SENIOR ONE SCENARIO BASED QUESTIONS

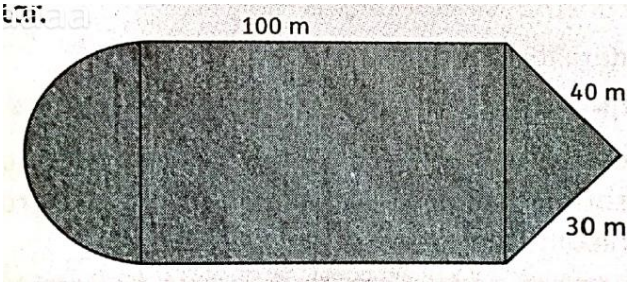
1. **Mr. Bwanika would wish to design his bedroom ceiling in form of an equilateral triangle surrounded by a circle with the sides of the triangle 6m. He wants to paint the triangular area with cream-coloured paint, which comes at a cost of UGX 15,000 per tin. Additionally, he plans to paint the circular region surrounding the triangle, excluding the triangle itself, with white paint, priced at UGX 12,000 per tin.**

   Mr Bwanika also wishes to design a circular seating area in his dining room and he has two options on his mind. Option A calls for two circular seating areas each with a 10 m radius and option B calls for a larger circular seating area with a 20 m radius.
   Task
   a) As a senior three student, help Mr Bwanika design a plan for the ceiling.
   b) How much do you think would be spent on paint if each tin of paint paints $1m^2$ area.
   c) Advise Mr Bwanika on which option will give him a bigger seating area.

2. **Mzee Zerubbabel invested his "senior citizen grant" of Shs.96000 in a Unit trust, which offers an interest rate of 8% per annum.**
   Mzee Zerubbabel's son Zachariah divided UGX17500 into two parts such that the interests on the first part at 8% simple interest per annum and on the other part at 6% simple interest per annum are equal.
   Task
   a) As a mathematician, help Mzee Zerubbabel establish how long it would take his money to accumulate to shs.126720.
   b) Help Zachariah to determine the interest accumulated on each part after one year.

3. **During Covid-19 pandemic, a liquid or spray sanitizer was used to kill the virus. Liquid sanitizer could be made using ethanol, hydrogen peroxide, glycerin and water. To make 20 liters of liquid sanitizer; 16 liters of ethanol , 1 liter of hydrogen peroxide, 0.4 liters of glycerin are required and water tops up to make 20 liters of the liquid sanitizer.**
   Tasks:
   a) What is the quantity of water that is used to make 20 liters of sanitizer?
   b) What is the fraction of each ingredient in 20 liters of sanitizer?
   c) What is the percentage of each ingredient in 20 liters of sanitizer?
   d) If you want to make 15 liters of sanitizer at once, what is the quantity of each ingredient that must.

4. **Juma wants to construct a perimeter wall around his plot of land. The plot of land is semi-circular at one end and has a right-angled triangle shape at the other end. The middle part of the land is rectangular.**



Task:

a) **Juma asks you to accurately construct the foundation plan for his perimeter wall. Explain how you have accurately constructed the perimeter wall plan. Discuss whether there are other ways of drawing an accurate plan.**

b) **Find the total cost of building the perimeter wall if the cost of building 1 meter is Ugx 35,000.**

c) **Find the total area of Juma's plot of land.**

5.

6. **Two learners were given a task of plotting the following points on the grid. A(0, 4) B (2, 2), C (4, 2), D (2, 0), E (4, -2), F (0, -1), G (-4, -2), H (-2, 0), I (-4, 2) and J (- 2, 2). Before they plotted the points, Jane told Musa that when plotting, for point A you move 4units to the right of the origin and no movement along the y-axis from the origin. For point C you move 2 units to the right of the origin and 4 units parallel to the y-axis in the positive direction. Musa said no for point A there is no movement along the x-axis, you only move 4 units along the y–axis. While for point C you move 4 units from the origin on the x-axis, then two units parallel to the y–axis.**

   a) Comment with reasons on Jane's explanation of plotting the points.

   b) Using Musa's explanation, plot the coordinates.

   c) Join the points to form a polygon. State the equation of the line of symmetry.

7. **Gareth and Barry each went with an equal amount of money for shopping at Mega Standard supermarket. Gareth spent Shs.95000 and Barry spent Shs.350000. After the shopping, Barry had 4/7 of what Gareth had remained with.**

   Gareth deposited some amount of money in the bank at a simple interest. After 15 years, the amount became seven times the amount deposited.

   Task

   a) How much did each (Gareth and Barry) go with for shopping?

   b) How many years will Gareth wait for the amount to become ten times if the interest remains the same?

8. Your guardian has a budget of Shs700,000 for your school expenses. To get to the school where your guardian wishes to take you for A-level, your guardian drove 4 km east from your home to

the stage and then 8km north to reach there. However, you realized later that there was a direct route from home to school your guardian could have used.

On reaching the school, you found out that, the school fees, admission fees and uniform fees are Shs900,000, Shs100,000 and Shs350,000 respectively. The school also offers a bursary of; 60% off school fees, free admission and eighty-seven thousand five hundred shillings off uniform fees to those who got first grade and according to your results, you qualify for this bursary.

It also has two payment plans on school fees that the guardians can choose from and they are:
- Paying in two installments that is to say; two thirds of the school fees at the beginning of the term and the balance at either visitation day or end of term.
- Paying in three equal installments; at the beginning of the term, on visitation day and end of term respectively.

Task:
(a) How far is it from your home to school if you travel through the direct route?
(b) (i) Since you qualify for the bursary, how much will you pay?
(ii) Will your guardian afford the school expenses according to his budget?
(c) (i) How much will those who are to pay school fees of Shs900,000, pay per installment, according to each of the payment plans?
(ii) Which payment plan would you recommend for them and why?

9. Your uncle has offered to drive you to your friend's birthday party. He normally drives his car at an average speed of 50 km/h, so he requests you to get directions to the party reception and the time you are supposed to be there so that you decide on when you can leave home to reach on time. You were informed that the party will start at 2:00 PM and the directions are:
- From your home, take the north eastern direction and reach the supermarket that is 20 km away.
- Then take the road that is south of the supermarket and it will take you 45 minutes to reach the junction.
- From the junction, take the southwestern road and drive 25 km to reach the party reception.

On reaching the party reception using the given directions, your friend remembers that there is a direct route from your home to the reception that you could have used but does not know how long it is.

Task: (a) (i) Describe the direction of your home from the party reception.
(ii) How far is the party reception from your home using the direct route?
(b) What time would you have to leave home for you to reach the party reception on time, if you used the direct route?

10. A shop keeper in Lugala community has a retail shop that deals in measured goods. In a certain week he decides to collect the data about the amount of rice (kgs) bought together with the number of people who buy a given amount. He found out that 5 people $\frac{1}{4}kg$ each, 10 people bought ½kg each, 12 people $1kg$, 28 people bought $2kg$ each, 7 people bought $5kg$ each, 4 people bought $10kg$ each.

    Tasks:
    a) Using a suitable table represent the above data.
    b) Determine the amount in kg sold that week
    c) If the cost of each kg of rice is shs.4500, help the shop keeper to know the quantity where he makes more money and how.
    d) In your own views, discuss why some people buy less kg of rice.

11. During a Mathematics lesson Graham borrowed a calculator from Joshua and he found a number on the screen 840 which made him wonder which two numbers can be multiplied to get the figure. Later in evening at 4:00pm, Graham traveled with his father in their family car to the beach carnival to have fun and his father drove from Ssembabule to Ggaba beach in Kampala at a steady speed of $60km/hr$ and he committed a traffic offense after he covered 2hours and was delayed by traffic officers for 30 minutes and proceeded to Kampala at a steady speed and reached Ggaba beach which is 500km from Ssembabule. The carnival was massive and it ended 3 hours later and they travelled back home at the same steady speed and reached Ssembabule.
    Tasks:
    a) Help Graham figure out all the possible values that Joshua could have typed in to get the number on the screen.
    b) At what time did Graham and the father reach Ggaba beach.
    c) At what time did Graham and the father arrive at their home after enjoying the carnival at the beach?

12. In Bukaaru village, Mr. Lubega had six children; Abdu, Isaac, James, Ashiraf, Mohammed and Tina. He made his will and kept it with a friend. After his death, children were fighting for the property as the elder son wanted to claim 50% as the heir. The lawyer saved the situation by reading the will. Tina was given 10% of the property. The remaining property was shared among the boys and the wife. Abdu was given 1/5, Isaac was given 15%, James was given 20%, Ashiraf was given 5% and Mohammed was given 20%. The remainder was given to the wife.
    TASK
    a) Help the family administrator to know how much property will each take given that Lubega had property worth UGX 6,000,000.
    b) What percentage of Mr. Lubega's property was allocated to his wife?

13. Five girls whose homes when marked on a grid make a trapezium, wanted to buy clothes. They realized that if they buy them in a bunch, it will be cheaper. So they mobilized themselves and each person contributed as follows:
    Girl 1: Contributed one hundred thirty-three thousand two hundred fifty shillings.
    Girl 2: Contributed 20% more than that of girl 1.
    Girl 3: Contributed $1\frac{1}{2}$ of the amount girl 1 contributed.
    Girl 4: Contributed a fraction that is $\frac{1}{5}$ less than the fraction of girl 3.
    Girl 5: She contributed the balance required to make the Shs.800, 000 required.
    TASK:
    a) What amount did each girl contribute?
    b) In which other way could they contribute the amount required fairly and according to that way, how much would each contribute?

14. The school plans to hold a Parents meeting and it expects 1000 parents. It plans to hire tents of capacity 50 seaters, they are to serve soda, a boiled egg and a piece of chicken. A tent is hired at sh. 100,000, a crate of soda has 24 bottles and costs sh.20,000, a tray of eggs consists of 30 eggs, each tray is at sh. 10,000, a chicken consists of 6 pieces, and each chicken costs sh.10,000. As a senior four student, using knowledge of number bases, help the school come up with a budget flame work for the event.

15. A couple wants to celebrate their anniversary. The wife promises to buy things worth 1.5million. and the husband promises to buy things that will cost an amount that is two quarters more than that of the wife. One of the older children promises to buy all the drinks on the budget which where, 3crates of soda each containing 24 bottles and 6 cartons of water each containing 6 bottles. To reach the venue, the couple planned to move 20km east from their home and then 30km north. However, the son plans to take the direct route from the parent's home to the venue.
    TASK:
    a) How much will the husband contribute?
    b) If the total amount on the budget was two million three hundred forty-six thousand, how much did the son contribute for soda and water?
    c) How many guests would you advise the couple to invite and why?
    d) What distance will the son travel?

16. A certain member of your family re-wrote each digit of his 4-digit ATM card pin from number system ten (base ten) to another number system less than four. He did this in fear of theft. Now he is sick in the hospital, he can neither talk nor write but the money on his account is needed to finance hospital bills. Here is how he wrote the pin: 12 20 22 10. Assuming that you have been able to encrypt the ATM pin for the family and funds are available to take care of him.

The hospital has a nurse who takes checks on him after every 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 9:30 am. He was treated well and discharged and advised as follows. He was advised to spend three eighths 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) Which number system do you think he used to re-write the pin and why?
(ii) Use the identified number system to help your family members to regenerate the original pin.

(b) (i) At what time did will both the nurse and medical doctor check on him again at the same time.
(ii) How many hours of the day in a week does he have spend on visiting the hospital.

17. 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.

Elijah 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.
TASK

a) Determine the least number of turns the machine has to make in order to supply the school.
b) Was Elijah able to buy the Machine after the decreases? If yes, was he able to remain with any balance.

18. Three schools from a Gayaza region want to participate in the National Schools Football Sports Gala to be held in Lyantonde district play ground. Unfortunately none of the schools has a school bus and they want to hire a bus for the one day for the activity. The bus charges UGX 25,000 per km moved. The three schools through their Sports master agreed to share the cost of the bus equally amongst themselves. One that day they hired a bus from your school in Gayaza and they set off at 4:30am and increased the speed gradually to 90km/h reaching Mpigi at 6:45am. From there the bus driver maintained this same speed for hours reaching Masaka. From Masaka then he reduced slowly in speed reaching Lyantonde at 9:30am. The games started at 10:00am sharp and each team played six games.
School A won 3 games, drew 2 and lost 1 game. School B won 4 games and lost 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) Find how much each school paid for the bus.

(b) Decide the cash prize for each school.

19. 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 5m yet on the other side he is to plant a tree every after 6m. 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 again directly opposite.

    His land has an area of $500m^2$. He plans to use 25% of the land to plant maize, one fifth of the land for beans and $205m^2$ for growing ground nuts.

Tasks:

(a) Help the man determine how many tree seedlings he needs to buy to just plant this first phase.

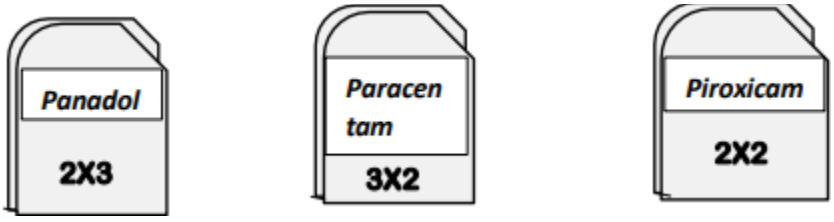
(b) Determine in m^2 the size of the land to be used for growing maize.

(c) Determine in m^2 the size of the land to be used for growing beans.

(d) Express the area to be used for growing ground nuts in standard form.

(e) Do you think he partitioned the entire land properly?

20. Omara went to the hospital and he was given a certain number of tablets of Panadol, Paracentam and Piroxicam to take starting from the morning.



He took his first doze in the morning and given more tablets equal to those he had remained with in order to complete a dozen of 20 tablets.

TASK

(i) Identify the number of tablets Omara took in the first doze.

(ii) (ii) If t represents the number of tablets he was given first, form an equation representing the above information hence find t.

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 Nwoya district, Koch Goma sub-county which has 4 wards. The wards are A, B, C and D. Basing on the size of land in each ward for every 100 packets of seed, ward A gets 30 packets, ward B gets 20 packets, ward C gets 40 packets and ward D gets 10 packets. The government has procured 45,000 packets which are allto be shared equitably according to the community.
    By using a statistical graph, help the local leaders to distribute these seeds to the community in wards. (Hint: Use a pie chart)

22. a) A Farmer said he annually spends at least 8000 per acre on spraying, weeding 24,000 per acre and shs 20,000 on pruning per acre. What is the spending on a farm of 20 acres?
    b) Given that the inflation rate according to bank of Uganda increased by 6.8%, implying that the price of commodities have increased by that mentioned rate. If the price of herbicides is now 4500/= per litre what is the original price of the herbicides per litre?
    c) The farmer mainly deals in growing green papers and noticed that on average he spends UGX 30 to produce a green paper and sells it at UGX100. At the end of a given planting season, the farmer produced 200 tonnes of green paper and managed to sell 150 tonnes only.
    i) Did the farmer make a profit or loss that season?
    ii) Calculate the percentage profit/ loss for the season.

23. a) Anita the shop keeper bought three bags of beans, rice and posho weighing 144kg , 90kg, and 54kg respectively. She wishes to repackage in smaller bags of equal weight.
    Anita, Kevin and Swale shared out money. Anita received 3/5 of the money, Kevin received 1/6 of the remainder and Swale received shs 36500 which was the actual amount of money that remained after Anita and Kevin had received their shares.
    Task
    a) Help Anita find out the highest weight of the smaller packs she can use without leaving any food stuffs in the big bags.
    b) Find how much money each received and also the total money that was shared among the three.

24. The caterer of a school located in kira Municipality 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 4000, UGX18,000, and UGX1500 per kg of rice, meat and Irish potatoes respectively in kyaliwajara market. The same items cost UGX. 2500, UGX. 14,000 and UGX. 1,200 per kg of rice, meat and Irish potatoes respectively, in Gayaza market. To hire a pick-up from Kyaliwajara market to school costs UGX 50,000 while a pick-up hire from Gayaza farmers' market is UGX100,000.

Using the information provided above, how would the caterer decide on where to do the shopping from? Justify your answer.

25. You went to the gym on 1st February 2024 with Shs.100,000 with hope to come back with some balance of not below UGX.50,000 to cater for home expenses. Reaching their, you met a new friend. She tells you that she comes every 4days and you come every 6 days.

    You ask her how much she pays so that you compare with yours and she says "I paid a member ship fee and now I only pay UGX. 30,000 a month which caters for all days I choose to come". However, when it comes to you, you pay UGX.10,000 each day you visit the gym. And you visit the gym 5 days a month.

    After the gym you decide to hang out for a cup of coffee and a PIZZA and each of you had to pay forty-five thousand five hundred shillings. Later your friend got an emergency call and left before you exchanged contacts.
    TASK:
    a) i) What are the fewest number of days you will have to wait for, to meet your friend again?
       ii) using the number of days, mark the exact date on the calendar.
    b) i) how much do you spend on the gym a month?
       ii) comparing with how much your friend pays, what can you do and why?
    c) c) i) how much did you spend that day?
       ii) on the money you came with, how much balance did you take back home?
       iii) will you be able to cater for all home expenses? Explain why you say so.

26. Kevin's goal is to find a job that provides an income of atleast 40 million a year. A glass mart company offers her a job paying a basic salary of 12 million a year plus a commission of 6% of her sales.
    Kevin bought a suit at UGX.490,000. She wishes to sell it at UGX.495,000 cash. Every customer wanting to buy it have less money than the cash price Kevin want, yet Kevin is in need of an emergency money of UGX.50,000. He wants in 7 months to have sold this Suit.
    TASK
    a) Determine what Kevin's total sales will need to be for her to have a yearly income greater than or equal to 40 million.
    b) As a learner who studied business mathematics, advise Kevin what to do with the suit.

27. John plans to visit the shop that is 12km south of his home and then the boutique that is 5km east of he shop and after drive back home using a direct route from the boutique to home. He is to use his motorcycle that consumes 0.035liters of fuel per km and he wants to know how much fuel he will need for the whole journey. He has seven hundred fifty thousand Uganda shilling. He plans to use part in the shop and part in the boutique in the ratio of 3:2 respectively. He wants to spend

UGX. 210, 000 to buy shirts and UGX.120, 000 to buy trousers. However he is not sure if his budget for the boutique will be enough.

From the shop, he is to buy 24 packets of cooking oil, 12 packets of sugar and 30 packets of salt. All of these are to be used to make packages for some of his family members in the village. He wants each package to have an equal number of items in it. He needs to know the highest numbers of packages he can make from them.

TASK:
a) How much fuel will he need for the whole journey?
b) Will the money he plans to use in the boutique be enough for what he plans to buy? Justify your answer
c) How many packages will he make from the items he plans to buy?

28. You decided to have a joint graduation party with your sibling. This is to cost you a total of UGX.4,000,000. You are nearing the D-day and want to find out whether you have the amount required or not. So you decided to revise your contributions below:
Your parents contributed 12.5% of the money. Your sibling contributed 12.5% more than your parents and since you were the eldest, you contributed $2\frac{1}{2}$ of the amount your sibling contributed.
TASK:
Do you have the required amount for the party or should you postpone it?

29. Four boys whose homes once located on a grid map form a rectangle, would like to meet at the Centre of their homes to play soccer since they believe that location would be a fair distance for all of them. One boy is located on coordinate (4,6) and the other boy is located on coordinate (4,12).
TASK:
a) Where are the homes of the other two boys on the grid?
b) On which coordinate will they meet?

30. You moved 5km from your class while walking in the northwest direction to the staffroom looking for the teacher. Reaching the staffroom, you were told that the teacher is in the park so you turned in the 180^0 direction and moved 6km towards the teacher. Reaching the park, you realized that you had a wrong book! You want to go back to class to get the actual book but using a different pathway since the school has many pathways.
TASK:
a) Accurately illustrate how you moved from the class to the teacher in the beginning.
b) From your illustration, which other path way will you take to return to class?
c) On which bearing will you turn for you to take that pathway?

d) How far is the park from the class using that path way?
e) In comparison to the first distance you moved, is it wise to choose that pathway? Give a reason for your answer.

31. You work in an art and design shop. You print different objects on clothes as requested by your customers. A customer comes and requests you to print triangles, circles and squares on his cloth following a particular pattern that will make the clothe beautiful. However, he first gives you a piece of paper that is 12cm in length and 8cm in width to illustrate how you plan to arrange the shapes on the cloth. As you are still talking to the customer, someone calls you requesting you to compute something, so you request the customer to assist you with his phone calculator and on opening it you find a figure 455.
TASK:
a) Show how your illustration will look like.
b) Which input and operation do you think the customer would have put in the calculator to get the figure you found on the screen?

32. Opiku and Legu own a rabbit farm, from which they make an average profit of UGX 750,000 monthly. They re-invest three-eighths of the profit and share the rest of the money between themselves. Opiku receives $\frac{5}{12}$ of the profits.
Opiku has five small containers of capacities: 12, 16, 24, 56 and 72 litres which he can to use to fill up a bigger container.
TASK:
a) Determine how much Legu receives.
b) What is the capacity of the bigger container which can be filled up by each of the above containers exactly without a remainder when used separately?

33. Musuuza works for 40 hours a week at a supermarket. He is entiled to a weekly salary of UGX220,000 plus a 3% commission on sales on over UGX 5 million. Assume that he sells enough this week to get the commission.
Musuuza plans to set up a milk storage tank of volume 6,000 litres.
TASK:
a) Determine his weekly:
    i) Income when the weekly sales are worth UGX 6 million.
    ii) Sales when the weekly income is UGX 430,000
b) How deep should the tank be, if it is three meters long and two meters wide.

34. You are planning a trip to visit a historic site that is 30 kilometers away from your current location. The trip will take approximately 1.75 hours by car. The speed limit on the road is 80 kilometers per hour, and the site charges an admission fee of UGX 25,000. The museum offers a 40% discount on admission fees for students with disabilities.

When you arrive, you notice that the site displays some information in binary. The binary number 100101 represents the number of years since the site was established. You also notice that the site displays the current temperature in Celsius using binary number system and the temperature is 10010.11,

TASKS

a) What is the approximate percentage of the speed limit that you will be traveling at during the trip?

b) If you have UGX 100,000 in cash, what fraction of the admission fee will you have left after paying?

c) i) What is the number of years since the site was established in base 10?

ii) Express the temperature of the site using the decimal base system?

c) If you have a friend who qualifies for the discount, what amount would he pay as admission fees?

35. You are helping your friend plan a road trip to visit a national park that is 180 miles away. The trip will take approximately 3 hours to complete, and the speed limit on the highway is 65 miles per hour.

    At the park entrance, there is a display showcasing the park's wildlife population. The display indicates that for every 5 Zebras, there are 3 hyenas and 2 elephants.

    The park charges an entrance fee of UGX 70,000 per vehicle and the national park displays the number of visitors in binary system and the number is 1010101.

    TASK

    a) What is the approximate percentage of the speed limit that you will be traveling at during the trip?

    b) What is the ratio of zebras to hyenas in the park's wildlife population?

    c) If the park has a total of 900 animals, what is the approximate number of each type of animal (zebras,hyenas and elephants) in the population?

    d) If your friend has UGX 350,000 in cash, what decimal value would represent the fraction of the entrance fee they have left after paying?

    e) What is the number of visitors in the decimal number system?

36. A senior one student identified specific boarder points of different regions from his community map extract these included a swamp A(-6,0), B(-2, 0), C(-4,3), D(0,3), a bushy area E(-8,-1), F(0,-1), G(-8,-13), H(0,-13) and a community well, I(2,-1), J(4,-1), K(2,-3) and L(4,-3). (use 1cm to represent 1 unit)

The chairperson suggested that the bushy area should be partitioned into square gardens as large as possible, so that no area is left and each family gets one.

James a from another community tried the same assignment using his own community map also and calculated the total area of his village on the map as 30 Square Units. When he shared his findings with a friend, they found that his answer was 25% less than the actual total area.

Four other students Aisha , Angel, Agatha and Arshad attempted the same assignment and were awarded as follows, 15 out of 25, 31 out of 40, 45 out of 60, and 35 out of 80 respectively.

Arshad requested for a retake to improve his project grades, the teacher tasked him to find the total area of one of the students findings giving his answer in base eight. The student had $(1003_{four})sq\ units$ for the swamp, $(2015_{seven})sq\ units$ for the bush area and $(10121_{three})sq\ units$ for the well.

TASK;

a) i) Identify the shapes formed by the regions
   ii) Calculate the total area covered by these regions.
b) i) Help the chairperson figure out the size of each square garden.
   ii) How many families will benefit from this arrangement?
c) What is the actual total area of John's village on the map.
d) Help rank the four other students Aisha, Angel, Agatha and Arshad who attempted the same assignment according to their performance in an ascending order.
e) Find the answer Arshad should present to the teacher?

37. 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 boda-boda. The boda-boda travels 3 km west from your home to the main road, then 4 km south to re ach 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 offers 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 reduction of Shs 150,000 for school supplies. You are eligible for this scholarship based on your outstanding performance. The school also offers two payment options for school fees:

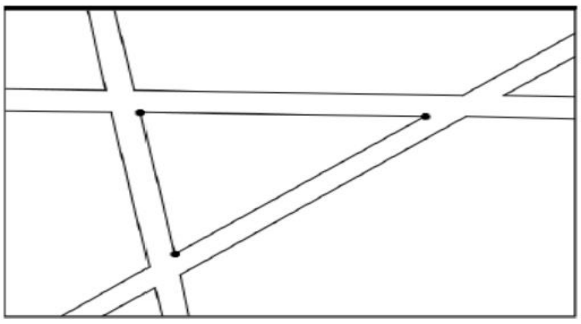
Option 1: Two Installments - Pay two-fifths of the school fees at the beginning of the

term and the remaining balance before the mid term exams.
Option 2: Four Installments - Pay equal amounts at the beginning of the term, before mid term exams, after midterm, and before final 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 your school expenses.
ii. Can your aunt afford 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?

38. The Parks Department in a Ugandan village has acquired a new sprinkler system to water their flower equilateral triangular lawn, which is essential for maintaining the village greenery. The equilateral triangular lawn, with each side measuring 10 meters, is surrounded by pathways, and the sprinkler needs to be strategically placed to ensure effective 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 with a circular sprinkler.
(b) Determine the best location inside the equilateral triangular lawn where the sprinkler should be positioned to maximize the watering coverage while avoiding the pathways.
(c) Estimate the area of the lawn that will not receive water effectively once the sprinkler is optimally placed.

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SENIOR TWO SCENARIO QUESTIONS

1. **John starts moving from home to the trading center which is on a bearing of 120° and a distance of 40km from home. From the trading center, he changes course and moves North East to his village, which lies 50km from the trading center.**
In the village, he wants to set up a poultry house (P), a kennel (K) and a pigpen(O) on his farmland. From the pigpen, 20 strides to the left, 30 strides upwards he wishes to set up a poultry house. From the poultry house, 30 strides to the right, 60 strides downwards he wants to construct a kennel. He also plans to construct a direct path from the pigpen to the kennel.
To set up this farm, he wishes to take a loan of 4 million, from Premium Bank at a simple interest rate of 15% per annum for a period of five years. To ensure safety of his individual projects, he plans to insure them. The insurance premiums paid for each project, depends on the value of each project as shown in the table below.

Project	Value of project	Insurance premium
Poultry	45% of the loan	15% of the project value
Kennel	20% of the loan	5% of the project value
Pigeon	$\frac{1}{4}$ of the loan	0.1 of the project value

TASKS.
(i)If he used a direct route from home to the village, what course would he take and how far would he move?
(ii) Of the two routes, which one is shorter?
(iii) If he travelled at an average speed of 60km/h how much time does he save by travelling along the shorter route.
Hint; use a scale of 2cm = 10km where suitable.
(i) Using a pigpen as a point of reference, what is the position of the kennel.
(ii) How long is the kennel from the pigpen?
(i) How much in total will he pay back to the bank after the 5 years?
(ii) Find out the total insurance premium he will pay every year.

2. **Teddy and Sons Wholesale shop buys 50kg bags of sugar, 25kg bags of rice and 100kg bags of maize flour from a factory at UGX 225,000, UGX 100,000 and UGX 250,000 per bag respectively. She then sells each bag of sugar, rice and maize flour at UGX 250,000, UGX 112,500 and UGX 300,000 respectively. Teddy pays an income tax of 15% of the monthly profit, a commission of 8% of the profit made on a monthly basis to her shop attendant and 10% of the monthly profit to SWICO insurance company. SWICO insurance company**

offers a discount of 6% of the basic premium expense to clients with CCTV cameras in their businesses. Given that Teddy installed CCTV cameras in her shop and sells 75 bags of sugar, 45 bags of rice and 60 bags of maize flour per month.

Teddy has plans of expanding her business and intends to apply for a loan of UGX 50,000,000, two banks A and B are willing to give her the loan where Bank A charges a simple interest rate of 9% per month for 2 years and Bank B charges a simple interest rate of 32% per four months for 2 years.
Task:

a) **Calculate Teddy's net profit per month.**
b) **Help Teddy to find out which bank to choose to apply for the loan given that she will pay the loan after 2 years.**

3. **You are planning to remodel the flooring in your kitchen. You have already measured the dimensions of the kitchen and found that it is a rectangular space with a length of 12 feet and a width of 9 feet. As you browse through different flooring options, you come across a display that shows the following pattern of square tiles:**
1 tile, 4 tiles, 9 tiles, 16 tiles, 25 tiles, ...
The display also shows the equations of various linear and quadratic functions. The display shows the equation of a straight line that represents the cost per square foot of a certain type of flooring. The line passes through the points (2, $4.50) and (4, $9.00). Another display shows the equation of a parabolic function that represents the cost per square foot of a different type of flooring. The equation is given as $y = 0.25x^2 + 2x + 1$.

TASKS
(a) i) Describe the pattern in the sequence of square tiles displayed. Determine the rule that generates the next number of tiles in the sequence.
ii) Write an equation that represents the n^{th} term of the sequence, where n represents the number of square tiles.
b) i) Find the slope of the line and write a mathematical statement of the line in slope-intercept form.
ii) Find the x-intercepts of the parabolic function.

c) **Suppose the cost of the flooring you choose is $6.75 per square foot. If you have a budget of $800 for the kitchen remodel, what decimal value would represent the fraction of the total cost that you have left after purchasing the necessary flooring?**

4. **You are planning a party at your house and need to purchase supplies. You've made a list of the items you need, including cups, plates, and napkins. You're also to hire one tent at UGX 100,000 and a chair for each guest at 500 @.**

At the local party supply store, you notice that a package of 24 glasses costs UGX 192,000, a package of 20 plates costs UGX 260,000, and a package of 50 napkins costs UGX 10,500. Each guest is supposed to be served with one glass, one plate and two napkins.

Earlier before the D-day for the party, you tasked your friend to come up with a mathematical statement that represents the relationship between the number of guests (x) and the number of chefs (z) required for the party. He came up with the equation y = 0.1z.

TASKS

a) How much will the store attendant charge a person who buys 65 glasses, 44 plates, and 120 napkins.

b) If you are expecting 200 guests at the party, what is going to be the total budget for the party including all the available expenses?

c) Write a mathematical statement that represents the relationship between the total expenditure (y) for any given number of guests (x).

d) Find the number of chefs needed for 200 guests.

e) The store offers a 15% discount on the total cost of the supplies if you purchase more than UGX 5 million worth of items.

i) Do you qualify for the discount if you purchase items enough to be supplied to the 200 guests?

ii) If yes, what would the new total cost be after the discount is applied?

5. 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) and he has invited a lot of guests. However due t the quarantine he cannot buy any animals 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 160 km North of Mbarara. From Masaka he moves west wards 150 km to Kampala. From Kampala he heads to Mukono which is in the direction S75^{o}W which is 90 km from Kampala. From Kampala he heads to Kayunga which is 148 km and south of Mukono. When he reached Kayunga he bought 400 cows and each costs UGX 850,000 per cow. The farmer and owner of the cow first gives a 5% discount on each cow plus an additional 10% discount for any number of cows bought in excess of 250. In order to package the yoghurt, he bought two identical types of buckets. A smaller bucket with a base radius of 30 cm and a larger 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 45 litres and he is to buy 4 smaller buckets and 2 larger buckets.

   TASKS.

   (a) Direct the honorable MP on the shortest route he should take and the shortest distance between Mbarara and Kayunga.

(b) Find the total cost he incurred in purchasing the cows.
(c) What is the maximum amount of Yoghurt be bought for his guests.

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 February 2016 compared to 12.8 per cent recorded for the year ended January 2016. On the other hand, the Annual Non-Food Inflation increased to 6.7 per cent for the year ending February 2016, compared to the 5.8 per cent recorded for the year ended January 2016. Key Drivers for higher Non-Food inflation were Transport (10.7 per cent), Clothing and Footwear (13.1 percent) and Miscellaneous Goods and Services (6.3 per cent).

Year		2015											2016	
Month		FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
Rated inflation (%)	Food	2.0	3.2	0.6	8.0	6.4	7.2	6.4	8.8	12.4	13.2	13.6	12.0	10.6
	Non - food	4.4	4.8	5.2	4.4	3.2	6.0	6.4	7.2	7.2	7.6	8.0	7.2	7.8
	Headline	3.6	4.0	6.0	6.0	6.4	6.8	7.2	8.4	7.8	8.0	8.8	8.6	8.4

Source: Final press release Feb 2016

TASK
As a learner of mathematics, help the community members who a less educated to trend inflation rate with the help of a graph. Identify the month that registered a high food inflation rate and give reasons.

7. 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 exactly in the plot of land available. He wants to know the actual cost of constructing the church. He also has to buy a Sino Truck to transport all building materials and requirements. The contractor informs him that the area of each triangle that can be formed from the hexagonal church will cost himUGX128 million. He then proceeded to Nina Motors to buy the Sino truck. A brand new Sino Truck costs four hundred eighty millions on cash. It can also be bought by paying a deposit of a quarter of the cash price value and either pay UGX7.5 millions weekly for 50 weeks or pay 24.5 millions monthly for 156 months. The pastor does not have the required money to obtain the Sino Truck on cash.
TASKS:
(a) Help the pastor determine the cost of the church.
(b) How much extra will he pay for the Sino Truck and explain.

8. James has a smart deep freezer at his shop. He usually monitors the temperature inside the freezer. He finds out that the temperature has dropped from -5'C as recorded at 7: 20am to -17°C

at 9:00am. At home, He has square garden and wishes to add a path way cutting across from one corner to the opposite corner.

The length of one of the sides of the garden is 10m. Besides the garden, he has another plot of land from which he wishes to lay bricks. There is a group of 12 men in the village who on average can lay 50 bricks every 3 minutes. However, James wants to do this work a little faster. In his mind, he wishes to lay 75 bricks in 2 minutes.

TASKS.
(a) Help James estimate the temperature inside the deep freezer at l10:00am.
(b) Help him also establish the length of the pathway in a simplest but most accurate way.
(c) How many men should James employ to meet his target if on average all men work at the same rate.

9. Customers of your family cake making company have always complained of too much sugar ingredient in the cakes bought. The company has 25 bakers together who can make 480 cakes in three days. However, your company has been hired to make 960 cakes in the five days remaining for a fourth coming cake festival in your town. The managing director has hired more 8 bakers and you have been selected to do a survey from the nearby related company to solve the problem of too much sugar in cakes. It has been realized that a delicious cake requires Sugar, coconut oil and flour that are mixed in the ratio of 2:3:5 respectively, each cake contains 0.75kg of flour.
   Hint:
   1 kilogram of sugar costs Shs 5,000.
   500 grams of coconut oil cost Shs 3,500
   1 kilogram of flour costs Shs 8,000
   Task:
   (a) Help your family to find if the available number of bakers can produce the required number of cakes in the stipulated time and advise them accordingly
   (b) Establish the total cost of sugar, coconut oil and flour required to make 960 delicious cakes.

10. A group of uneducated tourists came to visit Lira city in Uganda. Having reached the capital Kampala, they got confused onto what distance they are suppose to cover and the amount of fuel to fill in the vehicle tank to cover this distance(from Kampala to Lira city) yet they were even provided with the scale map shown in fig. 1 below. The map clearly shows the location of these two cities.

Fig 1. Shows part of the scale map given to tourist by the tourist guides on reaching Kampala.

Task:

a) The tourist are to follow a direct route from Kampala to lira. As a senior three student you have been instructed to guide these tourists basing on the scale map they have been given (refer to fig 1). In your guidance use their map to determine and explain to them the actual distance they are to cover in travelling from Kampala to Lira.

b) In each kilometer a diesel engine tourist vehicle consumes $\frac{1}{4}$ liter of fuel and a petrol engine tourist vehicle consumes $\frac{1}{2}$ liter of fuel. Determine the amount of fuel the tourist will have to fill in the vehicle tank in order to complete the journey from Kampala to Lira if they are to use:
   i) A diesel engine tourist vehicle.
   ii) A petrol engine tourist vehicle.

c) If each liter of petrol cost shs. 2500 and each liter of diesel cost shs. 6000. Advice the tourist which vehicle is most suitable for their journey and why?

11. Mr. Lwanyaga the 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 the bus. He later reviled that if a bus covers 100km then charged kshs.4500 and kshs.4000 for a distance of 60km. The distance between the school and Namanve is 480km and they expected to live the school at 8:00am at an average speed of $100km/hr$ according to the school's study trip rules and procedures and after the trip they students would rest for forty-five minutes and then proceed back to school.

Tasks:

a) As the treasure of the mathematics department help Mr. Lwanyaga to know total 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.

12. A Gagga bus left Kampala at 8:00 am and travelled towards Kasese at an average speed of 80km/hr. At 8:30 am, a link bus left Kasèse towards Kampala at an average speed of 20km per hour. Given that the distance between Kampala and Kasese is 400km.
    Task
    a) What do you think was the arrival time of link bus to Kampala, justify?
    b) As a senior three student what do you think is the meeting time and distance from Kampala.
    c) How far the Gagga bus is from Kasese when the link bus arrives in Kampala. Using (2cm: 50 km and 2cm: 1 hour)

13. Mr Okot wants to paint his room. The floor of the room is 5m long and 4m wide. The room is 3m high. The room has two doors each fixed in the walls that are opposite to each other, both 2m high and 75cm wide. It has one window in one of the longer walls and the window is 1m square. Draw a sketch of Mr Okot's room. Indicate the measurements of the floor, height, doors and window.

    TASK
    a) Afer a serious talk with the painter, it was agreed that the painter charges UGX 800 per square metre. Help Mr Okot to determine how much money he will pay the painter?
    b) If a 4-litre tin of paint costs UGX 70,000 and it paints 12 square metre of the wall and the walls already have an undercoat paint. How many tins would Mr Okot need to buy in order to paint his room and how much money will he require to paint his room?

14. In a Physics practical attempted by a senior four class, the force Y needed to move the 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

    (a) Plot the scatter diagram from the table above i.e Force (y) against the Load (x)
    (b) Draw the line of best fit and use it to find;
    (i) The Force corresponding to a Load of 3.5
    (ii) The load corresponding to a force of 6.2
    (iii) The Force corresponding to the load of 0 (zero)
    (c) Take any two points on the graph and use them to find the slope/gradient of the line of best fit.

(d) Compare your findings with the equation of the form $y = mx+$, hence find the law connecting Y and X, where $a = m$ and $b = c$ and state $Y = aX + b$.

15. Mr. Apeku Erias is an agent for three companies of soda: Coca cola. Pepsi and Riham beverages. He has highlighted the following places on the map of Africa where he intends to market these companies' products using her TikTok account. These include; South Africa, Burundi, Kampala, Dodoma, Accra, Bujumbura, Nairobi, Ghana, Johannesburg, Tanzania, Uganda, Kenya, Cairo, Kigali, Egypt and Rwanda.

    He earns 10% commission on every carton of soda sold. He sells each carton of Coca cola at UGX 11,000, Pepsi at UGX 11,000 and Riham at UGx10,000 On a good day, he sells 30 cartons of coca cola, 20 cartons of Pepsi and 10 cartons of Riham.

    TASKS:

    a)Help Mr Apeku to sort the places by use of an arrow diagram.
    b)i.List the places in the Domain set.
    ii. List the members of the range
    iii.What is the relationship between the domain and the range?
    iv.Describe the type of mapping in the arrow diagram in (a) above
    c) Help Apeku to know the commission earned on a good day from all the sales.

16. You are a farmer who is planning to plant a row of trees around the edge of your farm, you wish to plant a diferent type of tree every year, following a specific order. The order you want to follow starts with planting 2 apple trees in the first year, 4 oranges in the second year, 6 oranges in the third year and so on. Being a model farmer, you have been contracted by the government to organize a seminar about irrigation, of the 285 registered farmers in your village, two thirds have confirmed attendance, You plan to rent a conference room at UGX 400,000 and each attendant is to be given lunch worth 5500.

    To reach the venue of the seminar on time, you intend to leave your home at 7:00am and arrive at the conference center at 11:00am. You wish to use a boda boda for 4km and then board a taxi for the last 16km. On average, taxi's speed is 6km/hr greater than the boda boda's speed.

    TASKS
    (a) (i) Form a mathematical relation that you can use to predict the number of trees you would plant any year.
    (ii) lf you are planning to plant muvule trees in the 8^{th} year, using the relation in (i) above, how many trees would you plant?
    (b) (i) Form a mathematical formula relating total amount of money to be spent and the number of farmers expected to attend the seminar.

(ii) If you were given 1.5million shillings, using the formula in (i) above, how much will you save?

(c) Estimate the number of minutes you should spend on a boda boda if you are to arrive at the venue on time.

x

17. A ship leaves port M and sails on a bearing of 050^o heading towards island L. Two Navy destroyers sail from a naval base N to intercept the ship. Destroyer A sails such that it covers the shortest distance possible. Destroyer B sails on a bearing of 200^o to Island L. The bearing of N from M is 100^o and the distance NM = 300km.

    TASK

    Using a scale of 1cm to represent 50km;

    a) Determine the position of M, N and L

    b) Find the direction of N from L.

    c) Find the distance travelled by destroyer B.

18. 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.

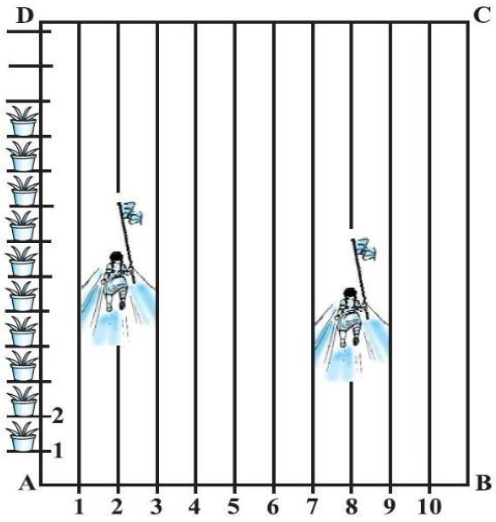
19. Your friend is shopping at a supermarket in Kampala during a clearance sale. He wants to buy a calculator that originally costs 120,000 UGX. The store has reduced the price of all calculators by 35% for the sale. Additionally, today there is an extra markdown of 40% applied to the sale price of all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

20. 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 field ABCD. The field 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 flags at specific locations on the field.



- 100 flower pots are placed at 1-meter intervals along the length AD.
- Two different lines (second and eighth) running parallel to AD are specifically used for this challenge.
- One student runs $\frac{1}{4}$ the length of the field along the 2nd meter line and posts a green flag.
- Another student runs $\frac{1}{5}$ the length of the field along the 8th meter line and posts a red flag.
- Taking one corner of the field (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 flag.
(b) Find the coordinates of the red flag.
(c) Find the distance between the two flags.
(d) If a blue flag is to be placed exactly halfway between the green and red flags, where should it be placed?
(e) Draw the locus of points that are equidistant from both the green and red flags and find it is equation.

21. 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 traffic, 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, approximately 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^{o}, which took them 1 hour and 44 minutes as they enjoyed the scenary along the roadside.

    TASK
    (a) Deserибe the direction from Jinja to Entebbe.
    (b) How far is it from Mukono to Jinja using the direct route insteaf 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 recommendations would you make to avoid such delays in the future?

    22……

    23…….

    24…….

SENIOR THREE SCENARIO QUESTIONS

1. **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 flour, 2 cups of sugar, 4 eggs, and 1 cup of mixed ingredients per cake.**
    - ✓ **Vanill a Cake: Requires 4 cups of flour, 3 cups of sugar, 3 eggs, and 2 cups of mixed ingredients per cake.**
    - ✓ **Red Velvet Cake: Requires 5 cups of flour, 2 cups of sugar, and 1 cup of mixed ingredients per cake.**

- ✓ **Lemon Cake: Requires 2 cups of flour, 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 Red Velvet 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 flour 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.

2. **Imagine you are a skilled image processing engineer working in a digital forensics laboratory. Your expertise lies in restoring and enhancing images to extract valuable information for investigative purposes. Today, you receive a blurred image taken from a surveillance camera that captured a critical moment in an ongoing investigation. To uncover the hidden details in the image, you must employ advanced image restoration techniques.**

As you dig into the image restoration process, you discover that the blurring effect on the image can be represented by a linear transformation. This transformation can be expressed as a matrix equation: $Y = AX$, where A is the blurring matrix given by $\begin{pmatrix} 2 & 0 \\ 2 & 3 \end{pmatrix}$, X represents the original image, and Y represents the blurred image.

After successfully restoring the blurred image and extracting valuable evidence, you discover that it contains confidential information that must be protected. To ensure the image's secrecy, you decide to encrypt it using matrix transformation. You develop an encryption matrix, denoted as E and is given as $\begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}$. The encryption process involves multiplying the original image matrix, X, by the encryption matrix, E, resulting in the encrypted image matrix, Z.

TASK

a) As the expert image processing engineer, explain how you can restore the original image from the blurred version Y and show the necessary workings where possible.

b) As the skilled image processing engineer, you must guide your team through the process of decryption to retrieve the original information. Show necessary workings where possible.

3. **Sky Electronics Manufacturing Company produces two different products: Smartphones and Tablets. Each product requires a specific number of labour hours, machine hours, and raw materials to manufacture. The company has the following production requirements per unit of each product:**

Smartphone:
- 3 labor hours
- 4 machine hours
- 5 units of raw materials

Tablets:
- 4 labor hours
- 5 machine hours
- 6 units of raw materials

The company has 144 labor hours, 186 machine hours, and 228 units of raw materials available for production this month.

The profit per unit for each product is as follows:
- Smartphone: UGX 114,000
- Tablet: UGX 95,000

On a certain day, a batch of 20 tablets and 30 smartphones were produced by the company and among them, there are a few defective tablets and smartphones. The probability of a tablet being defective is 0.2 and for a smartphone being defective is 0.12.

Task
a) i) Arrange the production requirements for the products in a rectangular grid of numbers in a way that preserves the data relationships.
ii) Represent the available resources in rows and columns in a way that preserves the original information.
iii) Carry out an operation on the corresponding elements of the data arrangements involved to determine the number of each product that can be produced using the available resources.
iv) Using rectangular array of numbers arranged in rows and columns find the total profit based on the production quantities and the given profit per unit.
b) If a product is picked at random from the batch, what is likelihood of picking a perfect product from this batch?

4. **A highly secure research institution has a sensitive laboratory room that requires a four-layered security protocol to access. The combination to access the laboratory is split into four parts; W, X, Y and Z. Each part of the combination is given to a different individual; Dr Edmond, Dr Edward, Dr Herman and Dr Frank respectively.**

The combination to access the laboratory is structured as follows: $\frac{Z+X}{W-Y}$

To access the laboratory, all the four individuals must be present and enter their respective parts simultaneously into the above structure to generate the final 10 digit access code which opens the laboratory.

If Dr Edmond has part $W = \frac{\sqrt{192}}{\sqrt{3}}$**, Dr Edward has part** $X = 3\sqrt{48} - \sqrt{75} - 2\sqrt{12}$**, Dr Herman has part** $Y = 2\sqrt{150} - \sqrt{96} - 2\sqrt{24}$ **and Dr Frank has part** $Z = \sqrt{18} + \sqrt{50}$**.**

TASK:

a) **Using the information provided, you are required to determine the 10-digit access code that unlocks the laboratory room. (Hint; a calculator should be used once at the very last step.)**

b) **Dr Herman had an argument with the top administrators of the institution that this arrangement of splitting the access code into different parts is a waste time and he suggested that the final code should just be given to one person. What is your thought on Dr Herman's suggestion?**

5. **A fashion brand has three stores in different locations, each carrying three types of shirts: formal, casual, and sportswear. The stores have different inventory levels, buying prices, and selling prices for each type of shirt. The details are as follows:**

Store A:
- Formal: 100 shirts, buying price Shs 15,000, selling price Shs 20,000
- Casual: 50 shirts, buying price Shs10,000, selling price Shs 15,000
- Sportswear: 75 shirts, buying price Shs 18,000, selling price Shs 25,000
Store B:
- Formal: 75 shirts, buying price Shs 12,000, selling price Shs 22,000
- Casual: 100 shirts, buying price Shs 9,000, selling price Shs 18,000
- Sportswear: 50 shirts, buying price Shs 15,000, selling price Shs 28,000
Store C:
- Formal: 50 shirts, buying price Shs 10,000, selling price Shs 25,000
- Casual: 75 shirts, buying price Shs 8,000, selling price Shs 20,000
- Sportswear: 100 shirts, buying price Shs 12,000, selling price Shs 30,000

TASK

Using matrices, help the brand's inventory manager to:
i) represent the inventory levels, buying prices, and selling prices of each store
ii) calculate the total value of each type of shirt across all stores
iii) determine the total value of inventory for each store
iv) calculate the total profit for each store if all shirts are sold.
v) identify which store has the highest total profit.

6. **A furniture manufacturer produces three products: chairs, tables, and desks. The production process involves three machines: Machine A, Machine B, and Machine C. The production data is as follows:**

Machine A:	Machine B:	Machine C:
- Chairs: 100 units, profit $10/unit	- Chairs: 75 units, profit $12/unit	- Chairs: 50 units, profit $15/unit
- Tables: 50 units, profit $15/unit	- Tables: 100 units, profit $18/unit	- Tables: 75 units, profit $20/unit
- Desks: 25 units, profit $20/unit	- Desks: 30 units, profit $25/unit	- Desks: 40 units, profit $30/unit

TASK: Using matrices,
a) Represent the production data and profit for each machine
b) Calculate the total profit for each product
c) Determine the total profit for each machine.

7. **You are a city planner working for the local government. Your team has been tasked with developing a zoning plan for a rapidly growing area of the city. The goal is to create distinct regions that allocate land for different types of development, such as residential, commercial, and industrial areas, while ensuring that they do not overlap or conflict with one another.**

To help visualize and analyze the zoning plan, your team has decided to use a coordinate plane, where the x-axis represents the east-west position and the y-axis represents the north-south position within the city. You will use a system of inequalities to define the boundaries of each zoning region, ensuring that the regions are clearly positioned and do not encroach on one another.

The city has designated a residential zoning region that is bounded by the following inequalities: $x \geq 5$, $x \leq 15$, $y \geq 10$, and $y \leq 20$.
The commercial zoning region is defined by the inequalities: $x \geq 10$, $x \leq 20$, $y \geq 5$, and $y \leq 15$. The city has also set aside a industrial zoning region, which is bounded by the inequalities: $x \geq 15$, $x \leq 25$, $y \geq 0$, and $y \leq 10$.
Suppose a developer proposes to build a new mixed-use development that would occupy a land area defined by the inequalities: $x \geq 12$, $x \leq 18$, $y \geq 8$, and $y \leq 16$.
The city is considering creating a "green belt" zone that would serve as a buffer (moderate the impact) between the residential and industrial areas. This green belt zone would be defined by the inequalities: $x \geq 10$, $x \leq 20$, $y \geq 10$, and $y \leq 20$.

TASKS

a) Sketch the residential zoning region on a coordinate plane and describe the characteristics of the land area that falls within this region.
b) Plot the commercial zoning region on the same coordinate plane and explain how it differs from the residential zoning region.
c) Sketch the industrial zoning region on the coordinate plane and discuss any potential overlaps or conflicts with the residential and commercial zoning regions.
d) Determine which zoning region(s) the proposed development would fall within, and explain any potential issues or considerations that the city planner should take into account.
e) Sketch the green belt zone on the coordinate plane and discuss how it could help mitigate any conflicts or compatibility issues between the different zoning regions.
f) As the city planner, develop a comprehensive zoning plan that incorporates all of the zoning regions discussed above, ensuring that the regions are clearly positioned and do not overlap. Explain how this zoning plan could be used to guide future development and growth in the city, and identify any potential challenges or considerations that the city may need to address.

8. **You are a civil engineer working on a transportation planning project for a growing city. Your task is to design the layout of a new public transportation system, including bus routes and light rail lines, to improve connectivity and accessibility across different neighborhoods.**

To visualize and analyze the transportation network, you decide to use a rectangular cartesian coordinate plane, where the x-axis represents the east-west direction and the y-axis represents the north-south direction within the city. You will use the equation of a straight line to model the paths of the bus routes and light rail lines, ensuring that they provide efficient and direct connections between key destinations.

As you work on the transportation plan, you need to consider factors such as population density, land use patterns, and the location of important landmarks and hubs, in order to optimize the network and meet the mobility needs of the city's residents.

The city has identified a major commercial district located at the coordinates (10, 15) and a residential neighborhood at the coordinates (5, 5).
A new light rail line is being planned to connect the city's central business district, located at the coordinates (15, 20), to a suburban employment hub at the coordinates (25, 10).
The city's transportation department has identified the need for a bus route that can serve multiple residential areas and shopping centers. One potential route connects the points (8, 12) and (18, 8), and then continues on to the point (25, 15).
A new mixed-use development is being planned at the coordinates (12, 18). The city wants to ensure that this development is well-connected to the existing public transportation network.

The city's transportation department is considering adding a new light rail line that will run parallel to an existing major roadway. The roadway is represented by the straight line with the equation $y = 0.5x + 10$.

TASKS

a) Determine the equation of the straight line that represents the most direct bus route connecting the major commercial district and the residential neighborhood. Explain how the slope and y-intercept of this line can be used to understand the characteristics of the bus route, such as the direction and distance of the trip.

b) Calculate the slope and y-intercept of the straight line that represents the path of the new light rail line, and discuss how these mathematical properties can inform the design and implementation of the transportation infrastructure.

c) Sketch the path of the bus route on a rectangular cartesian plane, and describe how the equation of each line segment can be used to analyze the efficiency and effectiveness of the overall route.

d) Determine the equation of the straight line that represents the most direct bus route between the new development and the nearest existing bus stop, located at the coordinates (8, 10).

e) Determine the equation of the line that represents the path of the new light rail line, if it is to be located 500 meters (on the y-axis) from the existing roadway.

9. **From the roof of a house, a boy can see a coconut tree, which is 20m away from the house. He measures the angle of elevation of the top of the tree as 21^o and the angle of depression of the bottom of the tree as 13^o.**

   On the other side of the coconut tree there is a tall building 100m high. The angle of depression of the base of the coconut tree from the top of a tall building is 20.3^o.

   TASK

   a) Find the height of the coconut tree.

   b) i) find the horizontal distance of the tall building from the tree.

   ii) If there is a monument statue in between the tree and the tall building, 70m from the tree calculate the angle of depression of the base of the monument statue from the tall building.

10. **You find yourself at the entrance of the forest, facing due North. You spot a large tree in front of you. Using your trusty compass, you take a bearing of 40 degrees East of North to navigate deeper into the forest and you walk straight along this bearing for 200 meters until you reach the tree.**

    As you continue walking into the forest on the same bearing, you come across a small river blocking your path which is 100 m from the big tree. You decide to find a safe crossing point. Using your compass, you take a new bearing of 70 degrees West of North to search for a suitable crossing.

TASK

a) How far North and East have you traveled from your starting point to be the tree?

b) If you walk along this new bearing for 150 meters, how far:

i) North and West have you traveled from the point you reached the river?

ii) East and North have you travelled from the point the entrance of the forest?

iii) what is the total distance you've covered from the starting point?

11. Bbula is an island found on lake Zzibi, there has been a serious problem of poor network 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) By scale drawing, help Engineers to come up with an accurate drawing of the island and use it to find;

(i) The angle ABC

(ii) Given that the Mast must be established where two perpendicular bisectors meet, establish with point M where the mast must be and find its perpendicular distance from the main landing site.

(iii) It is known that the frequency must cover the island, draw the locus of the frequency and measure its radius.

(b) Two points P and Q are 1000m apart. The angles of elevation of the top of the Mast from points P and Q are 60° and 30° respectively. Calculate the height of the Mast if;

(i) The points are on the same side of the Mast

(ii) The points are on opposite side of the Mast.

12. 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 candidates did not attempt any question from any of the three sections. Three attempted questions from section A only, five from section B only four from section A and C only while 5 attempted questions from all the three sections. Those who attempted questions from A and B only were 3 less than those who attempted questions from sections B and C only and three times those who attempted questions from section C only.

TASK

As a student of Mathematics, help;

(a) Show the above information using an appropriate diagram

(b) Find how many candidates attempted questions

(i) from each section

(ii) from section C only.

(c) If a candidate is selected at random, what is the probability that he or she attempted questions from at least two sections?

(d) Given that those who attempted at most one question, did not make it to oral interviews, how many candidates were they?

(e) In your opinion, why do you think the World Food Program hired a private company to carry out interviews?

13. A mathematician gave your friend a carpenter a task of making a rectangular ground floor of a rabbit house. The length of the house is to be $(x + 3)$m and the width is to y. Its perimeter should be 25m and its area must be $25m^2$. The mathematician adds that he needs the work to be finished in one day but the carpenter at one time he contracted 3men working at the same rate to assist him on his work and they only managed to work on $5m^2$. To be given this contract, your friend is 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) Determine the length and width of the floor to be occupied by the house.

(ii) Make a sketch of the floor your friend can present to the mathematician to get the contract.

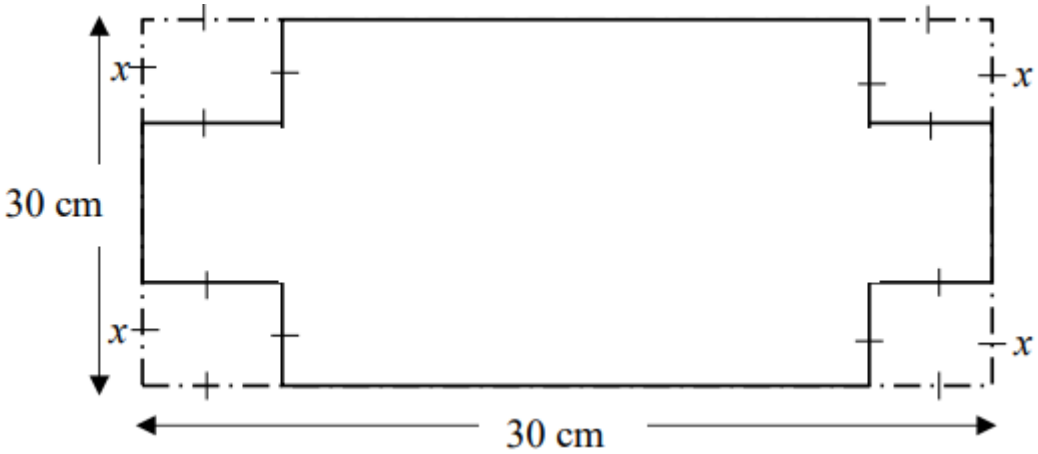
(b) Determine the number of workers who are needed to complete the house if they work at the same rate as the group the man as ever used.

14. Kasomba is a farm manager at Ngori production ltd. He has a task to buy fencing material to make a rectangular partition of an area $450m^2$ for cabbage production. The material is meant to cover three sides, since the other is already fenced with live fence. It has been confirmed a metre require fencing material at a cost of UGX.2000. Kasomba is given UGX.120,000 which is the exact amount needed to buy the fencing material for the three sides.

TASK

(a) Advise the farmer on how to choose the length and width of the partition to achieve his objective.

(b) The manager uses a rectangular piece of card measuring 30 cm by 24 cm to make an open box he would use to pack the produce. The net of an open box is has side x cm. The area of the net is 576 cm^2 made by removing a square from each corner of this piece of card. Each square that is removed



i) Form an equation in x and solve it to find the value of the height of the box.

ii) Determine the length and the width of the box.

15. The small individual farmers in a certain village are being cheated by the traders from towns by offering them low prices for their produce. These farmers decided to form groups and sell their produce through them at better prices. So far, they have two groups, Kamukamu and Tweziimbe. In the current season, 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.

    This month, the:
    - Kamukamu group had sales of 3,254 litres of milk, 42 bags of maize and 8 bags of beans.
    - 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.

    TASK
    Organize the information for the two periods and use it to determine the total sales of both groups.

16. For your leaver's party campaign, members suggested that you buy and put on T-shirts as a class. You have three suggestions of sizes of T-shirts you can buy these are; Small size(S), Medium size (M) and Large size (L) T-shirts.
    You will only buy the suggestion as the captain if 70% of your fellow students can fit in at least two sizes.
    Below are your findings that you are going to base on to make a decision:

    The number of students who fit in medium size is equal to those who fit in large size and they are 100.
    The number of students who fit in small size is 76.
    Those who fit in small size and large size are 50.
    Those who fit in medium size and large size are 70.
    Those who fit in small size and medium size are 60.
    Those who fit in none of the sizes are 4.
    Some students fit in all the three sizes.
    The class is made up of 140 students.

    TASK:
    Will you buy the suggestion of buying and putting on T-shirts as a class for your leaver's party campaign? Justify your answer.

17. In the bid to determine the likelihood of a particular cell phone being successful on the market, your uncle who owns an electronics workshop tasked you to conduct a survey on 150 people on the streets of your town about

the usage of any of these cell phones. Galaxy (G), Flip phone (F), and I-phone (I), then he will decide whether to purchase more of a given type if the likelihood of those who used only that one type exceeds 0.1. 45 owned a flip phone, 60 owned an I-phone, 63 owned a Galaxy, 15 owned a Flip phone and an I-phone, 25 have owned both a Galaxy and an I-phone, 15 have owned both a Galaxy and a Flip phone only and 5 have owned all the three.

Task:

(a) Find out if there are people who have not owned any of the three.

(b) Calculate the probability of people who owned only one type of cell phone.

(c) Advise your uncle on whether to purchase more of these types.

18. A supplier of foodstuffs supplied three types of food items to three schools as follows;

First week;

Kasaka S.S; 2bags of posho, 1 bag of rice and 3bags of potatoes

Mpugwe S.S; 2bags of posho, and 2bags of rice.

Sazza S.S; l bag of posho, 1bag of rice and 2bags of cassava.

Second week;

Kasaka S.S; 3bags of posho and 2bags of cassava

Mpugwe S.S; lbag of posho, 2 bags of rice and lbag of cassava.

Sazza S.S; 3bags of posho and 1 bag of cassava.

The price of posho, rice and cassava is sh.20,000, sh.30,000 and sh.10,000 per bag respectively.

After the two weeks, he wanted to improve his mode of supply that is to say, supplying what is preferred more by the students in the schools.

Therefore he decided to make a random survey among a selected number of students from all the three schools. All the students sampled liked at least one of the foodstuffs. , 47 liked cassava (C), 53 liked posho, 23 liked posho only, 10 liked cassava only and 15 liked all the three foodstuffs. Forty five liked rice is 45 and 5 liked only rice.

TASK

(a) Arrange the amount of foodstuffs bought for each week and the prices using suitable arrays of rows and columns, and use them to determine which school spent most in the first two weeks.

(b) (i) Arrange the results of a survey using a suitable statistical diagram.

(ii) Use it to determine the number of students that prefer at least two foods stuffs.

(iii) How many students were randomly picked for this survey?

(iv) What is the chance that a student picked at random prefers rice? What conclusion can he draw from this value as per the requirements of his survey?

19. A family decides to paint the inner walls of its living room for New Year celebrations with a budget of Shs 400,000. The room is 5m long, 4m wide and 3m high. The room has two painted doors in the middle of the walls opposite to each other. Each door is 2m high and 0.75m wide. The room has one painted window in one

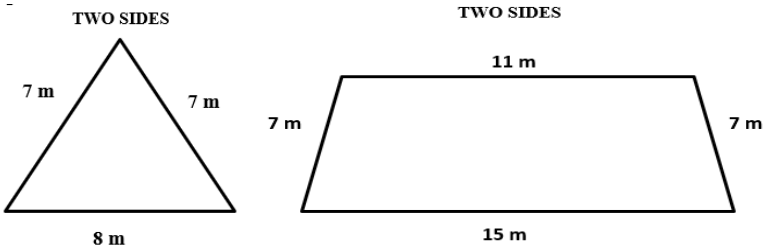
of the side walls which is 1m square. A painter charges Shs 800 per square meter painted and for every 10m square wall painted fully, consumes a 4 litre tin paint which he sells at Shs 70,000.
Task:
As a mathematics student; (a) Establish computations to find out if the budgeted money could be enough for this work.

(b) If a painter offers a discount of 10% on labour and 5% on every litre of paint. How much money shall the family save?

20. You have a piece of wood that is 12cm in length and 12cm in width. You to use it to make a simple money bank that is in shape of a cube and you use it to save your coins. You want to make it in such a way that to remove your money, you don't break it but rather you unfold it and then fold it back. You plan to start making it on 27th November 2023 and you want it to be done in one week!
TASK:
a) Accurately illustrate how many pieces of wood you would cut out of the piece of wood you have for your money bank clearly showing their width and length.
b) Show how you will arrange them on the floor such that when you start folding them, they form the shape you want.
c) What space will your money bank occupy?
d) On which date will your money bank be ready for use?

21. You are going to host some friends for a movie night. You have four options you can choose from: C= comedy, A= animation, M= musical, R= romance. You decided to ask them which one they would love to watch so that you choose one that is preferred by most of them. Below where their preferences:
C A A R R M M C M R C R R M AA R M AA R A RRR
TASK:
a) Summarize your data.
b) Represent your data.
c) Which movie will you choose to show your friends?

22. A friend was given sketches below of the rooftop he plans to put on his house;



The builder recommended iron sheets of 3ft by 4ft that cost UGX.40, 000 per sheet. Your friend needs to know how many iron sheets to buy and how much it will cost him. (1ft = 0.3)
He also plans to get a loan of UGX.4, 000,000 that he is to pay back in 3 years to finance his other projects One bank offers the loan at a simple interest rate of 10% and the others offers the same loan at a compound interest

rate of 5%. He is finding it hard to determine which bank is cheaper to help him decide which of the two he can get a loan from.

TASK
a) How many iron sheets will he need to buy and how much will he need to buy them?
b) Which bank do you recommend him to get a loan from and why?

23. You have a piece of wood that is 12cm in length and 12cm in width. You to use it to make a simple money bank that is in shape of a cube and you use it to save your coins. You want to make it in such a way that to remove your money, you don't break it but rather you unfold it and then fold it back. You plan to start making it on 27th November 2023 and you want it to be done in one week!
TASK
a) Accurately illustrate how many pieces of wood you would cut out of the piece of wood you have for your money bank clearly showing their width and length.
b) Show how you will arrange them on the floor such that when you start folding them, they form the shape you want.
c) What space will your money bank occupy?
d) On which date will your money bank be ready for use?

24. On your way to school from home, you plan to pass via you're friend's home to pick your book. You travel by a motorcycle that travels at constant speed of 88km/h. You want to decide on what time to leave home such that you reach school at 7:30am. On a grid map where each square is $1km$, your home is located at coordinate (3, 3), your friend's home is at (2, 9) and your school at (7, 9). As you were thinking of how to travel, you realized that your painting was shifted from position B to position A as shown below and hence would wish to shift it back.
NOTE: Time in hours $= \frac{distance\ in\ km}{speed\ in\ km/h}$
TASK:
a) What time will you have to leave home for you to reach school on time?
b) How will you shift you painting back to its original position

25. Mr Lwanga Badru Sheila's father a S.4 South student went to Kampala on Independence day and visited three shops. A clothing Store shop that was offering a general 25% discount on all there stock. However for that independence day only, the store advertised an additional 10% discount to celebrate with the Ugandans independence day. The price tag on Sheila's sweater was marked UGX60,000. He then proceeded to SG furniture dealers and found this information on the show room entrance.

"BEST TERMS ON SOFA SETS"

CASH PRICE: UGX 4,200,000 with a 10% DISCOUNT

HIRE PURCHASE: DEPOSIT UGX 1,200,000 AND PAY 8 EAQUAL MONTHLY INSTALLMENTS OF UGX 431,250

Mr. Lwanga could not pay cash and opted for hire purchase. He then proceeded to his Saving scheme which gave him a top up loan of UGX3,000,000 at a compound interest rate of 4.8% per annum. If he was to pay back the loan in a period of 24 months.

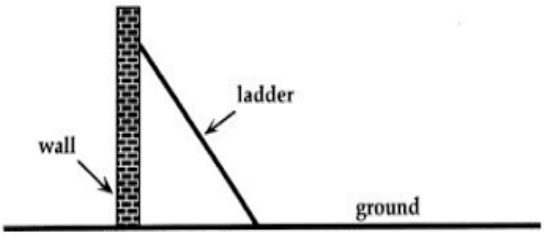
Tasks:

(a) What was the sale price of sweater.

(b) Find the extra amount of money he paid to the furniture dealer because he did not pay cash.

(c) How much interest did the SACCO earn from Mr Lwanga.

26. An internet router installer wants to install the router outside the building at a height of 15m from the ground floor since that's where the signals are. At first he puts the foot of un-adjustable ladder at 10m away from the wall on the ground and the head of the ladder on the wall at a height of 6m. However, he realized that he could not reach the position he wanted. He had to re-adjust the same ladder to make sure he reaches the position he wants!



TASK:

a) Illustrate the initial position of the ladder on a well labelled grid.

b) How steep is the ladder in that initial position?

c) Illustrate on the same grid how he can re-adjust the ladder to reach the position he wants.

d) How steep is the ladder in that new position?

e) Using the new positions, show the relation between the position of the ladder on the ground, on the wall and the slope? (show the mathematical relation)

f) How tall was the ladder used?

27. An investor wishes to buy a piece of land (family land) from your father to construct a factory. Your father and the whole family members have already accepted to have this land sold to this investor. The land is rectangular in shape and measures 150m by 100m in size. One longest side of this land is having its boundary covered by a water body. The investor is to pay each square meter of this land Uganda shs. 300000 according to the agreed terms and conditions regarding land price negotiation in this community. The investor is to fence the land immediately after payment.

Task.

a) As a senior three student, help your father and the whole family to determine the amount of money they should accept to receive from this investor for the whole piece of land (offer them understandable explanation where necessary).

b) If the investor is to fence this piece of land with barbed wire excluding or leaving out the side bounded by the water body and each roll of a barbed wire covers a distance of 25 meters in fencing and cost Uganda shs. 100000. Advice this investor on the amount of money he should have in order to fence this land

28. The government of Uganda is to set up a project in Kabasanda village, Butambala district. For this project to be set up, a group of villagers is to be displaced from their own land and compensated in cash money in order to relocate themselves to other places. The table below shows the affected villagers and pieces of land in hectares they own that are to be compensated.

Names	Land (in hectares)
Kateregga	2
Kirunda	3
Wasswa	1
Katende	4
Ssebagala	3

Task:

(iii)i) If in each hectare of land, a villager is to be given a compensation fee of shs. 2000000 and added a settlement allowance of shs. 800000. Form a mathematical function showing the relationship between the pieces of land (in hectares) and the total amount of money to be received in compensation. Taking x as pieces of land (in hectares) and f(x) as the total amount of money to be compensated

(ii) Using the relationship derived in a (i) above represent the above information on an arrow diagram. Show clearly the amount each villager will get in compensation.

(iv)b) Kirunda has just bought a piece of land in this village (3 hectares) at shs. 4000000 but unfortunately is amongst the people to be displaced as shown in table 1 above. Determine whether Kirunda will lose his land with a profit or loss and by how much.

(v) Mr. Kigenyi have 15 hectares of land in the same village. Determine by calculation how much he would have received in compensation if the whole of his land was to be covered up by the project set up plan.

29. 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 UBA443T, UBB223R and UBD132V, the numerical digits on the number plates were found to be in quinary base and he is interested in knowing which vehicle has digits which are a multiple of three so that he can paint that vehicle with a red color for easy identification.
All the three taxis leave Namayiba taxi park at 6:00am for their first route to different destinations, however they enter the after at different time intervals. The first taxi enters the taxi at 8:30am, the second taxi at 9:00am and the third one enters at 9:15am. The fuel consumption rate for all the three taxis is the same and it was observed that when any of the taxi had covered 60km, the fuel consumed costed UGX160,000 and when the taxi had travelled 15km, the fuel consumed was UGX0,000.
Task:
(a) Help your guardian know which taxi he will paint the red colour.
(b) At what time will the three taxis enter Namayiba taxi park all at the same time.

(c) What is the estimate cost on fuel consumption if the taxi plans to take your school for a tour to Jinja which is approximately 90km from Namayiba taxi park.

30. A family of your friend agreed to have family planning so that they can effectively plan for 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. At their drinks shop they sell two types of water bottles, type A and type B and they make the water bottles by themselves. The same equipment can be used to make either water bottle. In making type A water bottles, one man can supervise 10 machines and this batch will give them a profit of UGX50,000 per day. Type B water bottles yield a profit of UGX250,000 a day using 25 machines and 8 men. There are 200 machines and 40 men available.

    The produced water is parked in cartoons and your school had a thanksgiving function and budgeted for 5 boxes of water type A and 4 boxes of water type B at a cost of UGX92,500. However, the bodaboda man that was sent to buy the water brought 4 boxes of water type A and 5 boxes of water type B and was given a demand note of UGX4,000 as balance remaining to be paid for what he bought.
    Task.
    (a) In which year do you think your friend's family have their sixth born.
    (b) (i) Show the feasible region of the relation on a Cartesian plane.
    (ii) Help your friend's family determine the maximum profit they will receive from the sale of the water bottles.
    (c) What do you think is the actual price of each carton of each water type.

31. In Uganda, many are worried about the fire problem in schools which is becoming a threatening hazard. Research experts have carried out a survey to investigate the likely cause of the rampant fires in Education institutions. Findings showed that, three categories of stake holders were found to be responsible for the fire outbreaks in Education institutions. 50 respondents said they are learners, 50 respondents said they are parents and 40 respondents said they are school administrators. 10 respondents attributed it to all categories. 15 attributed it to learners and parents, 20 attributed it to parents and school administrators and 15 attributed it to learners and school administrators.

    Task:
    a) Help the expert researchers to summarize their report and be able to establish number of respondents who attributed it to;
    i. Learners only
    ii. Parents only
    iii. School Administrators only
    b) Find the total number of the respondents in the survey.
    c) What is the probability that the fire problem in schools is attributed to learners?

32. 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) and he has invited a lot of guests. However due t the quarantine he can not buy any animals 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 directionS75^{o}W which is 90km from Kampala. From Kampala he heads to Kayunga which is 148km and south of Mukono.

When he reached Kayunga he bought 400 cows and each costs UGX850,000 per cow. The farmer and owner of the cow first gives a 5% discount on each cow plus an additional 10% discount for any number of cows bought in excess of 250.

In order to package the yoghurt, he bought two identical types of buckets. A smaller bucket with a base radius of 30cm and a larger 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 45itres and he is to buy 4 smaller buckets and 2 larger buckets.

TASKS.

c) Direct the honorable MP on the shortest route he should take and the shortest distance between Mbarara and Kayunga.

d) Find the total cost he incurred in purchasing the cows.

e) What is the maximum amount of Yoghurt be bought for his guests.

33. 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 Pentagonal church which can fit exactly in the plot of land available. He wants to know the actual cost of constructing the church. He also has to buy a Sino Truck to transport all building materials and requirements. The contractor informs him that the area 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 four hundred eighty millions on cash. It can also be bought by paying a He then proceeded to Nina Motors to buy the Sino truck. A brand new Sino Truck costs four hundred eighty millions on cash. It can also be bought by paying a deposit of a quarter of the cash price value and either pay UGX7.5millions weekly for 50 weeks or pay 24.5millions monthly for 15months. The pastor does not have the required money to obtain the Sino Truck on cash.

TASKS:

a) Help the pastor determine the cost of the church.

b)How much extra will he pay for the Sino Truck and explain why.

34. There are very few teachers who have three teaching subjects. A survey was done in your school and it was found that the school has a teaching staff of 22 teachers 8 of them teach 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. The number of teachers who teach Physics and Chemistry is equal to that of those who teach Chemistry but not physics.

In the school staffroom there are two similar cans that have different heights. One 6cm and the other one 9cm. If the surface area of the larger can is 840 cm^2.

TASK

(a) Find the number of teachers who teach none of the three subjects.

(b) Find the probability that a teacher picked at random teaches only one subject.

(c) Find the surface area of the smaller can.

35. In a survey 100 people were asked which form of transport they used. 46 people only used bicycles (M). 21 people only used buses (N). 11 people only used motor bikes (P). 5 people used buses and bicycles but not motor bikes. 3 people used buses and motor bikes. 6 people used bicycles and motor bikes. 9 people declined to respond. Customs duty and purchase tax are levied on certain imported goods as:

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

Purchase tax= 15% of (value +duty)

TASK

(a) Find the;

(i) number of people who used all the three forms of transport.

(ii) percentage of people who used only two forms of transport.

(b) Find the total amount levied on a disco deck valued at 1.7millions.

36. Mr Wakida is a business man who deals in an agricultural produce business. He visited four markets in week two of the month of May 2024.

In Nakasero market (N), he bought 3 bags of beans, 5 bags of maize, 10 bags of potatoes and 3 bags of millet.

In Gayaza market (G), he bought 1 bag of beans, 4 bags of potatoes and 2 bags of millet.

In Jinja market (J), he bought 4 bags of beans, 3 bags of maize, 6 bags of potatoes and 1 bag of millet.

In Masaka market (M), he bought 5 bags of beans and 1 bag of maize.

Mr Wakida bought each bag of beans at Shs. 45000, a bag of maize at Shs. 30000, a bag of potatoes at Shs. 15000 and a bag of millet at Shs. 50000

However, since he is a business man, he later sold off all the produce he had bought at Shs. 50000 per bag of beans, Shs. 35000 per bag of maize, Shs. 18000 per bag of potatoes and Shs. 55000 per bag of millet.

TASK:

a) Assist Mr Wakida to summarize the above information (number of bags bought, buying prices and selling prices of the bags) in matrix form.

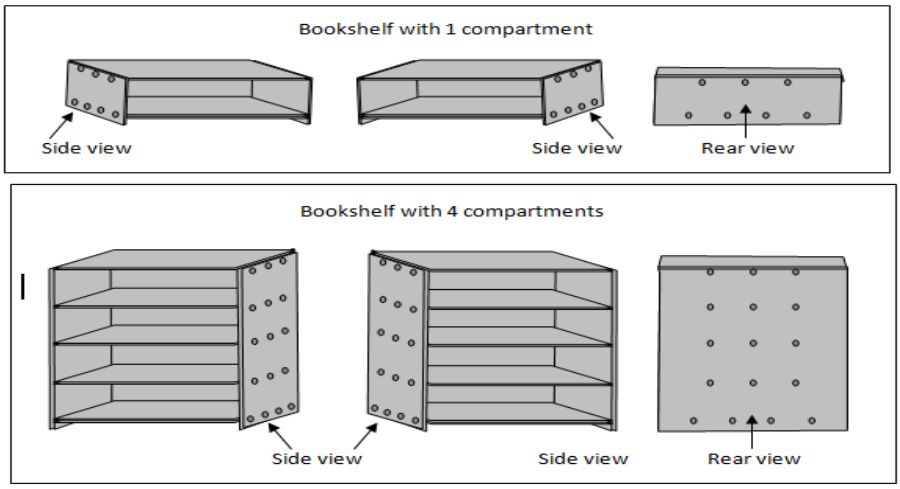
b) Using your knowledge of matrix multiplication help him to know:

i) the amount of money spent on the produce in each market.

ii) the amount of money he received after selling off all the bags.

c) Help him to know the amount of profit he made that week.

37. Acom is a carpenter. She specialises 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.



Apwoyo ordered a bookshelf with 1 compartment.
Kyoteeka ordered a bookshelf with 2 compartments.
Muwonge ordered a bookshelf with 3 compartments.
Zesilo ordered a bookshelf with 4 compartments.

TASK:

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

Number of compartments	1	2	3	4
Number of nails				

b) Acom recognised a pattern in the number of nails he used to make the bookshelves with 1, 2, 3 and 4 compartments. Work out the algebraic expression that Acom can use to find the number of nails needed to make a bookshelf with any number (n) of compartments.

c) Acom received a new order, for 4 bookshelves with 6 compartments each. She has to buy nails. Nails are sold in kilograms. In a kilogram there are 32 nails. Each kilogram costs UGX 5,000. How much did Acom pay for the nails for the new order?

38. In Uganda, many are worried about the fire problem in schools which is becoming a threatening hazard. Research experts have carried out a survey to investigate the likely cause of the rampant fires in Education institutions. Findings showed that, three categories of stake holders were found to be responsible for the fire outbreaks in Education institutions. 50 respondents said they are learners, 50 respondents said they are parents and 40 respondents said they are school administrators. 10 respondents attributed it to all categories. 15 attributed it to learners and parents, 20 attributed it to parents and school administrators and 15 attributed it to learners and school administrators.

TASK:

a) Help the expert researchers to summarize their report and be able to establish number of respondents who attributed it to;

i. Learners only

ii. Parents only

iii. School Administrators only

b) Find the total number of the respondents in the survey.

c) What is the probability that the fire problem in schools is attributed to learners?

39. Mr. Livingstone is a very rich man in Mbarara city where he has constructed 36 houses. He wants to paint his houses by either green, white or black colour. Of these, 10 houses must have to be painted with Green colour and 6 houses must be painted by black colour. The 5 houses must be painted with green and white, 8 white and black and 4 houses must be painted with green and black.

All houses which are painted white are three more than those which are pointed black.

TASK

a) Determine the number of houses that were painted with all the three different colours.

b) Determine the number of houses painted with at least one of each of the three colours.

c) If the house is picked at random, what is the possibility that it is painted black or white only.

40. A group of students from Nairobi University agreed to contribute equally to buy mathematical calculators worth Ksh 1200 for a school library.

Five students pulled out and so the others agreed to contribute on extra Shs 10 each. Their contributions enabled them to buy calculators worth Shs. 200 more than they originally expected.

TASK

a) If the original number of students was X, write an expression of how much each was originally to contribute.

b) Write down two expressions of how much each contributed after the five people pulled out.

c) Calculate the number of people who made the contribution and find out how much did each contribute.

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

(a) 80g butter

(b) 350g self-raising flour

(c) 30g sugar

(d) 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 venture.

d) 100g butter
e) 1kg self-raising four
f) 50g sugar
g) 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:
b) Butter: 5,000 shillings per 100g
c) Self-raising flour: 6,000 shillings per kg
d) Sugar: 1,000 shillings per 50g
e) 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.

42. 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. Addition ally, 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 atleast 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 findings, advise the school on whether to implement rules or not.

43……

44……

45……

SENIOR FOUR SCENARIO QUESTIONS

1. **You went to a casino and decided to play a game of chance. The dealer shuffles a standard pack of 52 playing cards and offers you a bet; if you draw a card that meets certain conditions, you win different prizes depending on the conditions you meet. The conditions are:**

   i) If you draw a 6 or a king, you win a Consolation Prize of UGX 10,000.
   ii) If you draw a club or an ace, you win a Bronze Prize of UGX 50,000.
   iii) If you draw a black card (spades or clubs) or a heart, you win a Silver Prize of UGX100,000.
   iv) If you draw the ace of spades, you win the Grand Prize of UGX 1,000,000!

   TASK
   a) Find the likelihood of winning the consolation prize.
   b) Find the chance of winning bronze price.
   c) Find the odds in your favor of winning the silver prize.
   d) Find the possibility of winning the grand prize.

2. **A wildlife conservationist creates a TikTok account to track and analyze animal population trends. Her business plan states that her goal is to reach 50,000 subscribers by the end of 2 years (24 months from now). She hopes that if she achieves this goal, her site will be featured on a prominent National Geographic Channel. The initial user base resulting from pre-launch social media campaigns is 400 subscribers.**

   The wildlife conservationist posted a video on her TikTok account and initially had 80 views as soon as it was posted. The total number of views to date has been increasing exponentially according to the exponential growth function $y = 80e^{0.2t}$, where t represents time measured in days since the video was posted and y represents the total number of views.

   TASK
   a) Assuming a constant monthly growth rate, what rate is required to achieve 50,000 subscribers at the end of 24 months?"
   b) How many days does it take until 2500 people have viewed her video?

3. **The Art and Photography exhibition is being held on a large circular walking path of diameter 50m surrounding a gorgeous sculpture of height 6m situated in the center of the circular path. Three entrances to the exhibition A, B and C are marked on the circular walking path. Two entrances A and B are marked on the circular path forming a central angle of 60^o and the third entrance C, is marked on the shorter length of the circular path between A and B in such a way that it is equidistant from entrances A and B.**

The event organizer ordered for two rectangular boxes each of dimensions 8m×6mx4m to transport the sculpture and photography equipment. To minimize the amount of storage space needed for transportation, the rectangular boxes should be modified by cutting a triangular prism-shaped section from each rectangular box, with a cross section that is an isosceles triangle with base 6m and height 4m.

The event photographer captured a shot of the fountain sculpture but later found out that it was distorted and to enhance the image quality he used image editing software and applied the following transformations to obtain a clearer image:
- Rotated the image 45° clockwise about the origin.
- Enlarged the image by a scale of 2.
- Reflected the image across the y-axis to flip the mirror image.

TASK:
(a) i) Find the portion of length of the circular path from entrance A to entrance B.
ii) Find the inclination between the positions of entrances A, B and C.
iii) If a person 1.8 m tall stands on entrance C and looks towards the fountain top, find the angle of elevation to the top of the fountain.
(b) i) Find the storage space needed for each box if they are not to be cut into triangular prisms.
ii) Sketch the unfolded shape (net) of the cross-section formed when the triangular prism-shaped section is cut from the rectangular boxes.
iii) Determine the surface area of each triangular prism. .
iv) Calculate the total storage space saved by cutting the rectangular boxes into triangular prism shaped section boxes.
(c) Find a single rectangular array of numbers that can undo all the transformations to obtain the original image before corrections.

4. ***Imagine you are a photographer capturing stunning landscapes. One day, you come across a strange flower that changes color with each passing day. Intrigued by its beauty, you decide to document this color-changing phenomenon. On the first day, the flower is bright red and its colour intensity is 200 units. However, each day it fades by 10% of its color intensity.***

In your photographic pursuits, you encounter a different flower that gains color intensity over time. This flower starts with an intensity of 50 units and increases by 15% each day.

Continuing your exploration, you stumble upon a glowing firefly that emits light. The firefly's light intensity decreases exponentially over time and the initial light intensity of the firefly is 100 units, and it decreases by 5% every hour.

As a final challenge, you encounter a block of ice that melts at a constant rate. Initially, the ice block weighs 500 grams, and it melts at a rate of 2% of its weight per hour.

TASK

a) How many days will it take for the color intensity to drop below 50 units?

b) How many days will it take for the color intensity to exceed 200 units?

c) How many hours will it take for the light intensity to fall below 10 units?

d) How many hours will it take for the ice block to melt to 200 grams?

5.
6. ,,
7. ,,,
8. ,,
9. Kaira prepared a birthday party at her home and invited her friends between the age of 20 to 54 years. She wanted to confirm which age bracket mostly could attend her party. So, she grouped them starting with (20 – 24) years. The people attended were of age,

30	22	38	25	41	37	33	40
39	38	51	32	48	34	43	24
25	31	37	43	23	46	36	47
39	44	26	36	37	41	29	32
40	38	42	31	49	28	54	35

TASK

a) Using clear mathematical procedures, find the age bracket which mostly attended her party and the most frequent age that attended her party.

b) Find the likelihood that the people who attend her party are of age ranging from 25 years to 36 years.

10. A produce wholesale dealer in Kalerwe Farmers Market has a broker who has been helping 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 UGX 4500 and in February when he bought 700 bags, the cost of transporting each bag was UGX 8500. 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. The pickup can transport **18bags** while the Isuzu Diana can transport 30 bags. The number of bags to be transported must exceed 120. Each trip the Pickup and Isuzu Diana makes cost UGX 240,000 and UGX 300,000 respectively yet he has allocated UGX 2,400,000 to cater for transport. The number of trips made by the pickups should not exceed those made by the Isuzu Diana by more than **2**.

TASK:

(a) Determine the cost the whole sale dealer will pay for the 1200 bags.

(b) Help the dear obtain how many trips each vehicle will make in order to minimize the cost of transport.

11. A school head teacher is thinking of how he can boost the mathematics department of your 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 is lower than that of the previous which was. He asked the department to give a test and the these were the students' marks.

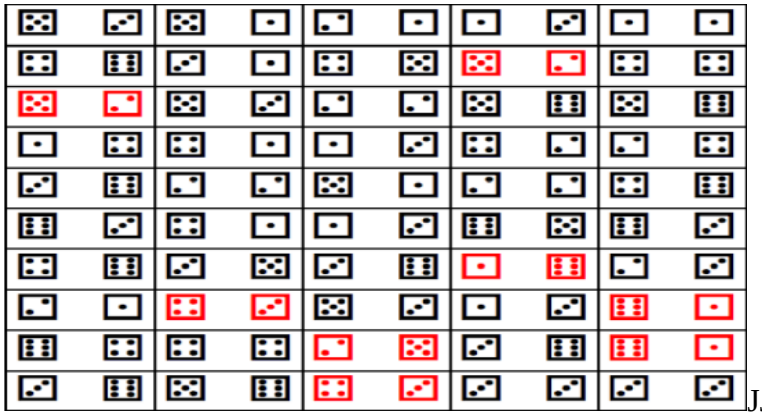
50	**71**	**40**	**48**	**61**	**70**	**30**	**62**
44	**63**	**60**	**51**	**55**	**25**	**32**	**65**
54	**45**	**65**	**50**	**45**	**40**	**25**	**45**
48	**45**	**30**	**38**	**30**	**28**	**24**	**48**
30	**48**	**28**	**35**	**50**	**48**	**50**	**60**

He also visited the library and found out that the previous's candidates used three books for there revision. Longhorn, Baroque or Maths Clinic. From the 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, used Longhorn and Baroque while **8** used Baroque and Maths Clinic only. The records show that **2** used all the three books. He observed that he should replace one book type of the three with Fountain publisher since no student read it only alone.

TASKS:

a) (i) Help the head teacher 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.

12. 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. He needs to find out whether he will compete favorably but he is unable to do so. He gives you the diagram below showing his scores so that you can guide him.

 JJJ

Tasks:

(a) Use the information above and clearly show how to determine the score with the highest chance of occurring on top. Which score is it?

(b) Find the probability that an odd number occurred when the die was rolled.

(c) Present the information of the above scores on a statistical graph.

(d) Will your friend compete favorably in the competitions?

13. A certain catering and decoration company was called to cook 100kg of rice at a certain party. According to their cooking notes, they put 22.5 liters of water in 10kg of rice and 67.5 liters of water in 30kg of rice. They want to use those notes to know how many liters to use in the rice they are ordered to cook but they are finding it hard.
The customer wants a tent at less than UGX.250, 000 and chairs at UGX.200, 000 at most. However to maximize profit, the company wishes to provide both at UGX.400, 000 at least. The company is finding it hard to decide on how much to charge the customer for the two items respectively.

    TASK:

    a) (i) Form a mathematical relationship between the quantity of rice and liters of water used to cook it according to their notes.

    (ii) Use the relationship developed to help them determine the liters they will use in the rice they are ordered to cook.

    b) (i) Form inequalities that are making it hard for the company to decide on how much to charge the tents and chairs respectively

    (ii) Use the inequalities, to help them decide on how much to charge for the tents and chairs respectively.

14. You have friends who rear cows and goats. During the festive season, they want to sell at most 10 of their cows and at least 8 of their goats. They also want to ensure that the number of goats they sell are less than twice the number of cows. They also do not want to sell more than 20 animals all together. They wish to maximise sales by selling each goat at Shs200,000 and each cow at Shs1.5 millions but they do not know the number of goats and cows to sell to fulfill their wish.

Task:
(a) write mathematical statements that show the relation between the cows and goats.
(b) Show the feasible region of the relation on the Cartesian plane.
(c) Help your friends to determine the maximum amount of money they will possibly make from the sale of cows and goats.

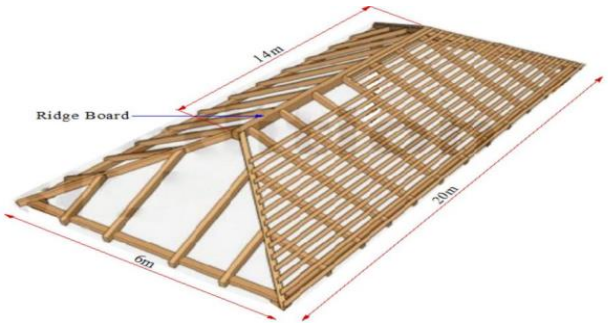
15. A day school holds a weekly assembly every Monday starting at 8:00 AM. The Head teacher has noticed a trend of learners arriving late for assembly. Since the school gates are opened at 7:30 AM, he decided to collect data from a sample of learners on their arrival times in minutes past 7:30 AM to make an informed decision about the assembly's start time. The collected data was as follows:

15	**18**	**20**	**22**	**17**	**25**	**23**	**28**	**26**	**21**
30	**33**	**35**	**32**	**36**	**39**	**42**	**37**	**41**	**28**
45	**48**	**29**	**31**	**26**	**27**	**30**	**33**	**34**	**31**
28	**35**	**40**	**42**	**37**	**39**	**36**	**38**	**29**	**43**
46	**47**	**30**	**32**	**31**	**45**	**27**	**44**	**46**	**49**
52	**53**	**55**	**51**	**50**	**56**	**57**	**58**	**59**	**51**

Task:
(a) Giving a reason, based on calculations using the data collected, suggest the time the assembly should always start.
(b) The deputy Head teacher advised the Head teacher to always start the assembly when at least 75% of the students are present. Based on the advise, determine the time the assembly should start.
(c) If you were the Head teacher, which of the two suggested assembly start times from (a) and (b) would you consider more appropriate and why?

16. 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 the chance 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, 10 people 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 of health.
(b) Calculate the probability of a person testing positive having visited at least one of the three districts.
(c) Advise the Ministry of health, with a reason based on calculation, whether to come up with control measures or not.

17. Your neighbor has a building structure that is at a roofing stage with the roof frame installed as shown below:



The roof frame has a rectangular base with dimensions of 20 m by 6 m and the ridge board of 14 m centrally placed. The triangular faces are equilateral. She wants to use iron sheets that are available in two types; type A and type B. The iron sheet of type A costs Shs33,000 each and that of type B costs Shs42,000. Each iron sheet has a length of 10ft and usable width of 2.623 ft. (1ft = 0.3m) The hardware shop from which she wants to buy the iron sheets gives a discount of 6% on the total cost of every fifty (50) iron sheets of type A bought and a discount of 10% on the total cost of every seventy (70) iron sheets of type B bought.

She intends to borrow money from a bank to buy the iron sheets but she is not so sure of the amount to borrow.

Task:

(a) Help your neighbour to estimate the amount of money to be borrowed from the bank for either type of iron sheets.

(b) Give your neighbour advice, with reason(s), on the type of iron sheets to buy.

18. Your friend wants to sell dresses in your home area according to age. She requests you to recommend the age range that she can sell. You wish to recommend an age range with the modal age being the highest. Below is the summary of data you gathered:

Age groups (Years)	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59
Number of People	6	3	13	7	4	3

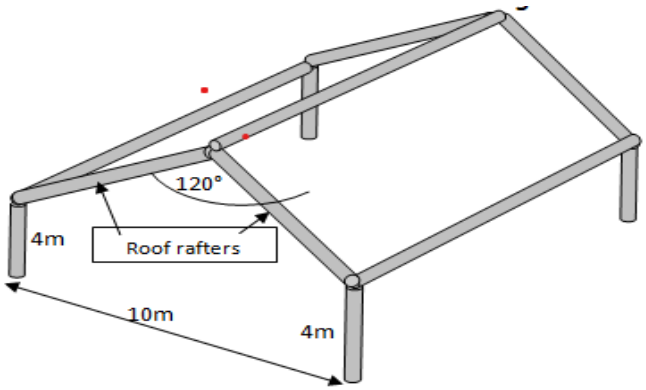
TASK

(i) Which age range will you recommend according to your data?

(i) What is the probability that your friend will succeed if she accepts your recommendation?

(i) According to the probability, is your recommendation a good choice? (Justify your answer)

19. Hadijah a small-scale farmer stays in a very hot environment and wants to build a shed for her cattle. She has sketched the framework of the milking shed as shown below.



The walls are 10 metres apart. The top of the roof is halfway between the walls. The sloping roof rafters meet at an angle of 120°.

TASK;

i. Construct a scale drawing of the cross-section of the milking shed.
ii. What scale have you used?
iii. What is the length of the roof rafter?
iv. What is the angle of inclination of the roof?
v. 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.

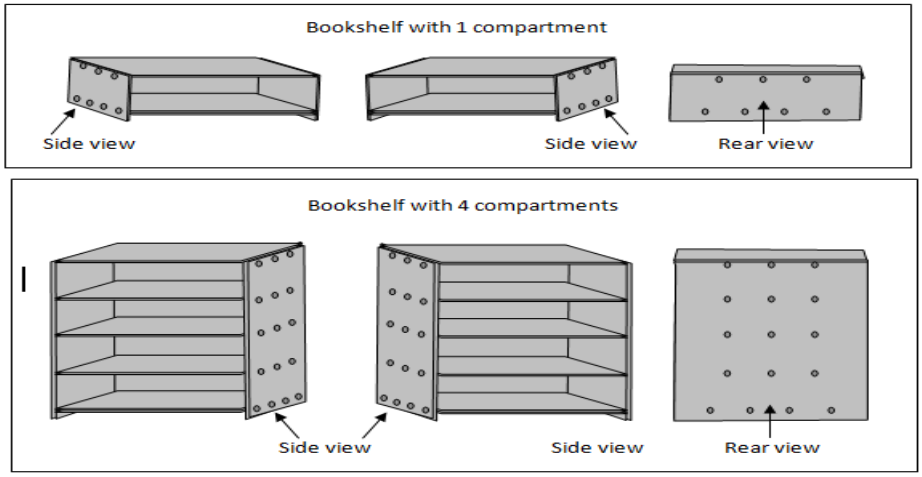
20. Mary usually sets off from a landing site that is located on coordinate O (9, 7) on the grid map to island A which is located at coordinate A (6, 3) during her day off. Island A is south east of landing site O. This time she plans to extend her tour from island A to another island B that is 9km north east of island A and then sail back to the landing site through the direct route.
She plans to tour around island A for 3hours and around island B for 4 hours. Her journey is to start at 10:00am. She hopes to be back by 20:00hours since she has work the following day. She wants to know if it's possible to return by that time. The boat is usually ridden at an average speed of 64km/hr.
She is in charge of paying her fellow workers. Some workers were given a salary increment to UGX.650, 000. This includes allowances of UGX. 120, 000. She needs to know how much income tax she is to deduct from them and the net amount she is to pay them using the tax bands below:

TAXABLE INCOME (UGX)	TAX RATES (%)
0 - 200,000	0
200,001 - 400,000	10
400,001 - 600,000	15

TASK
a) (i) what is the total distance they are to sail?

(ii) What is the total time the entire tour will take inclusive of the time the boat will take to sail the whole journey?
(iii) will she make it back at the planned time? (Justify your answer)
b) How much will she pay her fellow workers?

21. Janat is a carpenter. She specialises 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.



Obong ordered a bookshelf with 1 compartment.

Achen ordered a bookshelf with 2 compartments.

Nambi ordered a bookshelf with 3 compartments.

Mugisha ordered a bookshelf with 4 compartments.

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

Number of compartments	1	2	3	4
Number of nails				

b) Janat recognised a pattern in the number of nails he 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 (n) that Janat needs to make a bookshelf with b compartments.
(ii) What does the first number in the algebraic expression represent?

(iii) What does the second number in the algebraic expression represent?

c) Janat 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. How much did Janat pay for the nails for the new order?

22. Okot wants to paint his room. The floor of the room is 5*m* long and 4*m* wide. The room is 3*m* high. The room has two doors each fixed in the walls that are opposite to each other, both 2*m* high and 75*cm* wide. It has one window in one of the longer walls. It is 1m square.

    a) Draw a sketch of Okot's room. Indicate the measurements of the floor, height, doors and window.
    b) A painter charges UGX 800 per square meter. How much money will Okot pay for the painter?
    c) A 4-litre tin of paint costs UGX 70,000 and it paints 12*m* square of the wall. The walls already have an undercoat paint.
        i) How many tins would Okot need to buy in order to paint his room?
        ii) How much money will Okot require to paint his room?

23. John would like to continue with his studies at A-Level. He is challenged with raising tuition of UGX 200,000. John is gifted with a skill of making jewelry crafts. He has saved some money that can only help him buy glue and strings. So, he moves to different homes requesting for old calendars. From the old calendars, he makes necklaces and earrings. A necklace takes him an hour to make and sells for a profit UGX800. The pair of earrings takes him two hours to make but he gets a profit of UGX2000. He likes to make a variety by making at least as many necklaces as pairs of earrings. He has approximately 40hours per week for creating jewelry. He also knows that the crafts show vender wants sellers to have more than 20 items on display at the beginning of the show. Assuming he sells all his inventory, help him find;

    a) how many of each of necklaces and earrings he should make to maximise his profit.
    b) how much profit he makes in a week.
    c) how many weeks he requires to raise his tuition?

24. A camping supply company produces back packs in two models; journey and trek. The journey models requires 4 hours of labour and the company makes a profit of Shs 40,000. The trek model requires 6 hours of labour and the company makes a profit of Shs 80,000. The distributor will accept no more than 4 trek models and 15 journey models per week.

    Task:
    (a) Write mathematical statements that show the relation between the two models.
    (b) Show the feasible region of the relation on the Cartesian plane.
    (c) If you were the manager, determine the minimum number of hours of labour that are required for the company to make a profit of at least Shs 400,000 per week.

25. A telecommunication company plans to introduce a new minutes bundle on the menu and employs callers to investigate people's opinion on the minutes of the package that will cost 1200Shs. The

callers made a survey on random calls of the customers to gather their opinion and use the average minutes. They collected the data collected below.

52	36	76	51	62	70	50	45
86	69	72	85	71	80	50	49
53	49	84	72	84	70	56	54
88	66	75	78	78	57	64	58
65	42	42	43	43	64	74	53

Task:

(a) Giving a reason based on computations using the collected data, suggest the suitable number of minutes to be added on the menu.
(b) The supervisor wishes to know the number of people who prefer minutes greater than 60. Help him/her to estimate this number of people.

26. Your brother received Shs 597,000 as a salary and complains of underpayment exhibited in one of the private secondary schools in which he was employed as a teacher at the start of the year. He further says the biggest percentage of his money goes to the government as tax. On acquiring the job he signed a three-year contract with the following terms and conditions. A teacher's monthly gross income has certain allowances deducted from it before it is subjected to the government income tax band. The allowances are as follows.
    - Married teacher Shs 18,000 per month
    - Un married teacher Shs 12,000 per month
    - Each child below 11 years Shs 5,000 per month
    - Each child above 11 years but below 18 years Shs 7,000 per month
    - Each lesson taught Shs 3,000
    - Each examination invigilated Shs 5000
    - Meeting allowance Shs 50,000 per meeting
    - Housing allowance Shs 240,000 per month
    - Lunch allowance Shs 2,000 per day

    Government Income Tax Band

Tax income (Shs)	Tax rate (%)
0 – 100,000	10
100,001 – 200,000	25
200,001 – 300,000	30
300,001 – 400,000	45
400,000 and above	50

Your brother earns a monthly a gross pay of 1,240,000 he is married with 3 children of ages 10, 15 and 19. Given that he has 64 lessons taught in a month, attended beginning of term staff meeting and invigilated 5 examination sessions. Hint: A month has 30 days.

Task:

(a) Help him find how much money and its percentage he pays to the government as tax.

(b) Establish the take home pay of your brother and advise him if there could be something wrong with his payment transactions.

27. Mr. kyagulanyi is a physician who works with Uganda Research Institute and they carried out search on rampart causes of eyes infection on young population (youth) and they discovered that most of them spent hours on television watching different kinds of programs, and their time of watching was recorded to the nearest hours.

1	3	0	3	1	4	5	4	3	2
0	4	6	2	2	2	3	2	2	7
3	1	0	2	3	3	0	1	7	2
5	4	2	1	1	3	4	2	4	4
0	0	1	2	1	3	1	2	7	2

Tasks:

i) Help Mr. kyagulanyi organize his data in suitable table.
ii) Represent Mr. kyagulanyi ‘s research data in a suitable statistical data presentation showing degrees.
iii) State the modal and medium time.
iv) With reasoning suggest others ways that may cause eye infection.

28. Your facilitator gathered information on the ages of some few learners in the school from different classes. Below are his records:

14, 15, 16, 17, 18, 21, 18, 17, 15, 16, 21, 21, 17, 14, 18, 15, 17, 17, 15, 16, 21, 18, 18, 21, 17, 15, 14, 21, 16, 17, 16, 21, 16, 15, 16, 21, 17, 18, 16, 17, 21, 18, 15, 17.

TASK:

a) In which other way can the facilitator record the information above such that even another person looking at it can easily tell the number of learners in each age group?
b) Illustrate your suggestion in (a) above.
c) State which age are the majority of the learners in the school.
d) Your facilitator wants to sell either cartoon stickers or stickers for different singers in the school. According to the above records, which stickers do you think will be suitable?

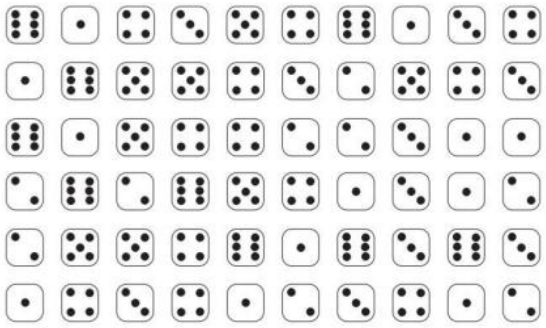
29. Your classmates are arguing whether to produce Sausages(S), or Popcorns (P), or cakes(C) or daddies (D) for the school project. To solve the argument, your class teacher assigned you as the group manager to make research and present the findings on a diagram and hence use it to decide. You questioned a group of 40 students from different classes of which product they prefer and below where there responses:

S	P	S	S	C	P	P	S	P	S
C	D	C	D	D	S	S	P	S	S
S	S	P	P	P	P	P	D	S	D
P	P	P	S	S	S	C	C	S	S

TASK:

a) Fulfill the teacher's assignment.
b) Which product do you think you and your fellow students will end up producing?

30. You are to participate in a Ludo game at school. Each of you was told to carry a dice that will help him or her to win. When you reached home, you decided to test your dice by rolling it 60 times while recording the value that appears. Below were the results of each roll you made:



TASK:
a) Summarize your scores.
b) Basing on your summary, which one is your lucky number on the dice?
c) Odd numbers and even numbers, which of the two has the highest probability on your dice?
d) You want to show your results to one of your friends at home so that he can help you to decide whether to take your dice or not. However, your friend understands diagrams more than numbers. Come up with a diagram that you will show to your friend.

31. A company was contracted to transport 1200 tonnes of sand. The company used type A and type B trucks to do the job. Each type A truck carries 10 tonnes of sand per trip while each type B truck carries 15 tonnes per trip. The total number of trips must not be less than 70 and type B trucks must make at least twice as many trips as type A trucks while the latter i.e. type A, must not make less than 10 trips. Taking x to represent the number of trips made by type A trucks and y to represent the number of trips made by type B trucks.

TASK:

(a) write down all the inequalities representing the above information.
(b) Represent the inequalities in (a) graphically. The company makes a profit of Shs 2000 per trip made by each type A truck and Shs 3000 per trip made by each type B truck.
(c) (i) Write down the objective function for profit.
(ii) Determine the number of trips, each type of truck must make to maximize the profit.
(iii) Hence calculate the maximum profit.

32. In MAXWEL STATIONERY SHOP, the manager gets the monthly allowances as follows.
Medical Shs 480,000 per annum
Transport Shs 50, 000
Housing Shs 10% of the gross monthly income
Marriage Shs $\frac{1}{80}$ of the gross annual income.
Lunch Shs 7,500 per week
Family allowance for four children using following system
12 years and below Shs 3000
Above 12 years but below 18 years Shs 2000

Okurut earns a gross annual income of shs 9,180,000 and his children are aged 5, 9, 15, 17 and 22. His tax structure is given below.

Taxable income (Shs)	Rate (%)
0 – 130, 000	5.0
130, 001 – 260, 000	10.0
260,001 – 360, 000	15.0
360,001 – 400, 000	20.5
Above 400, 000	30.0

TASK:
(a) Calculate Okurut's
(i) Monthly taxable income
(ii) Monthly income tax
(b)Express the net income paid as a percentage of his gross monthly income.
(Correct your answer to 1 d.p)

33. In an attempt to have some s.3 girls (suspected to be pregnant) tested for pregnancy at Sayidina Abubakar Secondary School, the school nurse decided to first measure the weight (kgs) of each suspected girl. The results for the weights were obtain and recorded as follows; 40, 42, 45,50,40,36,60,42,50,40,36,55,45,45. She is to use this data to decide whether these girls should undergo through the pregnancy test or not.
Task

a) i) Summarise for the school nurse the above information (data collected) in a frequency distribution table.
ii) According to the school nurse, if the average weight of these girls exceed 50kg, all of them are to go through the pregnancy test. Help the school nurse to decide whether to continue with this exercise (pregnancy test) or not. Give a reason.
iii) Determine the difference in weight between the heaviest girl and the lightest girl recorded by the school nurse.
iv) What weight is being shared by many girls according to your frequency distribution table.

34. Sayidina Abubakar Secondary School has just bought a new school bus a few weeks ago and the school stakeholders need to know the amount of fuel consumed by this bus per week for proper adjustment on the school budget. In an attempt to respond to this concern, the head teacher provided the committee with the information summarised in a table. Unfortunately he couldn't recall the right amount of fuel this bus consume every Wednesdays and Thursdays ; all he could remember correctly is that this bus uses the same amount of fuel on Wednesday and on Thursday and that on average, fuel consumption of this bus for the whole week is 10 litres.

Days	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Fuel (litres)	10	7			8	12	15

Task

i) From the information the head teacher has given, help the secretary of this committee to determine the amount of fuel the bus consume on Wednesday and Thursday

ii) If each liter of fuel cost shs. 3500. Advice this committee on the amount to be budgeted if this bus is to run for 4 consecutive weeks without resting even a single day.

35. Your school demonstration farm holds monthly sales of cattle on the first Saturday of every month. How the farm care taker has noticed that there is a trend of the same animals 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

Additionally he is going to sell 15 goats, 25 sheep and 10 ducks each at UGX140,000 per goat, UGX215,000 per sheep and UGX36,000 per duck respectively.

Task
(a) Giving a reason based on calculations, using the data collected, suggest the most minimum mass that can be accepted to be sold on this first Saturday this month.
(b) How many cattle will be sold on this first Saturday this month.
(c) Help the farm care taker know how much money he expects to get from the sales this month.

36. 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 in stagnant water and in order to prevent it, health official have advised that we sleep under 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 distribute mosquito nets, however they found that some homes were harboring mosquitoes 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 equal number of homes had neither mosquito nets nor had slashed their bushes, of which twelve homes had no mosquito nets and had not slashed their bushes round them, thus harboring mosquitoes. Twenty four homes all together had stagnant water available in their soak pits and open manholes, of whom eleven had neither mosquito nets nor removed the stagnant water. Thirteen homes had bushes around and also had 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) Determine the number of mosquito nets to be distributed, if each home that lacked a mosquito net was to be given exactly four nets.
    (b) Calculate the probability that a home visited needed also to have their bushes slashed.
    (c) Display the data on a statistical diagram.
    (d) Advise the district officials with reason based on calculations to come up with control measures for malaria.

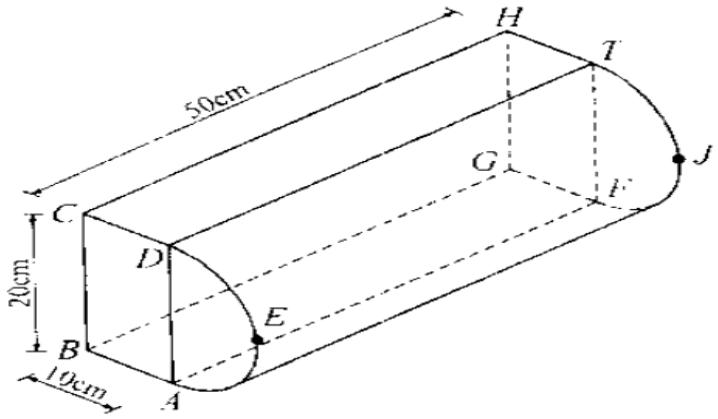
37. National Medical Stores (NMS) is a government parastatal mandated to procure, store and distribute essential medicines and medical supplies to all public health facilities in the country. It uses trucks and lorries to do the distribution. However there is concern about delay of the trucks to return 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. They were expected to return to the parking lot in Wandegeya which is exactly half way between Hoima and Kiryandongo. Both vehicles drive at a steady speed of 80km/hr and set off at 3:00am from the NMS offices in Entebbe.

From the point of setting off the lorry turns in the direction of 060o and drives with a steady speed reaching Hoima at 6:00am. The lorry sets off from NMS offices and moves to Kiryandongo which is 330km the offices in the direction of 200^o each spends averagely two and half hours off loading the drugs.

Task.

(a) Help the manager record the time each vehicle is expected to return to the parking lot in Wandegeya.
(b) What is shortest distance between Entebbe and Wandegeya.
(c) In your view how can the health system be improved in your area.

38. Your is starting a poultry farm after getting funds from the parish development model PDM. Your neighbor borrowed UGX48.52 millions from PDM to be returned after one 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.



Biyinzika Poultry farmers sells the each drinker at UGX 21,500, but offers a discount of 10 percentage on the total cost for every fifty drinkers and an additional 5% on the total cost on any excess of 50 drinkers bought. Because your neighbor is buying five hundred birds, he intends to buy 80 drinkers but does not know the capacity of each drinker which will help him buy water tank to harvest the water for the business.

Task:
(a) Help your neighbor estimate how much money he will return to the PDM after the one and half years.
(b) How much will he spend on buying the drinkers.
(c) Estimate the capacity of each drinker and advise your neighbor, with reasons on the capacity of the tank to buy.

39. Henry is a farmer in Mityana district who practices both farming and rearing of animals on a large scale. Due to demand of products that come out of animals, henry puts much emphasis on rearing of birds and cows on his farm. All together there at least 200 heads of birds and cows and There are at most 240 legs of birds and cows on the farm, the number of birds on the farm are two times than cows on the farms. Henry wishes to maximizes profits by selling each bird at shs. 50,000 and each cow at shs.1.5million but doesn't know the number of birds and cows to sell to fulfill his wish.

    Task:

    (a) write mathematical statements that show the relation between the cows and birds.
    (b) Show the feasible region of the relation on the Cartesian plane.
    (c) Help your friends to determine the maximum amount of money they will possibly make from the sale of cows and goats.

40. A school headteacher is thinking of how he can boost the mathematics department of your 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 is lower than that of the previous which was 47. He asked the department to give a test and 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

He also visited the library and found out that the previous candidates used three books for there revision. Longhorn, Baroque or Maths Clinic. From the librarian's records its 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 Clinic only. The records show that 2 used all the three books. He observed that he should replace one book type of the three with Fountain publisher since no student read it only alone.

TASKS:

(a) (i) Help the head teacher 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.

41. An organization wants to build a school in a certain community. Below were the reasons they identified as to why children were not schooling.

A = school is boring. **B** = no school fees. **C** = we want to work.

They carried out research on a sample of **50** children in that community to find out which reason has the highest probability amongst the above and hence base on that to either build 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) Present the data in such a way that the total responses for each reasons A, B and C respectively are clearly shown

(b) (i) Which reason has the highest probability?

(ii) What is the probability?

(iii) Basing on the value of probability should they build the school or not? Give a reason for your answer.

42. 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 carpenter needs to ensure the design fits perfectly within the rectangular frame of the door. The door frame available is rectangular with dimensions 2.5 meters in height and 1.5 meters in width. The circular design should be touching the two parallel sides of the door frame. Vanish is packed in tins of a litre and the cost of one litre of vanish is UGX 9,000. It is known that one litre of vanish can be used to paint one square meter.

TASKS:

(a) (i)Help the carpenter determine how much of the door will be covered by the circular design so that it fits perfectly within the door frame.

(ii) Will one tin of vanish be enough for the circular design? Give a reason for your response.

(b) With a reason(s), help the carpenter determine how much will be spent to buy vanish that will paint the entire front face of the door.

43. You are an athlete and soon competing with someone. You wanted to test your chances of winning the race by testing your speed and time in relation to that of your competitor you started to run at 4:50pm. From your home where you started from, you ran a distance of 5km northwest to place P, then from P, you turned south and ran 4km until you were at 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) What is the total distance that you ran?

(b) What is the total time you took to run that distance?

(c) How fast were you?

(d) (i) Do you think you will win the race or not?

(ii) Why do you think that way?

44. St Paul's Kitovu Secondary school is to transport its S.4 students for fieldwork in Kasenyi. All the 400 students are to be transported using either coasters or buses. Each coaster can carry 40 people while each bus can carry 80 people. The transport department of the school has only 8 drivers on 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 from which he found that three shirts and two trousers cost shs. 105,000 at Mr. Sembatya's shop. Two shirts and five trousers cost shs. 180,000 at the same shop;

Task:

a) (i) Write down the five inequalities representing the above information.

(ii) Represent the inequalities on a graph paper.

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

b) Find the cost of;

(i) each shirt and each trouser.

(ii) three items of each type at the shop.

45. Kampala (K) and Arua (A) are about 450km apart. At 7:30a.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 10.00a.m, the bus is stopped at town

C by police and ordered to reduce speed. After 30 minutes at C, it resumes its journey at a reduced average speed of 50km/hr until it reaches Kampala (K).

TASKS:

(a) State the difference in time when the two vehicles arrive at their destinations.

(b) Determine when and at what distance from Arua the two vehicles meet.

(c) Find the average speed of the bus.

46. Your parents are organizing to celebrate your 18th birthday and want it to be a memorable one. They went to Akamwesi mall which has a CINEMAX and it has two tickets.

Tickets to a play cost 9 $dollars$ for adults and 5 $dollars$ for children. If the show sold 180 tickets and earned 1380 dollars,

George your brother has been planning for this birthday for three weeks. He buys the following items in three weeks. Week one he buys 2 packets of tea , 2 tins of margarine , 3 kg of sugar and 4 packets of biscuits. Week two he buys 2 tons of margarine, 3 kg of sugar and 4 packets of biscuits . Week three he buys 2 packet of tea , 2 kg of sugar and 3 packets of biscuits. A packet of tea costs shs 1,000 , a tin of margarine costs shs 2,500, a kilogramme of sugar costs shs 3,500 and a packet of biscuits costs shs 2000. Your parents then demarcated the land they are to use for the party and plan to demarcate it. represented the plot of land he inherited using the following inequalities.

$40x + 60y \geq 480$
$30{,}000x + 45{,}000y < 600{,}000$
$x \leq 12$
$y \geq 2x$

He wants to fence it using poles(x) and barbed wire (y) and the cost function is given by $C = 45000x + 30{,}000y$

TASK;

(a) how many of each type of tickets were sold?

(b) Find his total expenditure in the three weeks.

(c) find the maximum cost.

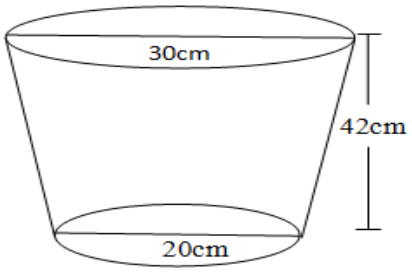
47. The length of a rectangular plot of land exceeds the width by $7ft$ and its area is 60 $sq\ ft$. Three business partners Wambusa, Aisha and Wekesa contributed Shs 300,000 , 500,000 and 700,000 respectively to start a business. They decided that $\frac{1}{3}$ of the profit was to be ploughed back to the business, $\frac{1}{5}$ of the remainder would be kept for emergencies and the rest to be shared in the ratio of their capital contributions. In that year the profit realized was one and a quarter times that of capital.

TASK:

(a) Find the dimensions of the rectangle

(b) Determine the amount received by each partner that year.

48. A bucket is in shape of a frustrum with an open end of diameter 30cm and a bottom diameter of 20cm. The bucket which is 42cm deep is used to fill an empty cylindrical tank of diameter 1.8m and Height 1.2m.



Three hundred and sixty litres of a homogeneous paint is made by mixing three paints **A**, B and C. The ratio by amount of paint 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. Taking π =3.142

TASK:

(a) (i) Determine the capacity of the bucket in litres correct to 3dp.

(ii) The capacity of the tank in litres correct to 2 dp.

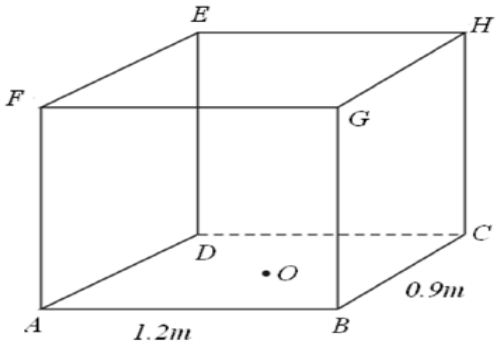
(iii) The number of bucket that must be drawn to fill the tank.

(b) (i) The amount of each paint in the mixture.

(ii) The amount of money need to make 1 litre of the mixture.

(iii) The percentage profit made by selling the mixture at shs 2,210 per litre.

49. Mr Kyeswa is buying a container to start a hardware in Kisoba Village to sell bags of cement. Each bag occupies an area of 0.8cubic meters. The container is $ABCDEFGH$ with $AB = 12m$, $BC = 9m$, $ADEF$ is a square and O is the point of intersection of $AC$and BD.



(a) Find the distances;

(i) BE,

(ii) OH.

(b) Determine the angle formed between;

(i) line BE and the base,

(ii) plane BDH and the base.

c) Calculate the number of bags that can be accommodated.

50. Mr Pamungu bought a car in January 2017 from his friend at shs. 12,500,000 and the value of the car depreciates at a rate of 10% per annum.

Recently Mr Pamungu toured Germany but got an emergency back home and left Germany for Uganda through Switzerland. While in Switzerland he bought a watch worth 54 Deutsche Marks (Germany currency) for his wife.

Mr Pamungu is a secondary school teacher as a requirement by the government pays PAYE every month according to the tax structure below.

Income (shs) per month	**Tax rate(%)**
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%
Above 500,000	35%

Mr Pamungu earns Shs.760,000 and his allowances include

Marriage allowance	-	shs.50,000 per month
Water and electricity	-	shs.60,000 per month
Housing allowance	-	shs 150,000 per month
Medical allowance	-	shs.300,000 per annum
Transport allowance	-	shs.3,000 per day
Paying for insurance and relief	-	shs.180,000 per annum

Family allowance for only three children for children in the age bracket;

- 0 to 10 years shs 12,000 per child,
- Between 10-15 years shs. 9000 per child.
- 15 years and above shs5000.

Given that the employee has five children, two of whom are aged between 0 and 10, the other two aged between 10 and 15 while the other 18 years. (A month has 30 days)

TASKS;

(a) Calculate the value of Pamungu's car by January 2020.

b) Given that 1 Swiss Franc = 1.28 Deutsche Marks,1 Swiss Franc = 1,350 Ugandan Shillings; find the value of the watch in;

(i)Swiss Francs

(ii)Ugandan Shillings.

(b) Determine the Mr Pamungu's 's net-income

(c) Determine the percentage of his gross income that goes to tax.

51. Mr. Ediangu is a government official working with Uganda Police. His gross monthly salary is shs 900,000, which includes the following allowances; water and electricity shs 20,000; relief and insurance shs 30,000; housing allowance shs. 50,000; medical allowance shs 25,000; transport allowance shs 28,000; marriage allowance shs 20,000 and family allowance shs 47,000.

The taxation body in Uganda has its income tax structure is shown in the following table:

TAXABLE INCOME PER MONTH IN SHILLINGS	TAX RATE (%)
0 - 50,000	10.0
50,0000 - 110,000	20.0
110,000 - 200,000	24.5
200,000 - 350,000	35.0
350,000 - 600,000	40.0
Above 600,000	49.0

TASK:

As a student who has studied Business Mathematics, help Mr Ediangu to determine his net pay in dollars if the exchange rate is 1dollar = Ugx. 3,840.

52. Arch-Bishop SS is to transport its S. 4 students for fieldwork in Kasenyi. All the 400 students are to be transported using either coasters or buses. Each coaster can carry 40 people while each bus can carry 80 people. The transport department of the school has only 8 drivers on 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 from which he found that three shirts and two trousers cost shs. 105,000 at Mr. Sembatya's shop. Two shirts and five trousers cost shs. 180,000 at the same shop;

Task:

a) (i) Write down the five inequalities representing the above information.

(ii)Represent the inequalities on a graph paper.

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

b) Find the cost of;

I. each shirt and each trouser.

II. three items of each type at the shop.

53. 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 bus is stopped at town C by police and ordered to reduce speed. After 30 minutes at C, it resumes its journey at a reduced average speed of 50km/hr until it reaches Kampala (K).

TASKS:

a) State the difference in time when the two vehicles arrive at their destinations.

b) Determine when and at what distance from Arua the two vehicles meet.

c) Find the average speed of the bus.

54. Two carpenters, Tom and Alex, receive an order to build two wooden crates of different sizes. The specifications require that one crate must have 2 more wooden boards than the other, and furthermore, the sum of the squares of the number of wooden boards in each crate is 52.

The two carpenters are also working on a rectangular soft board for home designs: the original rectangular soft board had a perimeter of 36 meters but they had to make some adjustments to the board to meet their customer's specifications. They took two meters off its length and added three meters to its breadth. By so doing, the area increases by 20 square meters.

Tom, one of the carpenters is 1.5m tall and stood on top of a building 34m tall to have a view of his town after a long day's work. In a straight line from where he is standing he saw a beggar seated on the entrance of a barbershop and also saw also a road safety sign which had fallen on the ground at angles of depressions of 50^o and 65^o respectively.

TASKS:

a) What is the number of wooden boards required for each crate?

b) What were the original dimensions of rectangular softboard before some adjustments were made?

c) How far is the beggar seated from were the road safety sign fallen?

55. Your parents are organizing to celebrate your 18^{th} birthday and want ot to be a memorable one. They went to Akamwesi mall which has a CINEMAX and it has two tickets.

Tickets to a play cost 9 dollars for adults and 5 dollars for children. If the show sold 180 tickets and earned 1380 dollars,

George your brother has been planning for this birthday for three weeks. He buys the following items in three weeks.

Week one:

He buys 2 packets of tea , 2 tins of margarine , 3 kg of sugar and 4 packets of biscuits.

Week two:

He buys 2 tons of margarine, 3 kg of sugar and 4 packets of biscuits . Week three he buys 2 packet of tea , 2 kg of sugar and 3 packets of biscuits.

A packet of tea costs shs 1,000 , a tin of margarine costs shs 2,500, a kilogramme of sugar costs shs 3,500 and a packet of biscuits costs shs 2000.

Your parents then demarcated the land they are to use for the party and plan to demarcate it. represented the plot of land he inherited using the following inequalities.

$$40x + 60y \geq 480$$
$$30{,}000x + 45{,}000y < 600{,}000$$
$$x \leq 12$$
$$y \geq 2x$$

He wants to fence it using poles(x) and barbed wire (y) and the cost function is given by $C = 45000x + 30{,}000y$

TASK;

I. how many of each type of tickets were sold?
II. Find his total expenditure in the three weeks.
III. find the maximum cost.

56. Henry is a farmer in Mityana district who practices both farming and rearing of animals on a large scale. Due to demand of products that come out of animals, henry puts much emphasis on rearing of birds and cows on his farm. All together there at least 200 heads of birds and cows and There are at most 240 legs of birds and cows on the farm, the number of birds on the farm are two times than cows on the farms. Henry wishes to maximizes profits by selling each bird at shs. 50,000 and each cow at shs.1.5million but doesn't know the number of birds and cows to sell to fulfil his wish.

TASK:

(a) write mathematical statements that show the relation between the cows and birds.
(b) Show the feasible region of the relation on the Cartesian plane.
(c) Help your friends to determine the maximum amount of money they will possibly make from the sale of cows and goats.

57. Due to Poor performance in Mathematics that was observed among learners. The school administration through academic board came up with strategies to improve on the learner's performance. Some of the strategies are that a prize is given to learners scoring above 70% and a remedial exam be given to learners scoring at most 50%. A Mathematics examination was given to S.3 learners and marks were obtained as below;

38	74	28	32	10	31	49	34	50
30	56	50	42	38	64	24	64	09
18	35	12	52	41	27	08	48	22
42	43	52	59	72	70	15	79	29

TASKS:

Using a classes with equal class width of 10 marks and starting with a class having the lowest class mark of 1;

a) Help the administration to find;

i) The number of learners to be awarded prizes.

ii) The number of learners to be give remedial examination.

b) What is the average performance of the class?

58. John moves to his village. From home, he travels 25km on bearing of 250° to trading centre, from there, he changes course and heads N30°W and moves 55km up to the village. In the village, He wishes to construct a country home, to fund this project, he is to take a loan from the bank worth 25 million at an interest rate of 5% compounded yearly for a period of 10 years.

He earns agross income of UGX 943,500, and entitled to the following allowances as well.

Housing and transport, 10% of his gross income

Insurance premium of UGX 36500

Marriage and child allowance of UGX 126,500

Medical care of UGX 92,400.

He is also subjected to the following tax rates

Taxable income (UGX)	Tax rates (%)
1 - 90,000	6
90,001 - 200,000	14
200,001 - 320,000	20
320,001 - 440,000	30
440,001 - 520,000	42
520,001 and above	47

TASK

(a) (i) If he used the direct route from his home to the village, and for each kilometer he travels, his car consumes 0.5 liters of petrol, how many liters would his car consume?

(ii) How much would he save in this case?

(b)(i) How much money will he pay back in the bank every month.

(ii) If the bank is to give him the loan on condition that the money he is to pay back every month is not more than 50% of his net income, will he get the loan or not? Justify.

59. The government of Uganda through Mulago hospital carried out free medical checkup for its state ministers in order to enable them attend the Allied Membership meeting (NAM) which took place in Uganda at the start of the year 2024. However, each Minister was weighed and the masses of those who attended the medical health function were recorded as follows.

64	58	52	73	62	50	60	64
49	47	58	45	58	74	66	73
48	46	55	52	51	69	59	44
60	42	48	54	73	61	58	50
41	53	54	46	43	61	67	70

TASK

a) Form a frequency distribution table using classes of size 5 and starting with class of 40-44

b) Giving a reason, based on the statistics calculation. What do you think was the average weight and most appearing weight.

c) Assuming you're the medical doctor who carried out the test, represent the information on a statistical graph to obtain the modal weight.

60. 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 atmost 15 loaves of bread in a day. He wants to bake atleast 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 profit, your uncle needs to earn more than Shs 30,000 from the sales each day.

TASK:

(a) Write mathematical statements that show the relation between the whole wheat bread and 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 maximum profit?

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

61. A manufacturer operates a production facility with 30 worker units (both male and female, considered equally efficient) and 17 units of capital. Two products, A and B, are produced using these resources. The production requirements and prices are:

    - Product A: 2 worker units, 3 capital units, priced at UGX 100,000 per product.
    - Product B: 3 worker units, 1 capital unit, priced at UGX 120,000 per product.

    TASK:
    (a) Formulate mathematical constraints representing the relationships between the units of goods A and B produced.
    (b) Graph the feasible region of the constraints on a Cartesian plane.
    (c) Determine the optimal production levels to maximize total revenue.
    (d) Do you agree with this view of the manufacturer that men and women workers are equally efficient and so should be paid at the same rate?

62. A shipping company needs to transport a large batch of rectangular boxes, each with a length of 8 meters, a width of 6 meters, and a height of 4 meters. To optimize storage space in the cargo hold, the company plans to cut off a triangular prism-shaped section from each box, with a cross-section that is an isosceles triangle with base 6 meters and height 4 meters.

    Tasks:
    (a) Find the storage space needed for each box if they are not to be cut into triangular prisms. .
    (b) Sketch the unfolded shape (net) of the cross-section of both the rectangular boxes and the triangular prism-shaped section cut from the rectangular boxes.
    (c) Determine the surface area of a single triangular prism that will be transported.
    (d) Calculate the total storage space saved by cutting the rectangular boxes into triangular prism shaped section boxes if 100 rectangular boxes were transported.

63. A photographer uses image processing software to correct distortions in a photograph. The software uses matrix transformations to apply corrections. The photographer wants to:

    i) Rotate the image by a positive quarter turn about the origin.
    ii) Scale the image by 2 times under the enlargement centre O(0,0).
    iii) Reflect the image across the y-axis to flip the mirror image.
    The image can be represented by a 2x2 matrix given as $\begin{pmatrix} 2 & 4 \\ 3 & 4 \end{pmatrix}$ where each column represents a pixel coordinate.

    TASKS:
    (a) Write the matrix representation of each transformation.
    (b) Multiply the matrices to find the composite transformation matrix.

(c) Apply the composite transformation matrix to the image matrix to correct the distortions.
(d) Find a single matrix that can undo all the transformations to obtain the original distorted image before corrections.

64. A landscape architect designs a circular walking path around a fountain. The path has a diameter of 20 meters, and the fountain is 6 meters tall. Two benches, A and B, are placed on the path, forming a central angle of 60°. A third bench, C, is placed on the path, equidistant from benches A and B.

    TASKS:
    (a) Find the portion of length of the circular path from bench A to bench B.
    (b) Find the inclination between the positions of bench A, B and C.
    (c) If a person 1.8 m tall stands at bench C which is 0.3 m tall and looks towards the fountain, find the angle of elevation to the top of the fountain.

65. A cooperative society of farmers has 50 hectares of land to grow two crops A and B. The profits from crops A and B per hectare are estimated as Shs 10,500,000 and Shs 9,000,000 respectively. To contol 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 fish and wildlife using a pond which collects drainage from this land. Keeping in mind that the protection of fish and other wildlife is more important than earning profit respectively.

    TASK:
    (a) Write mathematical statements that show the relation between the hectare of land to be 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 profit?
    (d) Do you agree with the message that the protection of wildlife is utmost necessary to preserve the balance in environmnent?

66. 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 traffic 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?

67. 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 understand 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 ad vice will you offer to the farmer.

68. 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 efficient 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 registration 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?

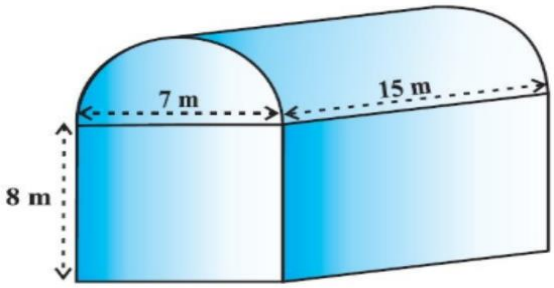
69. Your relative, is planning to start a small bakery business and seeks your advice on financial matters related to her venture. She plans to invest a total of $10,000 into the business and wants to understand the financial implications of different financing options. She has approached two money lenders 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 purchase baking equipment. The bank offers her two different repayment plans:
    Option 1: Simple Interest - The loan is offered at an annual interest rate of 20% and to be paid after 2 years.
    Option 2: Compound Interest - The loan is offered 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 specifies a down payment of $1,000 followed by monthly payments of $400 for 24 months. The supplier will consider a constant dollar rate at 1$ = UGX3, 800

    TASK
    (a) Calculate the total repayment amount for each financial option over the loan term and compare them to determine which option would be more cost-effective for your relative bakery business.
    (b) Analyze the monthly cash flow implications for your relative under each financing option, considering her ability to manage operational expenses alongside loan repayments.
    (c) Based on your calculations and analysis in (a) and (b), provide your relative, with a recommendation on which financial option would be optimal for her bakery business, taking into account both total repayment amount and monthly cash flow considerations.

70. Your neighbor runs an industry in a shed that is in the shape of a cuboid surmounted by a halfcylinder (placed on top). The dimensions of the cuboid base are 15 m by 7 m, and the height is 8 m.



TASK:

Your neighbor wants to install air conditioning units in the shed. The installation company offers 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 offers a 5% discount on the total cost for every 10 Type X units purchased and a 79% discount on the total cost for every8 Type Y units purchased. The neighbor plans to buy enough cover the entire volume of the shed. He intends to borrow money from a bank to buy the air conditioning units but is unsure of the amount needed.

(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.

71…….

72…….

73…….