a reason based on calculation, whether to comeup with control measures or not.

Part II

Answer **one** item from this part

Item 5 *(20 scores)*

In preparation for S.4 prom party, you were chosen by your fellow candidates to be a chairperson of organizing committee. You moved from school to Town **A** for shopping of party items which is *160km* north of your school. From town **A** you moved west wards *150km* to town **B**. from **B** you headed to town **C** in the direction **S75^{O}W** which is *90km* from B. from **C** you continued to town **D** which is *148km* and south of **B**. but after you discovered that there is the shortest route you could use to move directly from school to town **D**.

In the shopping, you bought 400 chicken and each cost UGX 35,000. The farmer gave you 2% discount on each chicken. You also bought two identical jerry cans of cooking oil. The larger being of height 30cm and smaller of 25cm. the larger has a capacity of 10liters and the smaller 5 litters. And you bought 4 smaller and 2 larger jerry cans.

Task

a) With relevant sketch and calculations, determine how far you would move if you usedthe shortest route.

b) Determine the total cost incurred in purchasing chicken.

c) What is the maximum amount of cooking oil you bought for the party?

Item 6 *(20 scores)*

The youths of a certain village have been playing football on Mr. Kizito‟s land. Of recent,Mr. Kizito has decided to cultivate his land to plant cassava and the youths are no longer having where to play football from. On reporting to the chairperson and the aspiring M.P of their area, the chairperson has promised them land that measures 60m by 120m and theaspiring M.P, a tractor to level this land into a football pitch. The youths are therefore to contribute for the fuel to be used by the tractor.

Support material

- The dimensions of the pitch should be 100m by 50m.
- Scale 1cm represents 10m
- The cost of fuel by liter is 5000/=
- The tractor uses 10 liters every after 30minutes.

Task:

(a) Help the youth leader of the village to:

(i) Design the given piece of land.

(ii) Determine the area of the proportion of land that remains after theconstruction of the football pitch.

(iii) Decide on what the remaining land should be used for

(b) If the tractor levels 100m^2 in one hour, how much money should be raised by the youth to level the ground.

END

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 its 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

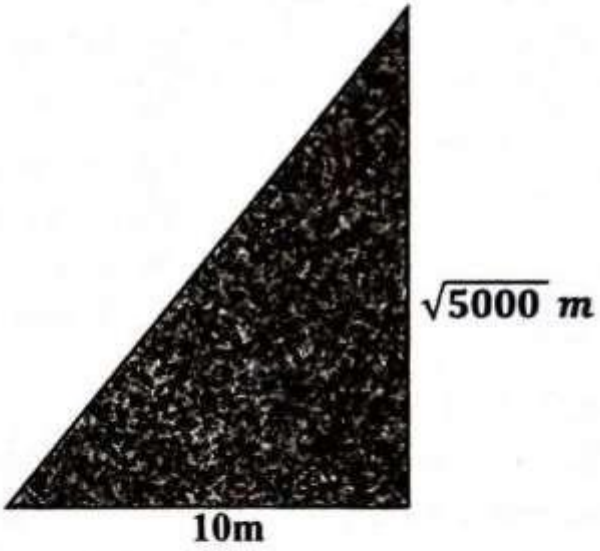
(c) A family with $(n-1)$ children is expecting another child. Help them determine the *extra cost of food*, per month, that will have to be met for the n^{th} child.

(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 $\sqrt{3200}\ m^2$, $\sqrt{1800}\ m^2$ *and* $\sqrt{9800}\ m^2$. 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.

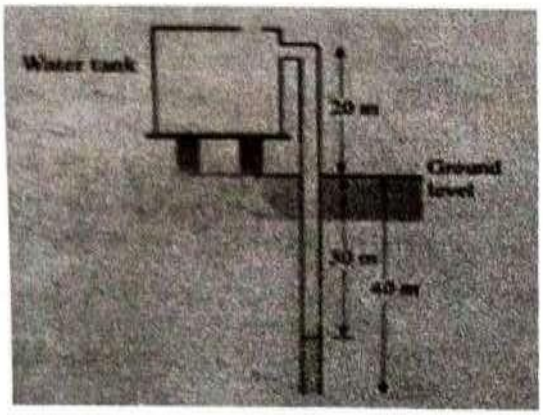
Task:

As a mathematician, help

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

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,,

a) determine the vertical length of the pipe
b) Ignoring the horizontal distance travelled by the water, determine how long will it take for the water to start entering the tank.
c) State the height of the water levels at intervals of 2 seconds after the pumping started.
d) How long will it take for the water level to rise from $-30m$ to 10m above the ground?
e) 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:

a) determine the cost of manufacturing the article in 2023.
b) 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 :

a) If you want to buy 23kg of the mixture, what would be the cost?
b) determine the ratio in which type A sugar will be mixed with type B sugar in order to produce a blend costing Shs. 5600.
c) 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 product are each made by two grades of labour, as follows:

	X hours	Y hours
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:

a). If x and y are the trips made by P and Q respectively, write down four inequalities satisfying the given conditions.

b). On the same axes, draw the graphs of the inequalities and shade the unwanted regions.

c). 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

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:

i. Write the matrix equation to show the cost of the purchase.
ii. 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.

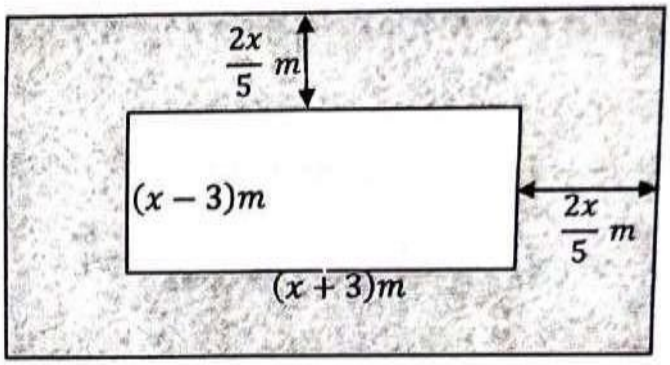
$x\,(m)$	0	0.25	0.5	0.75	1.0	1.25	1.5	2.0	2.5
$y(m^3)$		10.3	17.5	21.9		24.1	22.5		7.5

Task:

a) 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.
b) Using your graph, find the
   (i) two possible values for the depth of box when its volume is 15 m^3
   (ii)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.*

a) If the total area of the entire room is $315m^2$, calculate the value of x.

b) Determine the area of the carpeted margin.

c) 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 =74m, BC =48m, CD =56m, Angle ABC =81 ° and AB parallel to DC.

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

a) Using a scale 1cm to 10m, **construct** the plan of the plot.
b) 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
c) If L_1 and L_2 meet at M, a TV mast, **locate** M
d) **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 satify 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:

a) obtain a linear equation connecting x *and* y.
b) Suppose one of the recorded values of y is wrong, draw a suitable graph and identify the wrong value of y.
c) 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 $R(4,5)$.

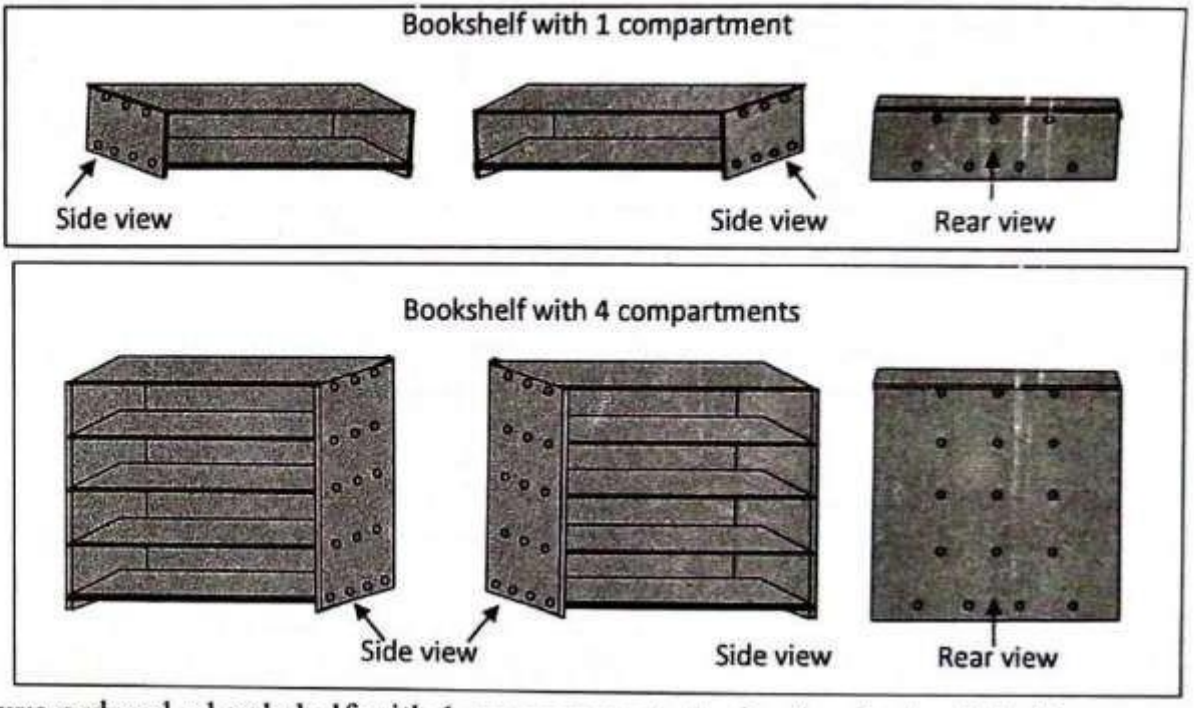
(a) The equation of road L_1 is
(b) Road L_2 has an equation given by
(c) The two road cross each other at the point
(d) The equation of another straight road that passes through R and is parallel to L_1 is given by
(e) The equation of another straight road that passes through point S (0 , 5) and is 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.

$$\_\_\_\_ + p(\_\_\_\_) = y$$

(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 one 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 be 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.

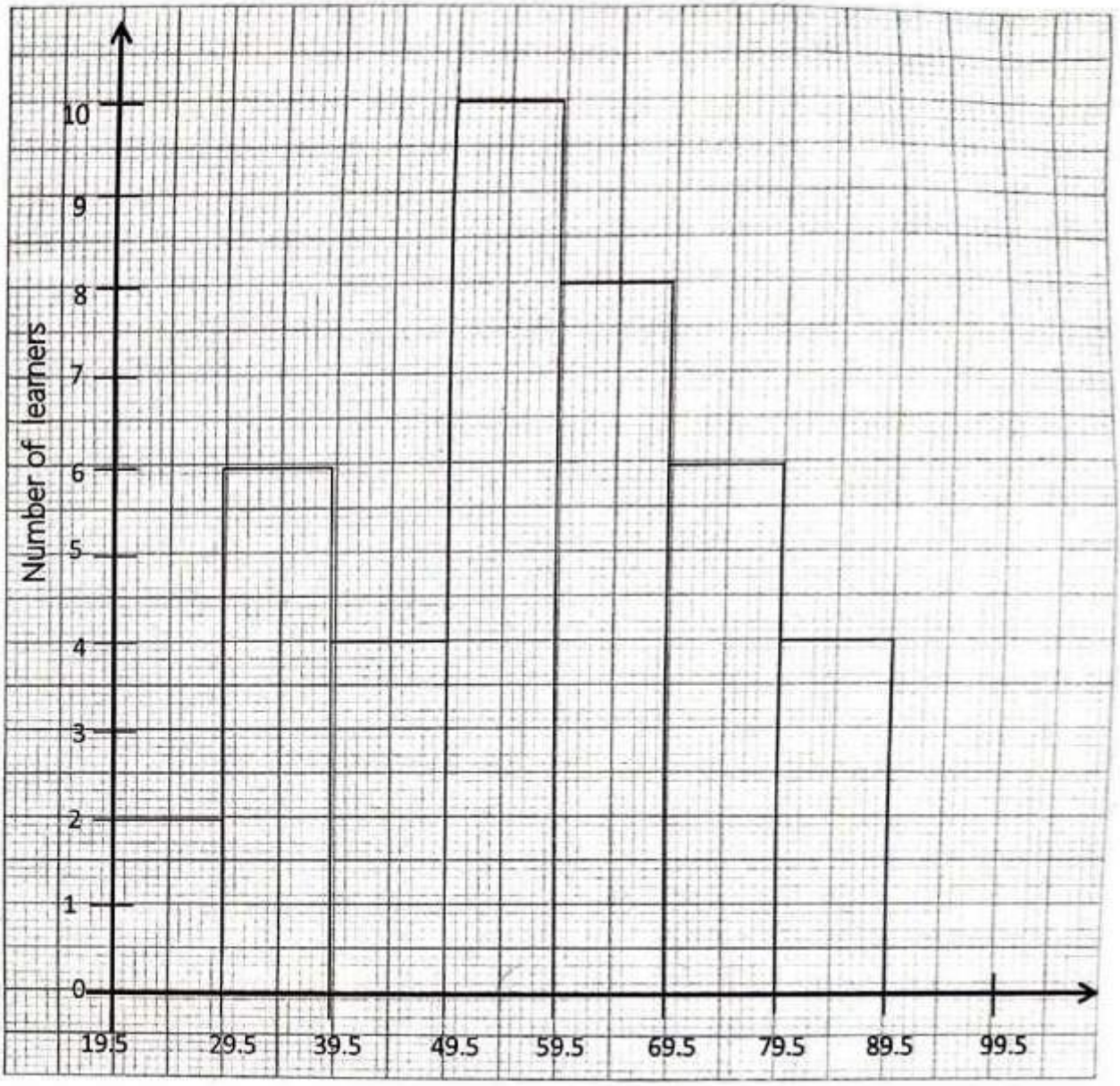
Task:

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.



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 x 2 matrix for questions answered

ii. 2 x1 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; $\mathbf{n(P)=13,\ n(M)=16,\ n(\varepsilon)=25,\ n(C)\ 15,}$ $\mathbf{n(P\cap C)=9,\ n(P\cap M\cap C^{I})=3,\ n(M\cap C)=11,\ n(M\cap C\cap P^{I})=3n(M\cap C^{I}\cap P^{I}).}$

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	December 2023		Due	Credited
Bal. B/F				16998.25	12403.25
60057 CTL	60722	January 2024	665	5320.00 532.00	5000.00
60722 CTL	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 12^0 *and* 19^0. 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 34^0 and the angle of depression of its foot is 62^0. 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.

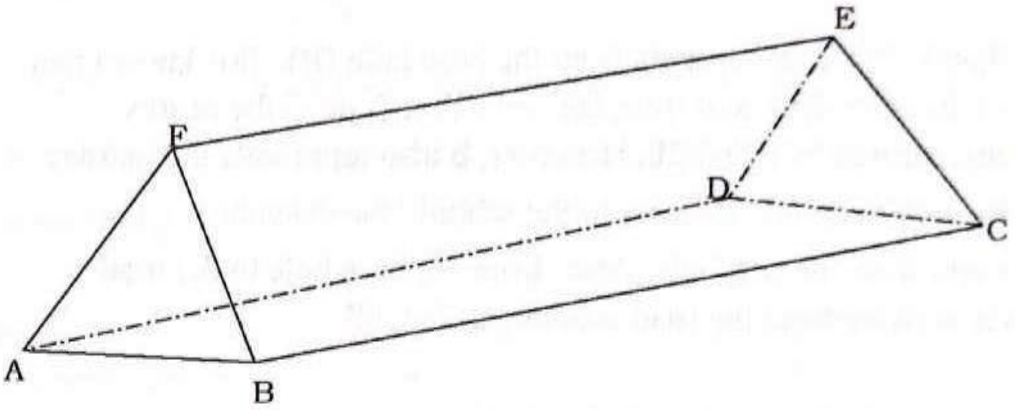
Given that the cost of hiring the pump is Shs. 12000 per day excluding the cost of diesel. The pump can consume 10 litres of diesel per hour, and the cost of diesel is Shs. 4700 per litre.

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

a) the number of days it takes to drain the swamp
b) 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.

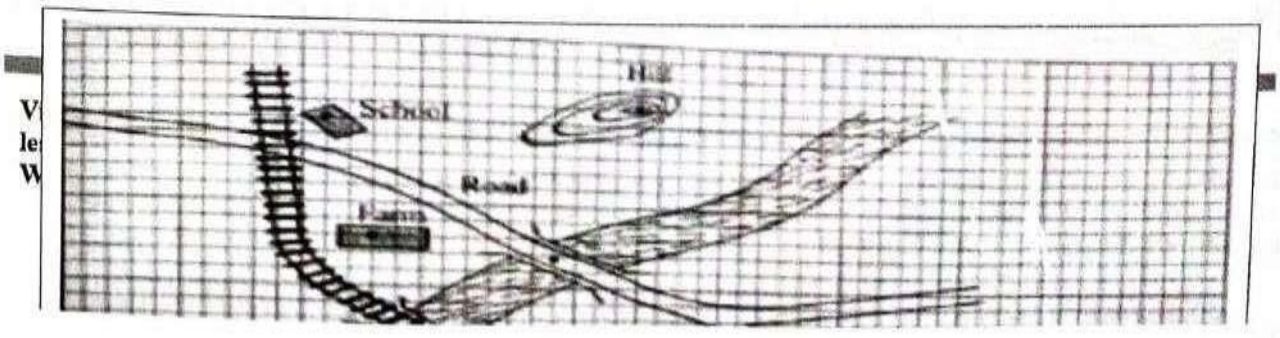


Given that the dimensions AB = 5m, $\overline{AF} = \overline{BF} = 3m$ *and* $\overline{BC} = 12.5m$.

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

a) total surface area of the roof.
b) volume occupied by the roof.
c) angle between the planes BCEF and ABCD
d) 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 **a** and 2**b**. However, **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 **a** and **b,** how would you present;

i. **BT**

ii. **TR**

iii. **SR**

iv. **SH**

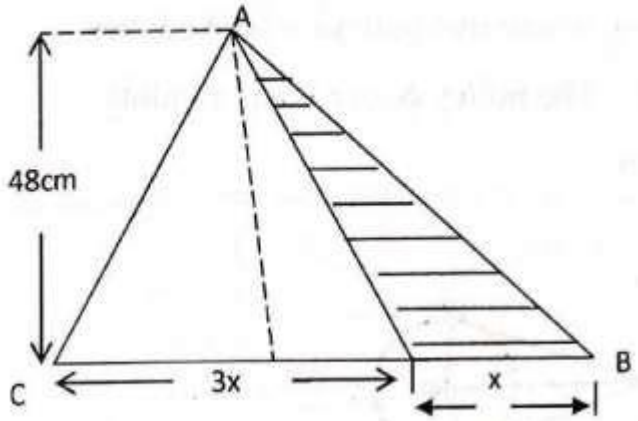
c) "S, R and H are such that they are all in a straight line", using vectors show that the statement is true.

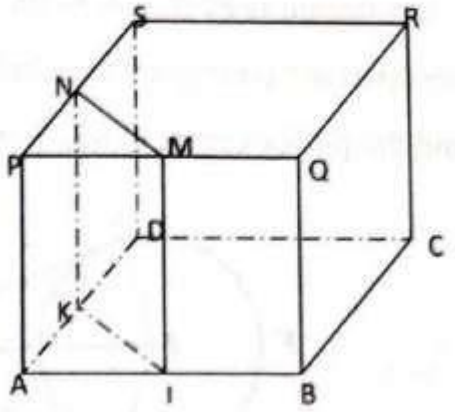
d) Given that $\mathbf{a} = \begin{pmatrix}3\\5\end{pmatrix}$, $\mathbf{b} = \begin{pmatrix}1\\0\end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix}11\\10\end{pmatrix}$ and that $\rho\boldsymbol{a} + \sigma\boldsymbol{b} = \boldsymbol{c}$, find the scalars ρ *and* σ hence determine $|\sigma\boldsymbol{a} - \rho\boldsymbol{b}|$

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 $1440cm^2$.

I **II**





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

Task:

a) Determine the

(i) area of the painted region in structure **I**.

(ii) A standard corrugated iron sheet is to be used to shelter the shaded region. if the iron sheet covers approximately 51.4cm^2. determine how nay iron sheets are needed, and work out the amount required if each iron sheet costs shs. 45000.

b) In Building structure **II** , determine the length $|KL|$

c) What is the angle between the faces?

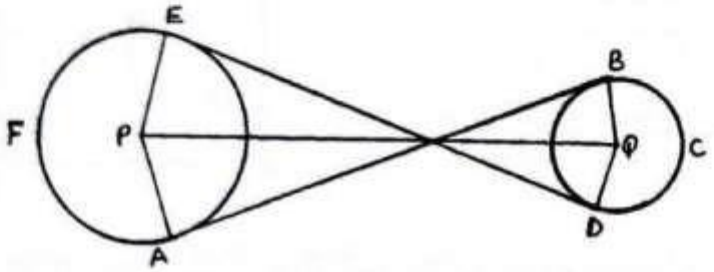
(i) $ABQP$ and the plane $KLMN$.

(ii) BDR and the base ABCD

d) if Point O is the point of intersection of the diagonals AC andBD. 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:

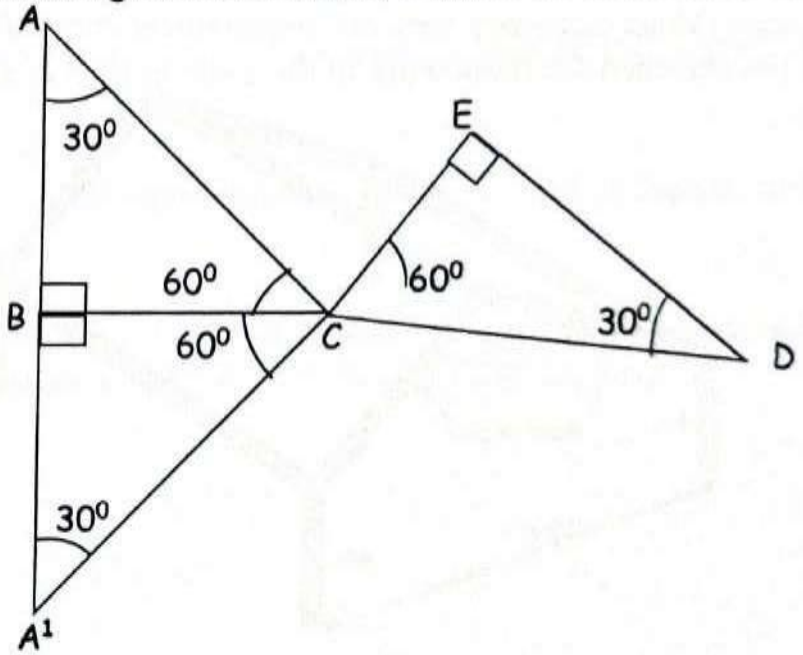
***Help the trader to calculate the*;**

a) profit or loss for each item

b) 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 30^0, 90^0 and 60^0 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^1BC?
(f) Describe fully the transformation that maps ABC onto A^1BC.

Item 37:

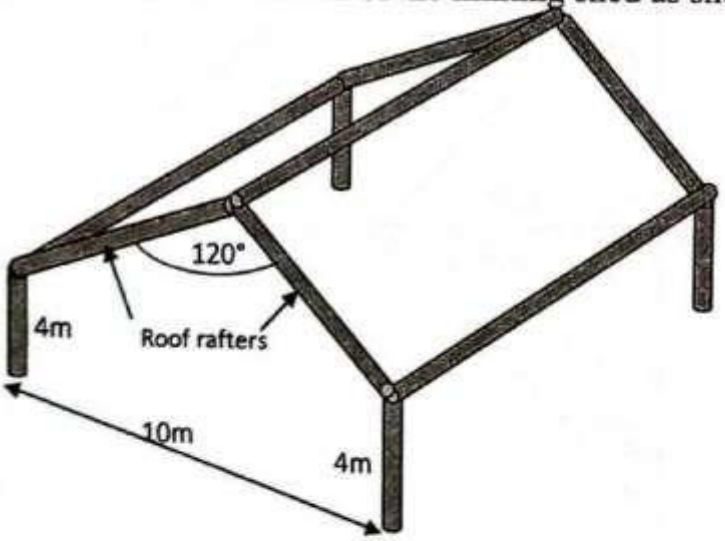
A regular pyramid with a square base, has a circle inscribed on the base of the pyramid. The edges of the square base of the pyramid are tangent to the circle. If the radius of the circle is 5cm, and each of the slant edges of the pyramid is 13cm;

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° 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

(a) 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)

(b) Use your graph to determine when the two cyclists passed each other and how far from B they were at this time.

(c) 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;*

a) the interest to be paid in 4 years
b) the total amount to be paid on completion of the loan
c) amount to be paid termly
d) 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 060^0 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 155^0 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,

a) 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 5Blue 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 $8kmh^{-1}$. 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 $2\frac{1}{2}kmh^{-1}$ 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.

ITEMONE:

A certain member of your family re-wrote each digit of his 4-digit **ATM** card pin from numbersystemten(baseten)toanothernumbersystemlessthanfour.Hedidthisinfear oftheft.Nowheissick in thehospital,hecanneithertalk norwritebutthemoneyon his account is needed to finance hospital bills. Here is how he wrote the pin: 12 20 22

10.Assumingthatyouhavebeenabletoencryptthe**ATM** pinforthefamilyandfundsare availabletotakecareofhim.Thehospitalhasanursewhotakeschecksonhimafterevery two hours and a medical doctor who checks on him after every four and half hours. Both medical personnel last checked on him together at **9**:**30am**. He was treated well and discharged and advised as follows. He was advised to spend three−eights of the day resting, one sixth of the day eating, two thirds of the remainder having a healthy diet and the rest of time of the day visiting the hospital for further checkup.

TASKS:

(a) (i) Whichnumbersystemdoyouthinkheusedtore-writethepinandwhy?

(ii) Usetheidentifiednumbersystemtohelpyourfamilymembersto regenerate the original pin.

(b) (i) Atwhattimedidwillboththenurseandmedicaldoctorcheckonhim again at the same time.

(c) Howmanyhoursofthedayinaweekdoeshehavespendonvisitingthe hospital.

ITEMTWO:

AproducewholesaledealerinKalerweFarmersMarkethasabroker whohasbeenhelping him order for his produce on his half. However he has been informed that his broker left for Saudi Arabia in quest for greener pastures, he is much troubled yet he wants to order for **1200 bags** of produce. He visited his business books and noticed that in January,when he bought **300 bags**, the cost of transporting each bag was **UGX4500** and in Februarywhen he bought **700 bags**, the costof transporting each bag was **UGX8500**. He has resorted to do the ordering and buying by himself.

In preparation for Easter he went to Luuka Village to buy some produce with his lorry. Unfortunately his Lorry broke down and opted for two vehicles a Pickup and an Isuzu Diana.Thepickupcantransport**18bags** whiletheIsuzuDianacantransport**30bags**. The number of bags to betransported mustexceed **120**.Each tripthe Pickup and Isuzu Diana makes cost **UGX240,000** and **UGX300,000** respectively yet he has allocated **UGX2,400,000**tocaterfortransport.

Thenumberoftripsmadebythepickupsshouldnotexceedthosemadebytheisuzu Diana by more than **2**.

TASKS:

(a) Determinethecostthewholesaledealerwillpayforthe **1200bags**.

(b) Helpthedearobtainhowmanytripseachvehiclewillmakeinorderto minimize the cost of transport.

ITEM THREE:

There is a quarantine of all cattle and goats in some parts of Western Uganda especially Mbarara District. The area honorable Member of parliament (M.P) wants to throw for his constituents a celebration party for the success of the Parish Development Model (PDM) andhehasinvitedalotofguests.Howeverduetthequarantinehecannotbuyanyanimals from Mbarara and he has been advised to go to Kayunga where cheap cattle and good Yoghurt can be found. He moves from Mbarara to Masaka which is **160km** North of Mbarara. From Masaka he moves west wards **150km** to Kampala. From Kampala he heads to Mukono which is in the direction $S75^{o}W$ which is **90km** from Kampala. From Kampala he heads to Kayunga which is **148km** and south of Mukono.

WhenhereachedKayungahebought**400**cowsandeachcosts**UGX850,000**percow.

Thefarmerandownerofthecowfirstgivesa**5**%discountoneachcowplusanadditional **10**%discountforanynumberofcowsboughtinexcessof **250**.

Inordertopackagetheyoghurt,heboughttwoidenticaltypesofbuckets.Asmallerbucket with a base radius of **30cm** and alarger bucket with a base radius of **50cm**. He intends to use the buckets to keep the Yoghurt for his guests. The capacity of the smaller bucket is **45litres**andheistobuy**4**smallerbucketsand**2**largerbuckets.

TASKS.

(a) DirectthehonorableMPontheshortestrouteheshouldtakeandtheshortest distance between Mbarara and Kayunga.

(b) Findthetotalcostheincurredinpurchasingthecows.

(c) WhatisthemaximumamountofYoghurtbeboughtforhis guests.

ITEM FOUR:

Holy Prayers Ministries International for a long time has been soliciting money to construct a church which can congregate all the church members. The Senior Pastor has a vision of a Hexagonal church which can fit exactlyin theplot of land available. He wants to know the actual cost of constructing the church. He also has to buy a Sino Truck to transportallbuildingmaterialsandrequirements.Thecontractorinformshimthatthearea of each triangle that can be formed from the hexagonal church will cost him **UGX128,000,000**.

He then proceeded to Nina Motors to buy the Sino truck. A brand new Sino Truck costs fourhundredeightymillionsoncash.Itcanalsobeboughtbypayingadepositofaquarter of the cash price value and either pay **UGX7.5 millions** weekly for **50 weeks** or pay **24.5millions** monthlyfor**15months**.Thepastordoesnothavetherequiredmoneyto obtain the Sino Truck on cash.

TASKS:

(a) Helpthepastordeterminethecostofthechurch.

(b) HowmuchextrawillhepayfortheSinoTruckandexplainwhy.*(25scores)*

ITEM FIVE:

A school head teacher isthinkingof how he canboostthe mathematicsdepartment ofyour school. He can either add another teacher or 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 islowerthanthatofthepreviouswhichwas **47**. Heaskedthedepartmenttogiveatestand the these were the student‟s marks.

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

Healsovisitedthelibraryandfoundoutthat theprevious‟scandidatesusedthreebooksfor there revision. Longhorn, Baroque or Maths Clinic. Fromthe librarian‟s records its is clear that all the candidates that did not use any book failed the subject greatly. Out of the **35** candidates this year **13** used Longhorn, **20** used Baroque and **17** used Maths Clinic.

9 used Longhorn and Maths Clinic, **3** used Longhorn and Baroque while **8** used Baroque and Maths Cliniconly.Therecordsshowthat **2** used allthethreebooks.Heobservedthat heshouldreplaceonebooktypeofthethreewithFountainpublishersincenostudentread it only alone.

TASKS:

(a) (i) Helptheheadteachergroupthemarkstomakeaninformeddecision one the fate of the department and defend it.

(ii) Displaythestudentsmarksingroupsonasimplestatistics diagram.

(b) (i) Helptheheadteacheridentifythebookheshouldreplaceandexplain why?

(ii) Findtheprobabilitythatastudentselectedfromtheclass failed.

ITEMSIX:

Three schools from a Gayaza region want to participate in the National Schools Football SportsGalatobeheldinLyantondedistrictplayground.Unfortunatelynoneoftheschools has a school bus and they want to hire a bus for the one day for the activity. The bus charges 25,000km per km moved. The three schools through there Sports master agreed to share the cost of the bus equally amongst them selves. One that day they hired a bus from your school in Gayaza and they set off at $\mathbf{4}:\mathbf{30}\boldsymbol{am}$ and increased the speed gradually to $\mathbf{90}\boldsymbol{km/hr}$ reachingMpigiat$\mathbf{6}:\mathbf{45}\boldsymbol{am}$. Fromtherethebusdriver maintainedthissame speed for $\mathbf{2}\ \frac{\mathbf{1}}{\mathbf{4}}$ hours reaching Masaka. From Masaka the he reduced slowly in speed reachingLyantondeat $\mathbf{9}:\mathbf{30}\boldsymbol{am}$.Thegamesstartedat$\mathbf{10}:\mathbf{00}\boldsymbol{am}$sharpandeachteam playedsixgames.

School Awon**3** games,drew**2** andlost**1** game.School Bwon**4** games andlost**2** games. School C won **2** games and drew **4** games. The organizers award three points for a win, one point for a draw and no point for a loss. They declared these schools the first three schools in order of their points they obtained from the games. They were to receive the price money of sixteen millions five hundred thousand shillings.

TASKS:

(a) Findhowmucheachschoolpaidforthebus.

(b) Decidethecashprizefor school.

ITEM SEVEN

A man intends to plant trees on the two sides of the road which leads to his land. On one side of the road, he is to plant a tree every after $\mathbf{5}\boldsymbol{m}$yet on the other side he is to plant a tree every after $\mathbf{6}\boldsymbol{m}$. at the start of the road, two trees are to be planted directly opposite each other. In the first phase of planting trees, he will plant trees, until another pair of tress is againdirectlyopposite.His land has an areaof $\mathbf{500}\boldsymbol{m}^{\mathbf{2}}$.Heplanstouse $\mathbf{25}\%$ oftheland to plant maize, one fifth of the land for beans and $\mathbf{205}\boldsymbol{m}^{\mathbf{2}}$dor growing ground nuts.

Tasks:

(a) Helpthemandeterminehowmanytreeseedlingsheneedstobuytojust plantthis first phase.

(b) Determinein$\boldsymbol{m}^{\mathbf{2}}$thesizeoftheland tobeusedforgrowingmaize.

(c) Determinein$\boldsymbol{m}^{\mathbf{2}}$thesizeofthelandtobeusedforgrowingbeans.

(d) Expressthearеatobeusedforgrowinggroundnutsinstandardform.

(e) Doyouthinkhepartitionedtheentirelandproperly?Giveareason.

ITEM EIGHT

Amathematician gaveyourfriend acarpenteratask ofmakingarectangularground floor of a rabbit house. The length of the house is to be $(\boldsymbol{x}+\mathbf{3})\boldsymbol{m}$ and the width is to $\boldsymbol{ym}$. Its perimeter should be $\mathbf{25}\boldsymbol{m}$ and its area msut be $\mathbf{25}\boldsymbol{m}^{\mathbf{2}}$. The mathematician adds that he needstheworktobefinishedinonedaybuthehasevercontracted $\mathbf{3}\boldsymbol{men}$ workingatthe

samerateand theyonlymanaged to workon $5m^2$.Tobegiven this contract,yourfriendis required to make a clear diagram showing the numerical sizes of the length and width but fails to do so and comes to you for help.

Tasks:

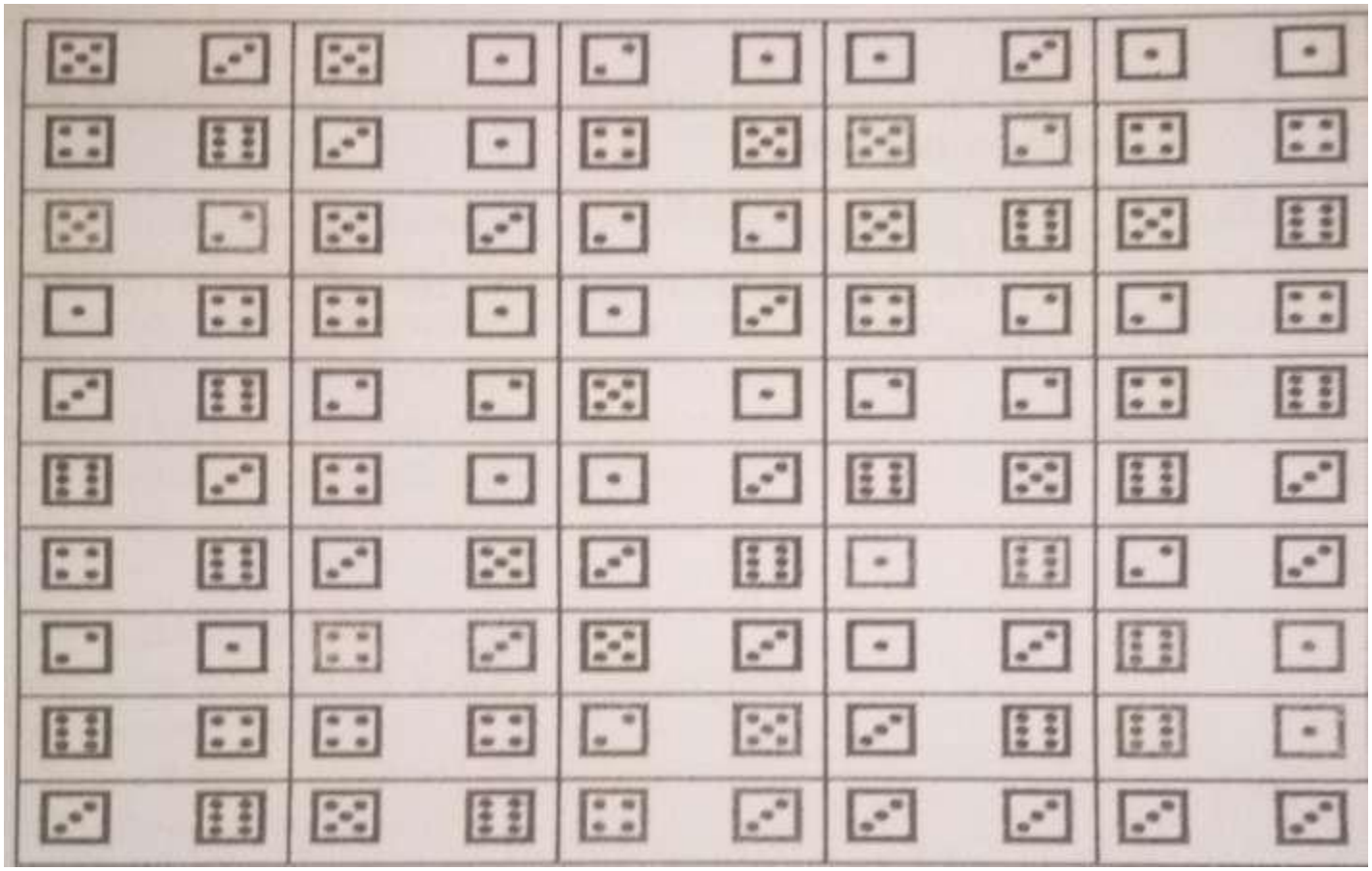
(a) (i) Determinethelengthandwidthofthefloortobeoccupiedbythe house.

(ii) Makeasketchoftheflooryourfriendcanpresenttothemathematiciantoget the contract.

(b) Determinethenumberofworkerswhoareneededtocompletethehouseiftheyall work at the same rate as the group the man has ever used.

ITEMNINE

A friend of yours wanted to participate in the National Ludo Champions competitions. During his practice, he rolled a die several times and kept on taking a picture of each occurrence.Heneedstofindoutwhetherhewillcompetefavorablybutheisunabletodo so. He gives you the diagram below showing his scores so that you can guide him.



Tasks:

(a) Usetheinformationaboveandclearlyshowhowtodeterminethescorewith the highest chance of occurring on top. Which score is it?

(b) Findtheprobabilitythatanoddnumberoccurredwhenthediewas rolled.

(c) Presenttheinformationoftheabovescoresonastatisticalgraph.

(d) Willyourfriendcompetefavorablyinthecompetitions?Giveareason.

ITEMTEN

Anorganizationwantstobuildaschoolinacertaincommunity.Belowwerethereasons they identified as to why children were not schooling.

A=schoolisboring. **B**=noschoolfees. **C**=wewant to work.

They carried out research on a sample of **50** children in that community to find out which reasonhasthehighestprobabilityamongsttheaboveandhencebaseonthattoeitherbuild the school or not. Children gave one reason, others gave two and the others gave three as shown below.

A	B,C	B	A,C	A	B,C	B	A,C	A,B,C	B
C,B	B	B,C	A,B,C	A,C	B	C	B	C	B
B	A,B,C	B,A	A	B	A	C,B	A,B	B,A	C
C	A,C	B,A	B	C,B	C	C	A	B	B,C
A,C	B	A	A	C	B,A	C	B	A	A,C

Tasks:

(a) Presentthedatainsuchawaythatthetotalresponsesforeachreasons**A**,**B**and **C**respectivelyareclearly shown

(b) (i) Whichreasonhasthehighest probability?

(ii) Whatisthe probability?

(iii) Basingonthevalueofprobabilityshouldtheybuildtheschoolornot? Give a reason for your answer.

ITEM ELEVEN

A carpenter is re-known for crafting traditional wooden doors with elaborate geometric patterns. The carpenter wishes to make a door with a circular design at its center. The carpenterneedstoensurethedesignfitsperfectlywithintherectangularframeofthedoor. The door frame available is rectangular with dimensions **2.5meters** in height and **1.5meters** inwidth.Thecirculardesignshouldbetouchingthetwoparallelsidesofthe door frame. Vanish is packed in tins of a litre and the cost of one litre of vanish is ***UGX*9,000**.Itisknownthatonelitreofvanishcanbeusedtopaintonesquare meter.

Tasks:

(a) (i) Helpthecarpenterdeterminehowmuchofthedoorwillbecoveredby the circular design so that it fits perfectly within the door frame.

(ii) Willonetinofvanishbeenoughfor thecirculardesign?Giveareason for your response.

(b) Withareason(s),helpthecarpenterdeterminehowmuchwillbespenttobuy vanish that will paint the entire front face of the door.

ITEM TWELVE

Youareanathleteandsooncompetingwithsomeone.Youwantedtotestyourchancesof winning the racebytesting yourspeed and time in relation tothat of your competitoryou started to run at **4**:**50pm**.Fromyour home where you started from, you ran a distanceof

5km north−westtoplace**P**,thenfrom**P**,youturnedsouthandran**4*km*** untilyouwereat place **Q** that is west of your home and then ran back and arrived at **5**:**12pm**. Your competitor ran the same distance during training at a speed of **10m/s**.

Tasks:

(a) Whatisthetotaldistancethatyouran?

(b) Whatisthetotaltimeyoutooktorunthatdistance?

(c) Howfastwereyou?

(d) (i) Doyouthinkyouwillwintheraceornot?

(ii) Whydoyouthinkthat way?

ITEM THIRTEEN:

A school head teacher isthinkingof how he can boostthe mathematicsdepartment ofyour school. He can either add another teacher or buy more books or both. He has decided that he will do both if the average performance for this year‟s performance for the 50 students islowerthanthatoftheprevious whichwas**64**.

Heaskedthedepartmenttogiveatestand the these were the student‟s marks.

86	30	26	64	87	47	49	26	43	25
45	38	44	56	59	52	76	27	89	46
90	57	73	48	58	89	51	32	56	88
66	62	52	67	69	68	49	92	66	95
54	74	32	39	35	36	69	50	71	92

Healsovisitedthelibraryandfoundoutthattheprevious‟scandidatesusedthreebooksfor there revision. Longhorn, Baroque or Maths Clinic. Fromthe librarian‟s records its is clear that all the candidates that did not use any book failed the subject greatly. Out of the **35** candidatesthisyear**13**usedLonghorn,**20**usedBaroqueand**17**usedMaths Clinic.

9 used Longhorn and Maths Clinic, **3** used Longhorn and Baroque while **8** used Baroque and Maths Cliniconly.Therecordsshowthat **2** used allthethreebooks.Heobservedthat heshouldreplaceonebooktypeofthethreewithFountainpublishersincenostudentread it only alone.

TASKS:

(a) (i) Helptheheadteachergroupthemarkstomakeaninformed decision one the fate of the department and defend it.

(ii) Displaythestudentsmarksingroupsonasimplestatistics diagram.

(b) (i) Helptheheadteacheridentifythebookheshouldreplaceand explain why?

(ii) Findtheprobabilitythatastudentselectedfromtheclass failed.

ITEM FOUTRTEEN

St. JULIAN is to transport its S. 4 students for fieldwork in Kasenyi.All the 400 students aretobetransportedusingeithercoastersorbuses.Eachcoastercancarry40peoplewhile eachbuscancarry80people.Thetransportdepartmentof theschoolhasonly8driverson duty and up to four coasters.If the cost of hiring a coaster is shs. 150,000 and that of hiring a bus is shs. 300,000.

While in Kasenyi their geography teacher Mr Kefa visited Mr Sembatya‟s shop fromwhichhefoundthat threeshirtsandtwotrouserscostshs.105,000atMr.Sembatya‟s shop. Two shirts and five trousers cost shs. 180,000 at the same shop;

Task:

(a) (i) Writedownthefiveinequalitiesrepresentingtheabove information.

(ii) Representtheinequalitiesonagraphpaper.

(iii) Find the possible number of coasters and buses that can be used and hence determine the minimum cost.

(b) Findthecost of;

(i) eachshirtandeachtrouser.

(ii) threeitemsofeachtypeatthe shop.

ITEM FIFTEEN:

Simon is the district inspector of schools in Butambala district found that his causal workersuseonethirdofhisfarmforbananas,onequarterforcoffeeandtwofifthofthe remainder for mixed farming.She still has some six acres of unused land.

Buddo S.S has a student population of 1200 students.On a particular day Simon invited theentirefora, $^{1}/_{5}$oftheboysand $^{1}/_{4}$ofthegirlswenttoWAKISSHAresourcecentre for a sports meeting.If 936 students were left behind.

ThepriceofSimon"shousewasvaluedat45millionshillings.Itincreasedby25%after the first year but in the second year, the value of the house depreciated by 10%.

Task:

(a) Findthesizeofhis farmandclearlyillustrateitonadiagram.

(b) Findhowmanymoreboysthangirlsattendedthemeeting.

(c) Findthevalueofherhouseattheendofthesecond(2^{nd})year.

ITEM SIXTEEN:

Kampala (K) and Arua (A) are about 450km apart.At 7:30 a.m, a bus starts from Arua and moves towards Kampala (K) at a steady speed of 100km/hr while a lorry starts from Kampala (K) an hour later moving at an average speed of 60km/hr to Arua (A).At 10.00 a.m, the busisstopped attown C bypoliceand ordered to reduce speed.After 30 minutes atC,itresumesitsjourneyatareducedaveragespeedof50km/hruntilitreachesKampala (K).

Task:

(a) Statethedifferenceintimewhenthetwovehiclesarriveattheirdestinations.

(b) DeterminewhenandatwhatdistancefromAruathetwovehicles meet.

(c) Findtheaveragespeedofthebus.

ITEM SEVENTEEN:

You are only two children in the family and the chairperson of your village has come to your home to register the details of you and your sibling. Unfortunately both parents are notaroundandyouhegivesthemacalltofindyourpresentages.Themotherinformshim that the two ages differ by 4. the father informs him that the sum of the squares of your ages is 136.

Your neighbor makes a rectangular flower bed by taking two meters off its length and adding three meters to its breadth. Byso doing, he increases the area by 20 square meters. Mosesis1.5mtall and standingontopofabuilding 34mtall.In astraight linefromwhere he is standing he can see a car and bicycle at angles of depressions of 50^{o} and 65^{o}respectively.

A magician on Easter day organized a presentation in your village to entertain the village. Hehadabadthat containsxredballsand(x -8)whiteballs.Iftheprobabilityofdrawinga redball is $\frac{2}{3}$.

Tasks:

(a) Helpthechairpersongettherightagesofyouandyoursibling.

(b) Whatisitsfinalareaoftheflowerbed?

(c) Howfaristhebicyclefromthecar?

(d) Findthenumberofballsinthebag.

ITEM EIGHTEEN

The cost of manufacturing Blue band in a factory is determined by the components milk x and flavor y**.**If the constraints for the production are$3y+2x\leq 15, 2x-3y\leq 5, x\geq 1andy\geq 0$. The factory has only chicken and goats. When the manager counted the heads of the stock inthe farm, the number totalledto200. When thenumber oflegs was counted, the number totalled to 540.

Task

(a) Giventhatthecostfunction fortheproductionofbluebandis $c=x+2y$findthe;

(i) Minimumcost

(ii) Maximumcost

(b) Howmanychickenswerethereonthefarm?

ITEM NINETEEN

Yourparentsareorganizingtocelebrateyour18^{th}birthdayandwantottobeamemeorable one. They went to Akamwesi mall which has a CINEMAX and it has two tickets.

Ticketstoaplaycost$9 dollars$ foradultsand$5 dollars$ forchildren.Iftheshowsold180 tickets and earned 1380 dollars, George your brother has neen planning for this birthday for three weeks. He buys the followingitemsinthreeweeks.Weekonehebuys2packetsoftea,2tinsofmargarine, 3 kgof sugarand4 packetsof biscuits.

Week twohe buys2 tinsof margarine , 3 kg

of sugarand4 packetsof biscuits . Week three he buys2 packetof tea , 2 kgof sugar and 3packetsofbiscuits.Apacketofteacostsshs 1,000 ,atinofmargarinecostsshs 2,500,akilogrammeof sugarcostsshs 3,500and apacketofbiscuitscostsshs2000. Your parents then demarcated the land they are to use for the party and plan to demarcate

it.representedtheplotoflandheinheritedusingthefollowinginequalities.$40x+60y\geq 480$

…(i) $30{,}000x+45{,}000y<600{,}000$…(ii) $x\leq 12$…(iii) $y\geq 2x$…(iv)

Hewantstofenceitusingpoles(x)andbarbedwire(y)and thecostfunction isgiven by

$C=45000x+30{,}000y$

Task;

(a) howmanyofeachtypeofticketswere sold?

(b) Findhistotalexpenditureinthethreeweeks.

(c) findthemaximumcost.

ITEM TWENTY

Thelength ofarectangularplotofland exceedsthewidthby$7ft$ andits areais $60sq.ft$. Three business partners Wambusa, Aisha and Wekesa contributed Shs 300.000, 500.000

and 700.000 respectivelytostart abusiness.Theydecided that$\frac{1}{3}$oftheprofit wastobe ploughedbacktothebusiness,$\frac{1}{5}$oftheremainderwould bekept foremergencies andthe

resttobesharedintheratiooftheircapitalcontributions.Inthatyeartheprofitrealized was one and a quarter times that of capital.

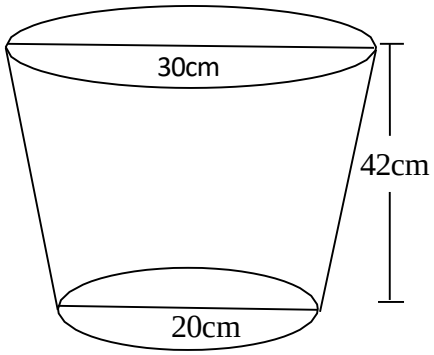
Task:

(a) Findthedimensionsoftherectangle

(b) Determinetheamountreceivedbyeachpartnerthat year.

ITEMTWENTYONE

A bucket is in shape of a frustrum with an open end of diameter 30cm and a bottom diameterof20cm.thebucketwhichis42cmdeepisusedtofillanemptycylindricaltank of diameter 1.8m and Height 1.2m



Takingπ=3.142.

Threehundredandsixtylitresofahomogeneouspaintismadebymixingthreepaints **A**,B and C. The ratio by amount of point **A** to point **B** is 3:2 and that of **B** to C is 1:2. Paint A costs shs 1800 per litre paint **B** costs shs 2400 per litre and paint C shs 1,275 per litre

Task:

(a) (i) Determinethecapacityofthebucketinlitrescorrectto3dp.

(ii) Thecapacityofthetankinlitrescorrectto2dp.

(iii) Thenumberofbucketthatmustbedrawntofillthe tank.

(b) (i) Theamountofeachpaintinthe mixture

(ii) Theamountofmoneyneedtomake1litreofthe mixture

(iii) Thepercentageprofitmadebysellingthemixtureatshs2,210perlitre.

ITEMTWENTYTWO

Thereareveryfewteacherswhohavethreeteachingsubjects.Asurveywasdoneinyour schoolanditwasfoundthattheschoolhasateachingstaffof22teachers8ofthemteach mathematics, 7 teach physics and 4 teach Chemistry. Three teach both mathematics and Physics and one teaches Mathematics and Chemistry. No teacher teaches all the three

subjects.ThenumberofteacherswhoteachPhysicsandChemistryisequaltothatofthose who teach Chemistry but not physics.

Intheschoolstaffroomthereareetwosimilarcansthahavedifferentheights.One6cmand the other one 9cm. If the surface area of the larger can is 840 cm^2.

Task

(a) Findthenumberofteacherswhoteachnoneofthethree subjects.

(b) Findtheprobabilitythatateacherpickedatrandomteachesonlyonesubject.

(c) Findthesurfaceareaofthesmallercan.

ITEMTWENTYTHREE

The traffic police arrests all motorists travlelling along Kampala-Jinja highway with a speedgreaterthan80km/hr.

Amotoristtravelledthefirst90kmatanaveragespeedof60 km/hrandforthenext3 $\frac{1}{2}$ hourshetravelledatanaveragespeedof80km/hr.

Onacertaindayacartravellingat$s$km/hrcanbestoppedwithinadistance$d$metres where $\boldsymbol{d}=\frac{\boldsymbol{s^2}}{\mathbf{200}}+\frac{\boldsymbol{s}}{\mathbf{10}}$ Thetablebelowgivessomevaluesof$\boldsymbol{d}$against$\boldsymbol{s}$.

s	0	10	20	30	40	50	60	70	80	90	100
d	0			7.5				31.5			60

(a) Findoutifthemotoristwillbe arrested.

(b) Findthestoppingdistanceforacarmovingat46km/hrandat85km/hr.Alsofind the speed at which a car is moving if its stopping distance is 35 metres.

ITEMTWENTYFOUR

In a survey 100 people were asked which form of transport they used. 46 people only used bicycles(M).21peopleonlyusedbuses(N).11peopleonlyusedmotorbikes(P).5people used buses and bicycles but not motor bikes. 3 people used buses and motor bikes. 6people used bicycles and motor bikes. 9 people declined to respond.

Customsdutyandpurchasetaxareleviedoncertainimportedgoodsas Customs duty = 35% of the value of the good.

Purchasetax=15%of(value +duty)

Task

(a) Findthe;

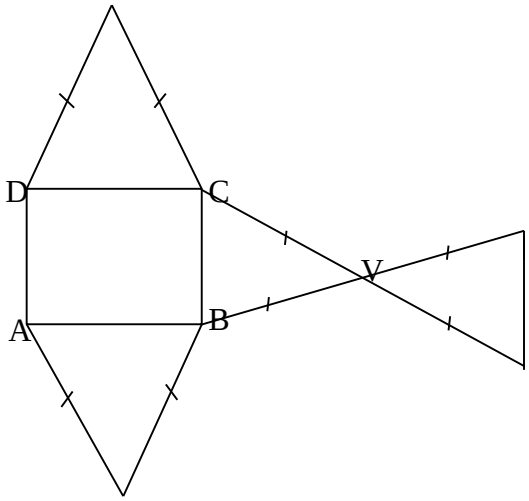
(i) numberofpeoplewhousedallthethreeformsoftransport.

(ii) percentageofpeoplewhousedonlytwoformsof transport.

(b) Findthetotalamountleviedonadiscodeckvaluedat1.7millions.

ITEMTWENTYFIVE

ThefigurebelowshowsanetofarightpyramidwitharectangularbaseABCD.

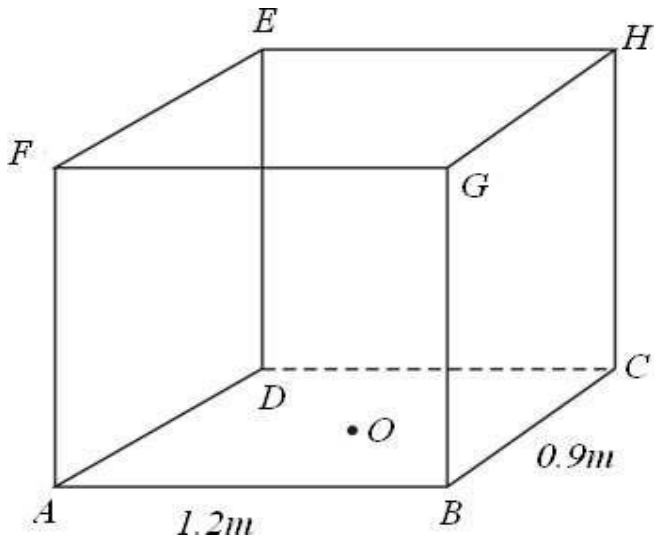


If**V**isthevertexofthepyramid **VABCD**abovethebase**ABCD**, and the slant sides of AB=16cm,BC=12cm, each triangle measure 26cm.

a) Drawtherightpyramidshowingclearlypoints VABCD,
b) Findtheheightofthepyramid.
c) Findtheareaofplane VAB
d) Findtheanglebetween;
   (i) EdgeVAandthebase
   (ii) FaceVABandthebase.

ITEMTWENTYSIX

Mr kyeswa is buying aconatinertostartahardwareinKisoobaVillagetosellbagsof cement.Eachbagoccupiesanareaof0.8cubicmeters.Thecontaineris$ABCDEFGH$with $AB=12m,BC=9m,ADEF$isasquareand$O$isthepointofintersectionofACandBD.



(a) Findthedistances;

(i) BE,

(ii) OH.

(b) Determinetheangleformedbetween;

(i) lineBEandthe base,

(ii) planeBDHandthebase.

(c) Calculatethecapacityofthecuboidaboveinlitres andhowmanybagscanbe accommodated.

ITEMTWENTYSEVEN

Pamungu bought a car in January 2017 from his friend at shs. 12,500,000. If the car depreciatesatarateof10%perannum.CalculatethevalueofPamungu‟scarbyJanuary 2020.

AUgandantouristleftGermanyforUgandathroughSwitzerland.WhileinSwitzerlandhe bought a watch worth 54 Deutsche Marks (Germany currency).

1SwissFranc=1.28DeutscheMarks

1SwissFranc=1,350Ugandan Shillings

AsecondaryschoolteacherasarequirementbythegovernmentpaysPAYEeverymonth according to the tax structure below.

Income(shs)per month	**Taxrate(%)**
01-50,000	5%
50,001-100,000	9.5%
100,001-180,000	15%
180,001-300,000	18%

300,001-400,000	23%
400,001-500,000	30%
Above500,000	35%

TheteacherearnsShs.760,000andhisallowancesinclude

Marriage allowance - shs.50,000permonth

Waterandelectricity - shs.60,000permonth

Housingallowance - shs150,000per month

Medicalallowance - shs.300,000perannum

Transport allowance - shs.3,000 per day Paying

for insurance and relief - shs.180,000perannum

Familyallowanceforonlythreechildren.Forchildrenintheagebracket 0 to 10 years, shs 12,000 per child,

Between10-15yearsshs.9000perchild 15 years and above shs 5000.

Giventhattheemployeehasfivechildren,twoofwhomareagedbetween0and10,the other two aged between 10 and 15 while the other 18 years. (A month has 30 days

(a) Findthevalueofthewatchin;

(i) SwissFrancs

(ii) UgandanShillings.

(a) Determinetheteacher‟sNet-income

(b) Determinethepercentageofhisgrossincomethatgoestotax.

SECTIONA

Answer**all**itemsinthis section.

Item1. *(20scores)*

Number plates, also known as license plates or registration plates are typically manufactured using a combination of digital printing technology and specialized equipment. Your guardian has three taxis that travel along Kampala-Gulu high way registered $\boldsymbol{UBA\ 443T}$, $\boldsymbol{UBB\ 223R}$ and $\boldsymbol{UBD\ 132V}$, the numerical digits on the number plateswerefoundtobeinquinarybaseandheisinterestedin knowingwhichvehiclehas digits which are a multiple of three so that he can paint that vehicle with a red color for easy identification.

All thethree taxisleave Namayiba taxipark at $\boldsymbol{6{:}00am}$ for their first route to different destinations,howevertheyentertheafteratdifferenttimeintervals.Thefirsttaxienters the taxi at $\boldsymbol{8{:}30am}$, the second taxi at $\boldsymbol{9{:}00am}$ and the third one enters at $\boldsymbol{9{:}15am}$.

The fuel consumption rate for all the three taxis is the same and it was observed that when anyofthetaxihadcovered $\boldsymbol{60km}$,thefuelconsumedcosted$\boldsymbol{UGX160{,}000}$ andwhenthe taxi had travelled $\boldsymbol{15km}$, the fuel consumed was $\boldsymbol{UGX\ 40{,}000}$.

Task:

(a) Helpyourguardianknowwhichtaxihewillpaintthered colour.

(b) AtwhattimewillthethreetaxisenterNamayibataxiparkallatthesametime.

(c) Whatistheestimatecostonfuelconsumptionifthetaxiplanstotakeyourschool for a tour to Jinja which is approximately 90km from Namayiba taxi park.

Item2. *(20scores)*

Afamilyofyourfriend agreedtohavefamilyplanningsothattheycaneffectivelyplanfor their children. They agreed to have a child spacing of two years so that their business of drinks (water and soda) can pick up with time. They had their first born in 2020.

Attheirdrinksshop theyselltwotypes ofwaterbottles,typeAand typeBand theymake the water bottles by themselves. The same equipment can be used to make either water bottle.In making type Awater bottles,oneman can supervise10 machines andthis batch

willgivethemaprofitof$\boldsymbol{UGX}$**50,000**perday.TypeBwaterbottlesyieldaprofitof

$\boldsymbol{UGX}$**250,000** adayusing25 machinesand8men.Thereare200machines and40men available.

Theproducedwaterisparkedincartoonsandyourschool hadathanksgivingfunctionand budgeted for 5 boxes of water *type A* and 4 boxes of water *type B* at a cost of

$\boldsymbol{UGX}$**92,500**. However,thebodabodamanthatwassenttobuythewaterbrought4 boxes of water *type A* and 5 boxes of water *type B* and was given a demand note of

$\boldsymbol{UGX}$**4000**asbalanceremainingtobepaidforwhathebought.

Task.

(a) Inwhichyeardoyouthinkyourfriend‟sfamilyhavetheirsixth born.

(b) (i) Showthefeasibleregionoftherelationona Cartesianplane.

(ii) Helpyourfriend‟sfamilydeterminethemaximumprofittheywillreceive from the sale of the water bottles.

(c) Whatdoyouthinkistheactualpriceofeachcartonofeachwatertype.

SECTIONB

Thissectionhastwoparts;**I**and**II Part I**

Answer**one**itemfromthis part

Task3. *(20scores)*

Your school demonstration farm holds monthly sales of cattle on the first Saturday of everymonth.Howthefarmcaretakerhasnoticed thatthereis atrendofthesameanimals remaining un sold every month because the farm attendants just select the animals which are near, and so he wants to obtain the average weight of all animals at the farm. He has agreed that this month all animals with a weight greater than the average weight of the animals be sold each at UGX 890,000 per animal. The data in kg of the weights of the animals is given in the table below.

86	85	56	59	67	62	63	50	91	62
56	27	50	54	80	61	52	52	16	28
66	46	55	58	56	77	26	40	42	51
35	45	68	51	49	40	93	84	79	63
52	53	25	93	27	71	66	52	30	12

Additionallyheisgoingtosell15goats,25sheepand10duckseachat$\boldsymbol{UGX\,140{,}000}$ pergoat,$\boldsymbol{UGX\,215{,}000}$persheepand$\boldsymbol{UGX\ 36{,}000}$perduck respectively.

Task

(a) Givingareasonbasedoncalculations,usingthedatacollected,suggestthemost minimummass that can be accepted tobesold on this first Saturdaythis month.

(b) HowmanycattlewillbesoldonthisfirstSaturdaythismonth.

(c) Helpthefarmcaretakerknowhowmuch moneyheexpectstoget fromthesales this month.

Item4. *(20scores)*

Malaria is a life threatening disease spread through mosquitoes that feed on humans, with symptoms such as high fevers and shaking chills. As one of the top diseases impacting Ugandans, it is at a risk to cover 90% of the Ugandan Population and is a leading cause of sickness and death especially in children. The mosquitoes breed easily in bushy areas and instagnantwaterandinordertopreventit,healthofficialhaveadvisedthatwesleepunder a mosquito net, slash all the bush around us and remove all stagnant water around us.

In a bid to curb the disease, health officials from your district visited your village to distributemosquitonets,howevertheyfoundthatsomehomeswere harboringmosquitos around us.

Fifty two homes were visited in your village, it was found that only four homes had mosquito nets, had cleared all the bushes around and had no stagnant water around and thus had managed to control malaria, the other homes had problems of malaria. It was found that *equalnumber*ofhomes had neithermosquito netsnorhadslashed theirbushes, ofwhich*twelve*homeshadnomosquitonetsandhadnotslashedtheirbushesroundthem, thusharboringmosquitoes.*Twentyfour*homesalltogetherhadstagnantwateravailable in

theirsoakpitsandopenmanholes,ofwhom*eleven*hadneithermosquitonetsnorremoved thestagnant water. *Thirteen* homes hadbushes around and alsohad stagnant water present in their homes. *Eight* homes had no single mosquito net, had huge bushes around and had stagnant water in their homes.

Task:

(a) Determinethenumberofmosquitonetstobedistributed,ifeachhomethatlackeda mosquito net was to be given exactly four nets.

(b) Calculatetheprobabilitythatahomevisitedneededalsotohavetheirbushes slashed.

(c) Displaythedataonastatisticaldiagram.

(d) Advisethedistrictofficialswithreasonbasedoncalculationstocomeupwith control measures for malaria.

PartII

Answer**one**itemfromthis part

Item5. *(20scores)*

National Medical Stores (NMS) is a government parastatal mandated to procure, store and distribute essential medicines and medical supplies to all public health facilities in the country. It uses trucks and lorries to do the distribution. However there is concern about delay of the trucks to return to the parking lot in Wandegeya. On a particular day a lorry and a truck are sent to deliver drugs to Hoima Regional referral hospital and Kiryandongo hospital respectively. Theywere expected to return to the parking lot in Wandegeya which isexactlyhalfwaybetweenHoimaandKiryandongo. Bothvehiclesdriveatasteadyspeed of $\mathbf{80}\boldsymbol{km/hr}$ and set off at $\mathbf{3}:\mathbf{00}\boldsymbol{am}$ from the NMS offices in Entebbe. From the point of setting off the lorry turns in the direction of 060^{o} and drives with a steady speed reaching Hoima at $\mathbf{6}:\mathbf{00}\boldsymbol{am}$. The lorrysetsoff fromNMS offices and movesto Kiryandongo whish is 330km the offices in the direction of 200^{o}. each spends averagely two and half hours off loading the drugs.

Task.

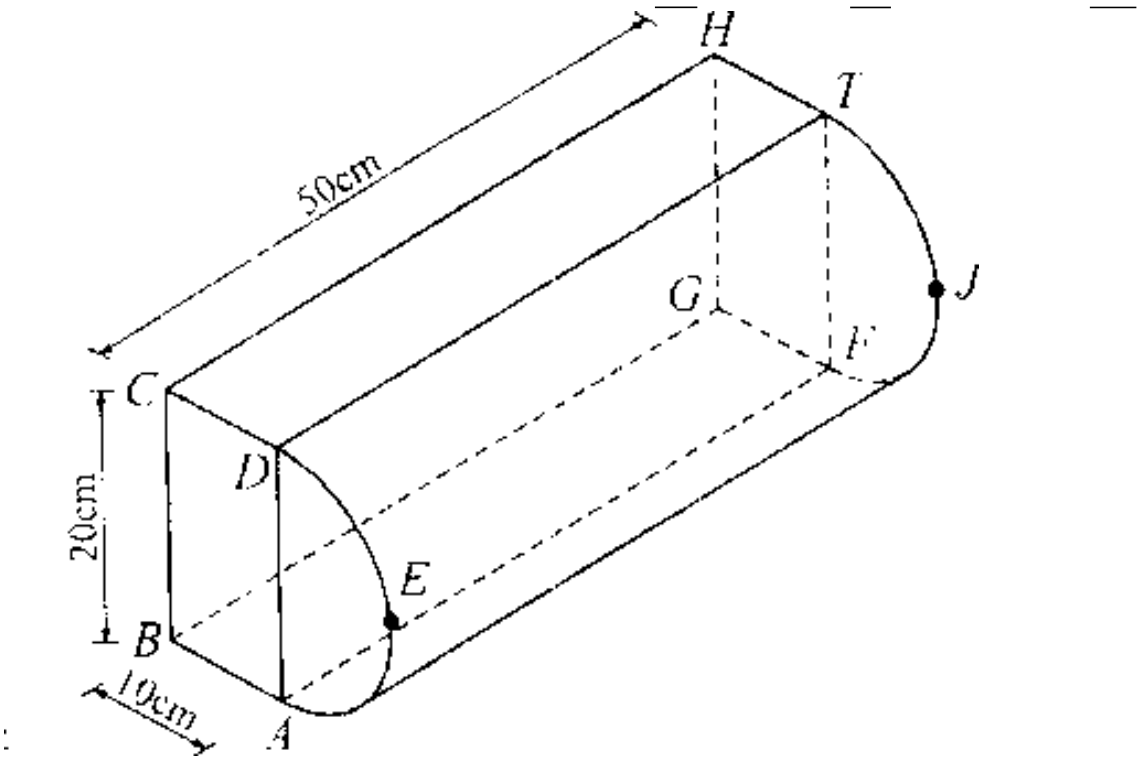
(a) Helpthemanagerrecordthetimeeachvehicleis expectedtoreturntotheparking lot in Wandegeya.

(b) WhatisshortestdistancebetweenEntebbeandWandegeya.

(c) Inyourviewhowcanthehealthsystembeimprovedinyour area.

Item6. *(20scores)*

Your is starting a poultry farm after getting funds from the parish development model PDM.Yourneighborborrowed**UGX48.52millions** from***PDM*** tobereturnedafterone and half years at a rate of **0.5**% per month simple interest a so he has ordered for chicken drinkers from Biyinzika Poultry Farmers with the shape *ABCD* in which *ABCD* is a rectangle and *ADE* is a semi-circle of diameter *AD*.*BC*= 20cm,*AB*= 10cm and*CH* = 50cm.



BiyinzikaPoultryfarmers sellstheeachdrinkeratUGX21,500,butoffersadiscountof 10 percentage onthetotal cost for everyfiftydrinkers and an additional 5% on thetotal costonanyexcessof50drinkersbought. Becauseyourneighborisbuyingfivehundred

birds,heintendstobuy80drinkersbutdoesnotknowthecapacityofeachdrinker which will help him buy water tank to harvest the water for the business.

Task:

(a) Helpyourneighborestimatehowmuchmoneyhewillreturntothe PDMafterthe one and half years.

(b) Howmuchwillhespendonbuyingthedrinkers.

(c) Estimatethecapacityofeachdrinkerandadviseyourneighbor,withreasonsonthe capacity of the tank to buy.

1. BbulaisanislandfoundonlakeZzibi,therehasbeenaseriousproblemof poornetwork on the island for a long time. The government together with the Network providers are planning to establish a Mast with the frequency that can cover the whole island. According to Engineers, the island is in a shape of a triangle ABC with $AB = 10km$ as the main landing site. Side $BC = 8km$ and $AC = 6km$.

(a) Byscaledrawing,helpEngineerstocomeupwithanaccuratedrawingofthe island and use it to find;

(i) TheangleABC

(ii) GiventhattheMastmustbeestablishedwheretwoperpendicularbisectors meet, establish with point M where the mast must be and find its perpendicular distance from the main landing site.

(iii) Itisknownthatthefrequencymustcovertheisland,drawthelocusofthe frequency and measure its radius.

(b) Two points P and Q are 1000m apart. The angles of elevation of the top of the MastfrompointsPandQare60° and30° respectively.Calculatetheheightof the Mast if;

(i) ThepointsareonthesamesideoftheMast

(ii) ThepointsareonoppositesideoftheMast.

2. (a) A senior four student, was given three points A(4,0), B(0,3) and C(4,3) of a triangleABCandaskedtoenlargebybothascalefactor2andascalefactor -2onthe same axes with the center as the origin, the learner could not distinguish between a positive and negative scale factor!Guide the learner through and state the images;

(i) Of triangle$A_1B_1C_1$,scalefactor2

(ii) Oftriangle$A_2B_2C_2$,scalefactor-2

Iftriangle$A_1B_1C_1$isan imageoftriangle $A_2B_2C_2$underenlargement,statethe center and scale factor of enlargement.

(b) You aregiven two cylinders oneoflength12cmandvolume $630cm^3$,another with length 14cm and volume $420cm^3$.

Statewithreasonswhetherthecylindersaregeometricallysimilar.

Whatwouldhavebeenthevolumeofthesmalleronefor the cylinderstobe similar?

PartIII (PatternsandAlgebra)

3. InaPhysicspracticalattemptedbyaseniorfourclass, TheforceYneededtomovethe load X by a machine is determined by a law $Y = aX + b$, where a and b are constants. The table below shows results which were obtained by one of the students.

Load(X)	1	2	3	4	5
Force(Y)	4	4.8	5.5	6.7	7.2

(a) Plotthescatterdiagramfromthetableabovei.e Force(y)againsttheLoad(x)

(b) Drawthelineofbestfitanduseittofind;

(i) TheForcecorrespondingtoaLoadof3.5

(ii) Theloadcorrespondingtoaforceof6.2

(iii) TheForcecorrespondingtotheloadof0(zero)

(c) Takeanytwopointsonthegraphandusethemtofindtheslope/gradientofthe line of best fit.

(d) Compareyourfindingswiththeequationoftheform$y = mx + c$,hencefindthe law connecting Y and X, where $a=m$ and $b=c$and state $Y=aX + b$.

4. Duringfootballtraining,thecoachmarkedthreepointsonthegroundformingatriangle OPQ, he labelled displacement OP as vector **p**, and displacement OQ as vector **q**.
HefurthermarkedpointRonOQsuchthat$OR:RQ=3:1$,andSonOPsuchthat $OS:SP=1:2$.HestationedpointTasthepointofintersectionofPRand SQ.

(a) Usingtheknowledgeofvectors,expressPRandQSintermsofvectors**p**and**q**.

(b) Giventhat$\boldsymbol{PT=\lambda PR}and\boldsymbol{QT=\beta QS}$,expressOTintermsof;

(i) $\boldsymbol{\lambda}$,$\boldsymbol{p}$and$\boldsymbol{q}$

(ii) $\boldsymbol{\beta}$,$\boldsymbol{p}$and$\boldsymbol{q}$

Hencefindthevalueof$\boldsymbol{\lambda}$and$\boldsymbol{\beta}$

DeterminetheratiosinwhichTdividesSQandPR.

PartIV (DataandProbability)

5. A private company was hired to administer an interview for World Food Program. 50 candidates sat for an aptitude test which was made up of Sections A, B and C. Two candidatesdidnotattemptanyquestion fromanyofthethreesections.Threeattempted questionsfromsectionAonly,fivefromsectionBonlyfourfromsectionAandConly while5 attemptedquestions fromall the three sections. Thosewhoattempted questions fromA and Bonlywere3 less than thosewho attemptedquestionsfromsections Band C only and three timesthose who attempted questions from section C only.

Asaseniorfourstudent,help;

(a) Showtheaboveinformationusinganappropriatediagram

(b) Findhowmanycandidatesattemptedquestions

(i) fromeachsection

(ii) fromsectionConly.

(c) Ifacandidateisselectedatrandom,whatistheprobabilitythatheorsheattempted questions from at least two sections?

(d) Giventhatthosewhoattemptedatmostonequestion,didnotmakeittooral interviews, how many candidates were they?

(e) Inyouropinion,whydoyouthinktheWorldFoodProgramhiredaprivatecompany to carry out interviews?

6. Thetablebelowshowsthecumulativefrequencyofmarksobtainedbyagroupofsenior four students in a Mathematics test to be presented to the academic committee.

Onthedayofpresentation,theteacherinchargecouldnotmakeit.

Youareaskedtoanalyzethedatafurtherforthelayman"sunderstandingwithvisualaid of a graphical representation.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Cumulative frequency(F)	18	52	110	152	176	186	192	200

Carryoutthefollowingforthecommittee

(a) Findthemeanandthemodal mark.

(b) The80th percentile.

(c) Drawacumulativefrequencycurveanduseittoestimate the;

(i) median

(ii) rangeofthemiddle50%ofthemarks

(iii) numberofstudentswhowouldpassifthepassmarkwasfixedat45.