

THEME 1: NUMBERS

1. Your uncle in Mpigi district would like to set up a farm in your village. However, he has no land, but you have identified the land that he can buy. This land you got occupies an area of $8.5m^2$ on a map of scale **1: 1500** but he has told you that if this land is less than $2000m^2$, he will plant on maize and beans and if it is more than $2000m^2$, he will plant on coffee and cocoa in the ratio **4: 5** and for **maize : beans = 3: 4**. Your uncle has instructed you to withdraw shillings one million six hundred eighty thousand from his bank account using a four-digit pin in base three, but he saved it as **213_{four}**. $\frac{1}{4}$ of this money will be used on your transport and lunch and 40% of the remainder will be used to buy metallic poles to fence the land. He expects a total of shillings 2,800,000 from maize and beans, Shs. 3,600,000 from coffee and cocoa.

Task:

- a) Help your uncle to determine which type of crops to plant on the land
- b) Determine the actual pin you will use to withdraw the money.
- c) How much money will be used to buy the metallic poles?
- d) What is the expected amount from maize? (**WAKISSHA**)

(ratios, percentages, scales and base conversion)

2. A company manufactures small rectangular cardboard pieces of size $\sqrt{5}m \times \sqrt{2}m$ from large rectangular sheets measuring $(\sqrt{5}+\sqrt{20})m \times \sqrt{8}m$. The small cardboard pieces are all of equal size and are cut efficiently from the large sheet without any wastage. The production manager wants to determine the number of small cardboard pieces that can be cut from one large sheet.

Abdul, a businessman in Kampala, sells soft and hard cardboard boxes. He keeps accurate records of his sales and stock to monitor the performance of his business. On Monday, he sold 25 boxes of soft boards at a price of Shs 20,000 per box. On Tuesday, due to increased competition in the market, he reduced the selling price by 10%. As a result, the number of boxes sold increased by $\frac{1}{5}$ of the number sold on Monday.

Later in the week, Abdul received a delivery of cardboard boxes. Out of the total delivery, 42 boxes were soft boards, while the rest were hard boards. The ratio of hard boards to soft boards in the delivery was 8:6. He needs to determine the number of hard cardboard boxes received.

Task:

- a) Determine the number of small cardboard pieces that can be cut from one large sheet.
- b) Help Abdul to determine the:
 - i. percentage increase in his income from Monday to Tuesday.
 - ii. number of boxes of hard cardboards in the delivery. (**MATIGO**)

(surds, fractions and percentages)

3. The Matugga Community Development Committee has received a land grant to build a modern health centre. The total piece of land allocated for this project is $24\frac{3}{4}$ acres. The project structural engineer has allocated 0.54 of the land for medical buildings, a fifth of the remaining land to planting grass and the rest to staff quarters, waiting area and parking area in the ratios: **staff quarters: waiting area = 3: 2** and **waiting area: parking area = 1: 2**. The hospital director can't understand the engineer's allocation but wants to know the actual area of land allocated to medical buildings. The hospital director also inquired from the structural engineer about the number of cars that can be parked in the parking area at once and the engineer was not sure, however, he said that one car can occupy an area of up to **0.02** acres of land. In the community, 2 men can clear half an acre of land in 2 days. The structural engineer wishes to hire men from the community

to clear the land for planting grass in only one day but does not know how many men he needs to have this work done.

Task:

- a) As the assistant director of the hospital, use the information provided by the engineer to determine the;
 - i. actual land in acres for medical buildings
 - ii. maximum number of cars that can occupy the hospital parking at once
- b) As the project coordinator, help the engineer to know the number of men he needs to clear the area for grass planting. (**KAMSSA**)

(fractions, ratios and rates)

4. You have fees balance of One million twenty-four thousand shillings which must be cleared before VD scheduled for **25th/July/2026**. Your father works from Kenya, and he comes back home every after 14 days. Your mother works from Jinja, and she comes back home every after 8 days. They both came home on **24th/May/2026** to take you back to school. They promised to clear all the fees balance when they come back home together. The bursar needs to know if your parents will be able to clear the fees balance before VD. Your father left **240,000** Kenyan shillings (Ksh) and he told your mother to exchange it for Ugandan Shillings (Ugx) and then use $\left(\frac{125}{64}\right)^{-\frac{1}{3}}$ of the money in Ugandan shillings to renovate the house and send you 2% of the remaining money as pocket money. When the mother goes to exchange the money, she finds that the rate of foreign exchange is **1Ksh = Ugx 38.346798** but the teller only must use 4 significant figures of the rate during the exchange. However, your mother has a challenge of determining the amount of money she should get in Ugandan shillings.

Task;

Help

- a) the bursar to determine whether your parents will be able to clear the fees balance before VD
- b) your mother to determine the;
 - i. amount of money in Ugandan shillings she should get.
 - ii. amount for pocket money (**UTES**)

(application of LCM, fractions, percentages, indices and currency exchange)

5. Your school has contracted a company to install a solar power system to address the issue of frequent hydro-electricity blackouts. The project will cost the school a total of one billion two million forty-eight thousand Uganda shillings. The cost is to be paid in two instalments in a ratio of **7:10** respectively. The first instalment will be deposited on the company's bank account. Three quarters of the second instalment amount will be paid in cash on completion of the installation of the system. The Environmental Protection Board of the Local Council will approve the project if the crystalline solar cell peak efficiency factor exceeds a threshold of **$15\sqrt{2}$** . Given that crystalline solar cell to be installed has a peak efficiency factor expressed as, $\frac{\sqrt{72} \times 2^5 \times 4^{-1}}{8^3 \times 16^{-2}}$ they need to know whether the project will be approved. Of the total land allocated for installation, the Solar Arrays will take up **0.35**, the Inverter Stations $\frac{3}{20}$, and the Battery Storage & Substation $\frac{2}{5}$. They need to know whether the remaining percentage will be enough for the Green Buffer Zone, given that it requires at most 12% of the total land. Two types of inverters will be installed, and they will require to be serviced. Type-A inverters will be serviced every 18 days, while Type-B inverters will be serviced every 30 days. If both are to be serviced on the day of installation, they need to know in how many days both inverters will be serviced again.

Task:

- a) How much will the company receive in cash on completion of the contract.
- b) Will the project be approved by the Environment Protection Board? Justify
- c) Will the remaining percentage of land be enough for the Green Buffer Zone?
- d) In how many days will both inverters be serviced? (**UMTA**)

(ratios, fractions, indices and surds, percentages, application of LCM)

6. An organization in a particular community owns 4cm^2 of land on a **1: 250,000** scale map. They do not know the exact size of the plot of land on ground in km^2 . The organization gave some plots to a certain group in that community. The group wants to hire two tractors to plough the land; however, it is revealed that tractor A takes 45 minutes to plough an acre of land and tractor B takes 20 minutes to plough an acre of land while they both work at the same speed. The group is challenged on how long it takes to plough 10 acres of land after starting at 7:00 a.m. The ploughing budget will be supported by clergy, area Members of Parliament (MPs), and group members. The clergy will contribute $\frac{3}{4}$ of the budget, $\frac{1}{8}$ by the Area MPs and half of the remainder by the group members. Each of the 48 members was required to contribute UGX 50,000.

Task;

Help the youth group to determine;

- a) the actual area of the piece of the land in km^2 .
- b) The time the tractors shall plough the 10 acres
- c) Find the total budget for ploughing. (**ACEITEKA**)

(scales, rates, and fractions)

7. A senior four leaver wants to start a poultry project, and she has bought 48 broilers, 60 layers and 72 local chickens (birds). But her parents advised her not to mix up these birds, so she must put an equal number of birds in the different rooms. She does not know the highest number of birds she can put in each room. She also needs to feed the birds with a mixture of maize feed, but she does not know how it can be done. When she approached her friend Rita who is an expert in poultry, she gave her a formula in the form $\frac{4+\sqrt{2}}{2-\sqrt{2}}$ in which she needed to first simplify it to its simplest form of $a + b\sqrt{2}$ so that she could obtain the mixing ratio **a: b: 2** of the bird's feeds. She did not know on how this can be achieved. Later, she went abroad and left four million one hundred twenty-five thousand Uganda shillings to her mother. She instructed her to use only **0.454545 ...** for family expenses and reinvest the balance in their poultry project.

Task;

- a) Help this senior four leaver to know the highest equal number of birds he can put in each room without mixing them
- b) Also help her to understand the formula for mixing the feeds by calculating the mixture ratios
- c) Determine the fraction of the amount of money for family use and the money her mother will reinvest in the poultry project. (**COUHEIA**)

(application of HCF, surds, and decimals)

8. Jacob and Morgan have been contracted to paint a newly constructed classroom block at Werut High School. If Jacob works alone, he can complete the work in 20 hours, while Morgan would take 30 hours working alone. To complete the work more quickly, they decide to work together. The contractor agrees to pay them UGX 70,000 per hour for every hour they work until the job is completed. After completing the work, the total amount earned will be shared according to the ratio of their present ages. The ratio of Jacob's present age to Morgan's present age is **2 : 1**, Six years from now, the ratio

of their ages will become **5 : 3**. Jacob plans to invest his share of the money by starting an ice-cream business. As part of his first stock, he purchases 36 Litres of vanilla ice cream and 54 Litres of chocolate ice cream. He wishes to pack each flavor completely into identical containers, using the largest possible container size so that no ice cream is left out. Each container costs UGX 10,000. The school's master plan is drawn to a scale of **1 : 2,500**. On the plan, the newly painted classroom block occupies an area of **25cm²**.

Task;

- Determine the amount of money each of them will receive after sharing the earnings.
- Determine the present ages of Jacob and Morgan
- Determine the amount of money Jacob will need to buy the identical containers
- Calculate the actual area of the newly painted classroom block in square metres. (**SHURE**)

(rates, ratios, application of HCF and scales)

9. The Senior Four class is preparing for its Leavers' Party to celebrate the successful completion of their lower secondary education. A finance committee has been appointed to manage the party budget and ensure that all preparations are completed on time. The committee has been assigned the following responsibilities:

- Allocate money for decorating the venue, which is one-tenth of the total party budget. The estimated budget for the party was UGX 12,000,000. However, due to an increase in the prices of decorations, food, and entertainment, the budget has been increased by 10%. The committee needs to determine the amount to be allocated for decorations.
- Purchase soft drinks every 8 weeks and snacks every 12 weeks for planning meetings. Three weeks have passed since both items were purchased on the same day. The committee needs to determine the number of weeks remaining before both items will next be purchased together.
- Allocate a monthly preparation fund of UGX 1,550,000 between transport for the organising committee and refreshments for committee members in the ratio 5 : 3 respectively. The committee needs to determine the amount to allocate for transport.

Task:

Help the finance committee determine:

- The amount of money to be allocated for decorating the venue.
- The number of weeks remaining before soft drinks and snacks will next be purchased at the same time.
- The amount of money to allocate for transport for the organising committee. (**WAKATA**)

(fractions, percentages, application of LCM and ratios)

10. A vendor who deals in spices makes a special tea spice by mixing ingredients A, B and C. For 2 cups of A, he mixes 3 cups of B and 5 cups of C, and this gives him 1.5 kg of the spice. A client has made an order of the special tea spice but wants the measure of ingredient C to be 0.6 in the 1.5 kg produced but the vendor is not sure if this mixture meets the client's requirement. Another client has requested for 9 kg of the original mixture, but the vendor wants to determine the number of cups of B that will be needed for this order. To make 1 kg of the spice, he spends sh 4500= . He wants to set a new selling price so that he is able to make a profit of 30%, but he is unsure of the amount of money he should charge per kilogram of his spice and the cost of the 9 kg of spice.

Task

- Will the first client be able to get his order with the amount of C he wants?
- Determine the number of cups of B that will be needed for the 9 kg the second client has asked for.

- c) Help the vendor to determine his new selling price for 1 kg in order to make his desired profit and the price of 9 kg that he will charge the client. **(HOIMA) (Ratios and business mathematics)**

11. Due to the increasing demand for yoghurt in Wakiso Town Council, a local factory supplies products to different Shops A, B and C. Shop A places an order every 12 days, Shop B every 18 days and Shop C every 24 days. On 1st April, all shops placed orders on the same day, which prompted the council to organize a joint promotion.

The factory had used a digital labelling system coded 101101 during a production cycle in which it packed 600 boxes of yoghurt. Out of the total production, three-fifths of the boxes were vanilla flavoured, while the remaining boxes were strawberry flavoured. Due to lower-than-expected production, the factory had reserved only 15% of the strawberry-flavoured boxes for two catering companies, P and Q, which shared the allocation in the ratio 1:3 respectively. The factory management had then contacted you to determine how the available stock had been distributed and to establish the sales distribution for planning purposes.

Task:

Help us to:

- a) Establish the ordering schedules and determine when the next joint promotion can be held.
b) Compute the number to be stored in the database in denary form.
c) Determine the quantity of yoghurt to be delivered to Company Q (UTEC) **(application of LCM, fractions, percentages and ratios)**
12. Mama Amina has 4 children, she distributed sh.360,000 as back to school shopping money in the ratio of their ages 4, 9, 11 and 16 years.
She pays 65% at the start of the term, $\frac{2}{5}$ of the remaining balance on visitation day and the rest amounting to shs84,000 at the end of the term. She also goes for parent – teacher meetings every after 28 days and visits her doctor after every 21 days. On 22nd June 2026, she attended a parent – teacher meeting and visited her doctor that same day.
Task
- a) How much shopping money does each child get?
b) Calculate the total school fees and the amount paid in the;
i. first instalment
ii. second instalment.
c) When is the next likely date mama Amina will have both a parent – teacher meeting and visiting her doctor on exactly the same day? **(ASSHU) (ratios, % and fractions and application of LCM)**

13. At birthday party of your uncle James on Monday 10th May 2025, Him and his two sons agreed to startup a hardware business which required eight million, fifty thousand shillings. They planned to contribute for this cause as follows;

Uncle James: 60% of the total money required, 0.25 of the remaining amount to be contributed by the young son while the $\frac{2}{3}$ of the balance for the old son. The remaining balance was to be borrowed from Uncle James' friend who accepted to send the young son to withdraw the money from his account using the ATM card. For security reasons, he wrote his pin as 21 20 21 13 all in a number system less than five which has to be converted to a decimal base to get the actual pin.

They agreed to bring money and startup their business when the two sons meet home with their father. The older son comes home after every 16 days, and the young son comes after every 12 days. Uncle

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James wanted to know when his sons are meeting home again for proper preparations for the business startup.

Task;

- Determine how much each contributed towards the start of the business.
- Determine the actual pin used to withdraw money from the friend's account.
- Determine when the business started. **(JIEB) (% , Fractions, number bases and application of LCM)**

THEME 2: PATTERNS AND ALGEBRA

1. A transport company is preparing to transport 700 passengers using 10 drivers and its fleet of buses and coasters. Each bus can carry 70 people at a time while each coaster carries 35 people at a time. The manager wants to take the required vehicles for service and fuelling to avoid any inconveniences that may arise.

This company also owns a truck which the contractor is planning to use to deliver construction materials to the site. This truck can carry 3000kg of cargo or more. The contractor needs more bags of cement than bags of lime.

A bag of cement weighs 50kg and costs Sh. 25000 while a bag of lime weighs 80kg and costs Sh. 20,000. A contractor has a budget of 1.5 million for buying materials.

Task;

- How many of each vehicle type should be worked on?
- Determine the maximum number of bags of cement that he should buy to meet his budget. **(JIEB) (Linear programming and simultaneous equations)**

2. After noticing that animals were crossing into his garden and damaging crops, Mr. Mandela noticed that stray animals were crossing into his rectangular garden through the open sides. To protect his crops, he decided to fence the garden using the existing wall on one side. The wall had been built earlier by his neighbours. The area of the garden was $312.5m^2$ and Mandela had 50 m of fencing material. To improve the environment around the garden, Mandela decided to plant trees along the fenced area. He planted 8 seedlings in the first row and increased the number by 3 in each new row. The garden can accommodate 15 rows of seedlings. Before buying the last batch, he wants to know how many seedlings will be needed in the final row. You have been asked to help Mr. Mandela plan the fencing and tree planting activities.

Task

Help us to:

- Determine the dimensions of the garden.
- Interpret the planting pattern and determine the number of seedlings in the last row.
- Predict what would happen if the increase changed from 3 seedlings to 4 seedlings per row. **(UTECE) (Quadratic equations and sequence)**

3. Anisha has organized a family meeting, and she expects to have 50 family members attending. She will only start the meeting at 2:00 pm if at least 45 members have arrived. She arrived at the venue at 7:00 am and at 8:00 am one member had arrived. At 9:00 am four members had arrived. At 10:00 am, 9 members had arrived and at 11:00 am, 16 members had arrived. She is wondering if by 2:00 pm the meeting will start if the members keep on arriving the same way.

Matovu deals in mobile phones. He wants to order, for twelve mobile phones but he does not know how much it will cost him. His assistant has informed him that when they ordered for five phones they paid Shs. 618,000 transport inclusive, when they ordered for eight phones, they paid Shs: 978,000 transport inclusive and unit prices being constant. The supplier charges a constant fee on transport

irrespective of the number of phones bought. Matovu wants to know the cost on transport and the total cost of ordering for twelve phones.

National forest Authority has realised that people are increasingly cutting down trees from Mabira Forest. The officials studied the rate at which this was happening and recorded it as a function $f(x) = -x^2 + 5x + 6$ where x is the number of days of the week from Monday to Saturday. The officials had to write a report including a graphical representation of the number of trees cut during the above selected days of the week.

Task:

- a) Determine whether the meeting will start by 2:00 pm
 - b) Help Matovu to determine;
 - i. the constant transport costs.
 - ii. the amount to be charged for 12 phones.
 - d) Help the officials to;
 - i. draw the graph showing the number of trees that were cut during the selected number of days.
 - ii. obtain the day(s) on which many trees were cut. **(WAKISSHA)**
(sequencies, application of simultaneous equations, quadratic graphs)
4. Kigozi is an innovative young farmer in Luwero district who grows sweet peppers in his green house. He uses two systems that is the Solar system and the Biogas system in his greenhouse but he realizes that the sum of the maintenance cost of the solar system and twice the cost of the biogas system is Shs 35,000 and also the difference between three times the solar system cost and two times the biogas cost is Shs 5,000. He finds it difficult to determine the daily individual maintenance costs for each system. The peppers he produces are of two categories, pepper x and pepper y whereby he wants to know the quantities in every category he can produce to maximize profit. He realizes that he can produce at least 20 peppers for x . The number of quantities for pepper x should also not be less than twice the quantity for pepper y . Given that the cost for pepper x and pepper y is Shs 200 and Shs 300 respectively. He wants to ensure that the total cost does not exceed Shs 54,000. He needs to know the quantity of pepper x and y he can produce to maximize profit given that the unit profits realized from pepper x and y are Shs 500 and Shs 600 respectively.

Task

1. Help Mr. Kigozi to determine the daily cost of maintaining one solar system and one biogas system.
 2. Represent Mr. Kigozi's produces as inequalities and equations.
 3. Help him to determine the possible quantities of the pepper x and y that he should produce to maximise profits. **(KAMSSA)**
(application of simultaneous equations and linear programming)
5. A shoe manufacturing company has expanded its production to meet the increasing demand for school shoes. To encourage bulk purchases, the company charges a fixed handling fee of UGX 3,500 on every order. In addition, the total cost of an order depends on the number of pairs purchased according to the model $C(x) = 100x^2 + 2000x + 3500$, where; $C(x)$ is the total cost (in Uganda shillings), x is the number of pairs of shoes ordered. One distributor paid UGX 23,100 for an order. The company manager wants to determine the number of pairs of shoes ordered.
- To increase production, the company hired experienced shoemakers and trainee shoemakers to assemble shoes. On the first day, 3 experienced shoemakers and 2 trainee shoemakers produced 12 pairs of shoes. On the second day, 2 experienced shoemakers and 5 trainee shoemakers produced 19

pairs of shoes. The production manager wants to determine the average daily output of each type of worker to plan future production schedules.

Task:

Help the production manager determine:

- a) The cost of one pair of shoes.
- b) The average number of pairs of shoes produced per day by:
 - i. an experienced shoemaker;
 - ii. a trainee shoemaker. (**WAKATA**)

(application of quadratic and simultaneous equations)

6. A school compound club is planning to work on its compound pathways in form of two straight lines. The first pathway follows the line $4y - 3x + 2 = 0$ and the second pathway must be parallel to the first pathway passing through the point (8,5). The school compound club is also planning to make a third pathway perpendicular to the first pathway. This third pathway must pass through (0,7) and the club will put it only if its $y - intercept$ is greater than 4. The compound club patron wanted to reward the club members and went to town to buy scholastic materials for them after working on the compound. On reaching town she found out that there was a go back to school promotion where materials were sold in groups so she could not buy one item. She was informed that a ruler and a set together cost ugx5000 and the cost of 3 sets and 2 rulers is ugx11000. The patron wants to buy 8 rulers and 6 sets for all the club members, and she has a budget of ugx40000, she is wondering if this amount is enough. The school compound patron also manages the school bakery, and she is struggling to represent the bakery's production constraints on a graph. The bakery produces two types of bread loaves and buns. Each loaf costs ugx2000, and each bun costs ugx1000. The bakery has a daily budget of ugx100000 that cannot be exceeded and in addition the bakery must produce 20 pieces of bread to meet customer demand. The patron wants to put them on a graph but has no idea on how to represent them as inequalities.

Task;

- a) Help the patron to come up with the equations of the second and third pathways and advise her on whether they should put the third pathway.
- b) Help the patron to know how much each set and each ruler costs.
- c) Will her budget be enough for the items she wants to buy?
- d) Help the patron to represent the constraints on a graph and find the region that satisfies the conditions. (**COUHEIA**)

(equations of a straight line, application of simultaneous equations and linear programming)

7. On 21/08/2026, the S.1 students at Brighton secondary school will be starting their holidays. The class consists of 800 students and since they are young and unable to travel home by themselves, the school administration has decided to arrange transport for all of them to Kampala City Square where their parents will pick them up. The school plans to use two types of vehicles. A Bus with a capacity of 40 passengers and a Costa with a capacity of 20 passengers. The cost per bus trip is UGX 40,000, while each Costa trip costs UGX 30,000. The school has a total budget of UGX 1,200,000 for transportation. Additionally, the number of trips made by the Costa cannot exceed twice the number of trips made by the Bus. The transport officer wants to ensure that all students are transported and have some money left over for his allowance. After finalising the transport arrangements, the transport officer checked his previous records and found out that the amount of fuel used during the exercise is partly constant and partly directly proportional to the total number of vehicles. When 30 vehicles were used, 170 litres of fuel were consumed, while using 35 vehicles required 190 litres of fuel.

Task

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- a) Help the transport officer to determine the maximum possible amount of money he can save given all the students are transported.
- b) Write the equation relating the amount of fuel used to the number of vehicles used.
- c) Determine the amount of fuel that he is expected to use if he uses 20 vehicles.

(SHURE) (linear programming)

8. An internet data provider charges customer in a certain village a service charge plus a fee based on the data they use each month. Mukisa is new in this neighbourhood and wants to subscribe for internet of 20 GB for his whole family for each month. He needs to determine its cost before he subscribes to the company. His neighbour, Alex, tells him that he pays sh 10,000 for 2 GB while another neighbour, Tony, said he pays the same company sh 34,000= for 8 GB.

Mukisa is also a baker who specialises in chocolate cakes and vanilla cakes and has got an order from a supermarket to supply at least 10 cakes.

A chocolate cake requires 2 kg of flour and 3 hours in the oven while a vanilla cake requires 4 kg of flour and 2 hours in the oven. In stock, he has not more than 80 kg of flour and it is recommended to use his oven for at most 60 hours. He usually makes a profit of sh 400 per chocolate cake and sh 500 per vanilla cake and wants to determine the number of cakes he should supply to maximise profit.

Task

- a) Help Mukisa to determine the amount of money he needs for the 20GB of data for the family.
- b) How many chocolate cakes and vanilla cakes can Mukisa make to maximise profits. **(HOIMA)**

(Equations of a straight line and Linear programming)

9. The chef of your school has stocked 20,000kg of rice for both workers and students to run for the entire term. At your school all workers consume 800kg of rice for a term and students consume 250kg of rice per day. The chef wants to remain with at least 200kg of rice at the end of the term for the footballers and the askari who will remain at school in the holiday. The chef therefore needs your assistance to know the maximum number of days that the term should have to fulfill his target.

Your school has a total population of 1850 students. The accounts office designed a model for determining the daily cost (C) in shillings of running a school. This cost depends on the number of students (n) who attend school on a particular day. The model is $C(n) = an + b$ where *a* and *b* are constants. The Headteacher wants you to help him to find the daily cost when the entire school population attends. When you go to the accounts office you get the following information; $C(1200) = 760,000$ and $C(1350) = 850,000$

Task;

Help the;

- a) chef to find the maximum number of days a term should have so as to fulfill his target.
- b) headteacher to determine the daily cost of running a school when the entire school population attends. **(UTES)**

(equations of a straight line, and application of simultaneous equations)

10. Your family plans to purchase a total of 30 Electric and Petrol motorcycles for delivering products to their customers. The total daily maintenance budget to be allocated for these motorcycles is \$420. Given that the daily maintenance cost for an Electric motorcycle is \$20 and that of a Petrol motorcycle costs \$8, they need to determine the number of motorcycles of each type that they are to buy. To create parking space for the motorcycles, your family plans to buy a rectangular piece of land. The length of the land must be 4 meters longer than twice its width. The total area required for parking of motorcycles is 160 square meters.

Task:

- a) How many motorcycles of each type will they buy?

- b) What are the dimensions of the space they will buy for parking the motorcycles? (UMTA)

(linear programming and application of quadratic equation)

11. Debbie has a rectangular piece of land where she plans to start a fish farming project. She wants to cover the floor with tiles and has approached a builder to do the work. The builder asked for the exact measurements of the land, but Debbie only knows that the length is 4 metres more than the width and that the area of the land is $320m^2$. She needs help to determine the dimensions of the land. Debbie plans to buy the tiles from a company that has been running a promotion. According to the advert, the company offers a 25% discount to all customers and an additional 10% discount for one day only. Debbie wants to determine the total percentage discount and the sale price of a box of tiles with an original price of Shs 120,000.

Task:

Help Debbie to:

- Determine the dimensions of the piece of land.
- Form a composite function to calculate the final price after the two successive discounts.
- Determine the:
 - total percentage discount.
 - sale price of a box of tiles she decided to buy. (MATIGO) ***(application of quadratic equations and composite functions)***

12. At Bright Future wholesale shop, they sell bags of rice and packets of milk powder.

One day a customer bought 3 bags of rice and 5 packets of milk powder and paid shs.81,000. On the same day, another customer was given shs. 70,000 to buy 4 bags of rice and 2 packets of milk powder. After shopping he remained with shs.6,000. The shop keeper did not issue receipts, so the customers failed to know the price of one bag of rice and one packet of milk powder.

At the same shop, cartons of soda and cartons of mineral water are also sold. The number of cartons of mineral water sold per day is at least 30 while the number of cartons of soda sold per day is always greater than half the number of cartons of mineral water sold. Each carton of mineral water is sold at shs. 8,000 and each carton of soda is sold at shs. 10,000. The total sales made per day from mineral water and soda are at least shs. 500,000.

The profit earned on each carton of mineral water is shs. 900 and the profit earned on each carton of soda is shs. 1,200. The total daily profit from soda and mineral water does not exceed shs. 72,000

Task:

- Help the customers to determine the price of one bag of rice and one packet of milk powder. Give your response to the nearest hundreds of shillings.
- Form inequalities and equations showing the relationship between cartons of mineral water and cartons of soda.
- Represent the above inequalities graphically and show the feasible region.
- Determine the number of cartons of mineral water and soda that should be sold per day to maximize profit and the maximum profit earned. (ASSHU) ***(Application of simultaneous equations and linear programming)***

13. Two men at their workplace were asked about their children's age during a survey. They could only remember that Peter is the father to John, Mary and Monica. Rashid is the father to Muhamood, Sumini and Bakari. Peter is twice as old as Rashid and the sum of their ages is 90 years. Mary is three times as old as Sumini and the sum of their ages is 30years. The termly cost of a child's school requirements is partially constant and partly inversely proportional to the number of children in the household. A family of 10 children needs shs 350,000, whereas a family of 20 requires shs 400,000. Peter has three children and is challenged on how much to spend on requirements for the upcoming school term.

Task:

- a) Help the researcher;
 - i. to illustrate the relationship among the men with their children
 - ii. determine the age of Peter, Rashid, Mary and Sumini
- b) Help peter to find out how much he is likely to spend on his children's requirements for next school term. **(ACEITEKA)**
(mappings and relations, algebra and partial variation)

THEME 3: DATA AND PROBABILITY

1. The sports master in a certain school is developing a team of learners, who will participate in the regional school's competition in Volleyball and Tennis. This will be possible if 65% and above of the learners are good at volleyball. Out of 32 learners, 17 were excellent in Tennis while 12 were excellent at volleyball only. There are some learners who were not good at any of the two games. The number of those who were excellent at both games was equal to the number of those who were not good at any of the two. Robert a science teacher is investigating the relationship between Maths (x) and Physics (y). He wants to use an appropriate graph to visualise this relationship and use it to make the necessary predictions. He summarized the previous scores in both subjects.

Maths (x)	40	60	55	30	50	80	25	92	56	63
Physics (y)	87	73	85	95	80	70	97	60	86	80

Task:

- a) Will the sports master be able to develop the team?
- b) Help Robert to;
 - i. develop an appropriate graph to visualise the relationship between scores of Maths and Physics.
 - ii. use the graph above to predict the scores of Maths for a learner who scored 63% in Physics. **(WAKISSHA)**
(set theory, scatter graph 'relationship between variables')
2. Johnson wants to play a lottery game. The terms and conditions of the game are; throw two dice, note the product of the outcomes and find out the chance of the product being divisible by 4. If the chance is greater than 0.5, then you win and otherwise you lose. Johnson is wondering whether he will win or not. Global Transport Company has taxis and buses that follow a chart route of Kampala to Bukedea. The two towns are 300 km apart. One day, a taxi left Kampala at 7:00 am moving at average speed of 60 km/hr. After covering 150 km, the taxi stopped for passenger to refresh. This lasted for 30 minutes, and the taxi resumed its journey but with an increased speed of 15 km/hr more than the original until it reached Bukedea. The same day, a bus left Bukedea at 7:30 moving at average speed of 80 km/hr nonstop to Kampala. The bus driver had a package to deliver upon arrival, however, during the journey the bus driver received a call instructing him to give the package to the taxi driver when they meet to return it to Bukedea. The bus driver did as instructed but failed to note the time of the handover and the distance he had covered.

Task

- a) Help Johnson to find out whether he will win the lottery game.
- b) Help the bus driver to determine;
 - i. the time at which the handover took place.
 - ii. the distance he had covered by the time of the hand over. **(WAKISSHA)**
(probability theory and distance-time graph)

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3. Company Y produces and sells plastics. To increase their sales, they tried a new method of selling products. This involved hiring sales personals who moved on foot selling products mainly in remote areas. This method is to be maintained if within the trial period, the average products sold by the hired personals exceeds 45. The company is to terminate the percentage of personals that sold at most 45 products within the trial period. Below are the numbers of products sold by different sales personals in the trial month:

55	38	54	58	52	71	40	50	62	23
48	50	42	67	37	51	40	67	65	40
39	59	47	60	26	47	51	46	58	53
45	40	68	69	73	32	46	39	51	59
74	44	51	43	60	48	59	61	36	70

Task:

- Summarize the products sold above on a frequency distribution table using a class interval of 10 and starting with the smallest product sold.
- Is the company to maintain the new method of selling products or not? (Justify your answer)
- What percentage of sales personals is to be terminated? (**KAMSSA**)

(Data and display 'statistics')

4. The class teacher of class X had three students A, B, and C that he wanted to select a class monitor from. He provided the remaining 116 students with papers. They were to tick against whoever they would prefer to be the class monitor. On collecting and counting the papers, he noticed that: 20 had ticked on A and C, 18 had ticked on A and B, 9 had ticked B and C only. Those who ticked on B only were half of those who ticked on A only. 42 had ticked on B, 20 had ticked on C but not the other two. Those who ticked A and C exclusive of B were equal to those who ticked on none of the names. The teacher needs help to determine the total number of those who ticked on A and C respectively. He is later to compare all the totals of A, B, and C to select one who was preferred by the majority to be the class monitor. It will be easy for the one selected to manage the class well if the percentage of those opposing him is less than 50%.

Task:

- Help the teacher to determine the total number of those who ticked on A and C respectively and hence help him conclude on who to select as the class monitor.
- Will it be easy for the one selected to manage the class? (Justify your answer)

(KAMSSA) (set theory)

5. The administration of a certain school is concerned about the declining performance of learners in science subjects. To improve academic achievement, the Head of Department (Sciences) has been asked to prepare a report showing the overall performance of learners and to determine whether most learners are likely to meet the school's target score of 75% and above. The Head of Department collected the average science scores of 50 learners from several continuous assessment tests as shown below:

33, 79, 58, 76, 37, 74, 56, 37, 80, 41, 62, 44, 89, 45, 87, 65, 47, 49, 52, 69, 87, 49, 54, 77, 86, 57, 61, 58, 65, 30, 58, 68, 38, 46, 50, 63, 34, 53, 70, 59, 60, 43, 87, 59, 69, 36, 55, 60, 49, 50

The report will be used by the school management to decide whether additional support programs should be introduced for science learners.

Task:

- Help the Head of Department to estimate the learners' average score using a class width of 10.

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- b) Represent the data using a suitable graph to show the highest score obtained for inclusion in the report.
- c) Determine the percentage of learners who scored 75% and above.
- d) Advise the school management on the likelihood of learners achieving the school's science performance target. **(WAKATA)**

(Data and display 'statistics')

6. A school tour coordinator is planning an educational air transport study tour and wants to determine the percentage of learners who have ever travelled through at least two of the airports intended for the trip. If the percentage is above 50%, the coordinator plans to change the destinations and select different airports to give learners a new experience. After conducting a survey among the learners who had paid for the trip, it was noted that: 20 learners have travelled through Airport A, 30 learners have travelled through Airport B, 15 learners have travelled through Airport C, 6 learners have travelled through both Airports A and B, 4 learners have travelled through both Airports B and C, 5 learners have travelled through both Airports A and C. The number of learners who have travelled through Airport B only is twice the number who have travelled through Airport A only. Every learner surveyed has travelled through at least one of the airports.

Task:

- a) Help the school tour coordinator to represent the information obtained.
- b) Based on the calculations, advise the school tour coordinator on whether to maintain the selected airports or choose different airports for the study tour.

(WAKATA)

(Set theory)

7. Malvin earns a profit of shs 500, shs 1000 and shs 2000 on each glass of juice of 250ml, 300ml and 400ml sold respectively. Given that in week one she sold the following number of glasses of juice in different flavors as listed below:

Watermelon: 10 glasses of 250ml, 15 glasses of 300ml and 12 glasses of 400ml.

Passion: 15 glasses of 250ml, 20 glasses of 300ml and 30 glasses of 400ml.

Beat root: 5 glasses of 250ml, 4 glasses of 300ml and 2 glasses of 400ml.

In week two she made the following:

Watermelon: 20 glasses of 250ml, 30 glasses of 300ml and 24 glasses of 400ml.

Passion juice: 30 glasses of 250ml, 40 glasses of 300ml and 60 glasses of 400ml.

Beat root: 10 glasses of 250ml, 8 glasses of 300ml and 4 glasses of 400ml.

She needs to determine whether there was improvement in business performance or not given that in the previous two weeks she had earned a total profit of shs 200,000.

Task:

By arranging data in rows and columns, help Malvin to determine whether there was improvement in business performance or not. **(COUHEIA) *(Matrices)***

8. The games department of a certain girl's school has bought 5 netballs and 3 footballs, and these balls are being picked from the bag by the games prefect randomly without replacing them. The games prefect is to pick 2 balls, but she is not sure of the type of balls she will pick. The games department still has a choice of three games: football (F), Netball (N) and volleyball (V). It was found that 40 played football, 35 played netball and 60 played volleyball, 7 played Football and Netball, 10 played Netball and Volleyball and 4 played Football and Volleyball; 34 played no game at all. If there are 150 girls in the school.

Task;

- a) Help the games prefect to find the probability of selecting;
 - i. Two netballs.

- ii. One football and one netball.
- b) Help the games department to know the;
 - i. Number of girls who played all the three games.
 - ii. Number of girls who played only one game.
 - iii. Number of girls who played at most two games.
- c) Probability that a girl chosen at random from this school plays two games only. **(COUHEIA)**
(Probability theory and set theory)

9. An NGO is supporting a technical institute that has enrolled 60 students who were unable to finish their formal schooling. To ensure that the program is sustainable, the NGO has set strict budgetary limits and performance-based incentives for the students. The students are to report in three consecutive weeks. The institute requires pens, books, and box files for its students. Each student reporting in week 1 needs 2 pens, 3 books and 1 box file. Week 2 students require 3 pens, 4 books and 2 box files each. Week 3 students require 6 pens, 5 books and 2 box files each. The number of students to report week 1, week 2 and week 3 are 10, 20 and 30 respectively. If the total number of items of any type is more than 300, the students will have to contribute some tuition. The 60 applicants took a mathematics test. To maintain quality, the NGO will only award a "Certificate of Excellence" to those who qualify for plumbing only if they are at least 48% of the total applicants. Applicants scoring 65 marks and above will be eligible for the Electric Installation and Electronics course. The mathematics test results are summarized below:

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Number of applicants	2	5	8	8	22	7	7	1

Task:

- a) Using rows and columns, represent the information above.
- b) Determine whether the students will contribute some tuition.
- c) Using a suitable graph;
 - i. Determine whether "certificates of excellence" will be awarded given that to qualify for plumbing, an applicant should score from 45 to 65.
 - ii. Determine the number of applicants who qualify for the Electric Installation and Electronics course. **(SHURE)**
(Matrices, data and display 'statistics')

10. In Bingwa High School, there was an epidemic and a sample of 84 students was diagnosed with the signs: high temperature (T), intense flu (F), and red eyes (R). The following data was collected: 16 students were diagnosed with red eyes, 49 students were diagnosed with intense flu, 4 had high temperature and intense flu only, 32 had intense flu only, and 2 had high temperature and red eyes but without intense flu. It was observed that the difference between those with no signs and those with "high temperature only" is 8 and it is 17 for those with "no signs" and those with "intense flu and red eyes only". A quarantine is to be imposed if the number of students with at least two signs is more than 20. Only two injections of vaccine are available at the moment. The two available injections are to be administered to two students selected at random from the group of students who had either all three signs or "intense flu and red eyes only". If the probability of selecting a student with all three signs for vaccination is more than 0.2, then more vaccines will be brought next week.

Task:

- a) Determine the number of students diagnosed with high temperature.
- b) Determine whether the quarantine will be imposed.

c) Will they bring more vaccines next week? **(SHURE)**

(Set theory)

11. Masaka FC has an away football match with Lira FC. The distance between the two cities is 475km. The match is scheduled for 4:30pm. Masaka FC's bus leaves Masaka city at 9:00am to Lira at an average speed of 100km/h. After travelling for $3\frac{1}{2}$ hrs, their bus gets a mechanical problem. They call a mechanic from Lira who instantly drives towards Masaka at 90km/h. When the mechanic meets the bus, he repairs it for 66minutes. After the repair, he advises the driver of the bus to continue with the journey at an average speed of 95km/hr. However, the team gets worried and they request you to use a graph to find if they can still catch up with the time for the match.

The manager of the team wants to surprise his players with soda, beer and water. Due to limited resources, he does not want the number of those who take all the three drinks to exceed 15. He therefore interviews them and discovers that, 18 players take water, 30 take soda and 24 take beer. All the players take at least one of the drinks. 14 players take both water and soda, 17 take both soda and beer, 11 take both water and beer. The number of those who take beer only is twice those who take water only.

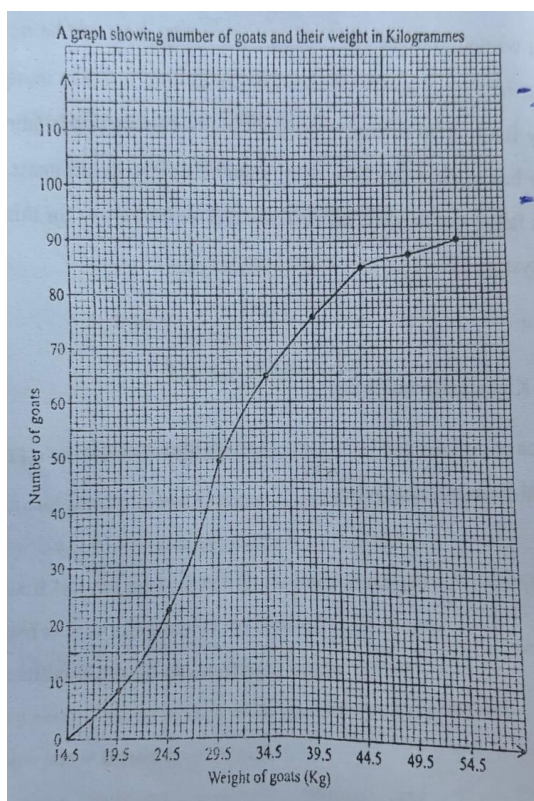
Task:

Help the:

- team to know if they can still catch up with the match.
- mechanic to know the distance from Lira to where the bus breaks down.
- manager of the team to decide on whether to surprise his players or not **(UTES)**

(Kinematics and set theory)

12. Mukasa has a goats' farm in Gomba. The last time he visited the farm, the average weight of the goats was 28.5kg. He introduced new pastures at the farm on which the goats have been grazing for a full month. He wants to assess the contribution of these pastures to the weight of goats. The manager of the farm gives him the following graph.



However Mukasa needs your assistance in determining the impact of the pastures he introduced at the farm. On the farm Mukasa has 20 bucks (male goats), 40 nannies (female goats) and 30 wethers

(castrated). He decides to slaughter 2 goats randomly, one on Saturday and another one on Sunday. Mukasa wants to slaughter at least one wether but he is not sure of the available chances to do so
Task:

Help Mukasa to;

- a) Find out if there is a positive impact brought by the new pastures
- b) Determine the chances of slaughtering at least one wether. (UTES)

(data collection and display 'statistics')

13. Districts A, B and C were affected by an earthquake. The rescue team organized a given number of crates of food, Medical and water purification supplies to be delivered to the affected districts. Given that 15 crates contain only medical supplies, 40 crates contain Food and some other supplies, 38 crates contain Water Kits and some other supplies, 30 crates contain medical supplies and some other supplies, 12 crates contain both Food and Medical Supplies with some water purifiers, 14 crates contain both Food and Water Kits with some medical supplies, 11 crates contain both Medical Supplies and Water purification Kits with some food supplies and some crates contain all the three Supplies, they need to sort all the mixed crates before they start distributing them. To improve the welfare of the victims, the rescue team plans to include additional hygiene kits if the number of crates containing at most two types of supplies is greater than 60%.

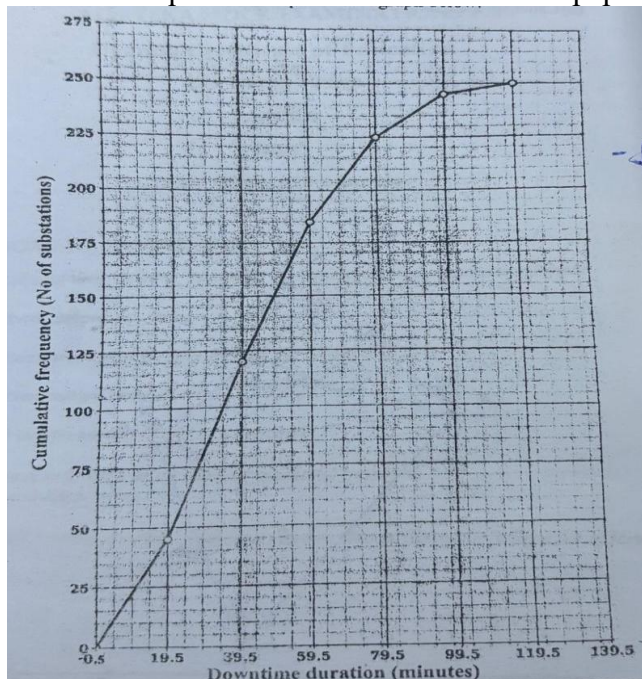
Those to distribute the items are to make 2 trips to District A, 3 trips to District B and 2 trips to District C. The rescue team needs to know how much to prepare for distribution given that each trip to A will cost Shs.88,000 in terms of fuel, each trip to B will cost Shs.100,000 and each trip to C will cost Shs.70,000.

Task:

- a) With aid of a relevant presentation, determine whether the rescue team will include additional hygiene kits.
- b) By arranging data in rows and columns while stating the orders of arrangements, conclude about the amount they will need for all the trips to be made. (UMTA)

(set theory and matrices)

14. The Capital City Council proposed to switch from diesel to Electric buses. The higher officials are to approve the proposal if within 90 percentage of the substations, the duration of grid voltage fluctuations exceed 75 minutes. On requesting for data about the duration of grid voltage fluctuations from different substations. The council was provided a graph below



There was also need to report about the duration of grid voltage fluctuations for majority of the substations that were sampled.

Task:

- Conclude about the duration of grid voltage for majority of the substations that were sampled.
- Will the higher officials approve the proposal? (Justify your answer) (UMTA)

(Statistics 'data collection and display')

- A games master in a certain school wants to award sports bursary to a group of new senior five students when the probability of playing two games only is less than 50% and know the number of students that play both netball and volleyball but not tennis. Among the 100 students picked randomly, it was found out that 78 students play Netball, 82 play Volleyball, 53 play Tennis and 2 do not play any of three games. All those that play tennis also play Volleyball. 48 play all the three games.

Task

Help the games master to determine:

- The number of students who play both netball and volleyball but not tennis.
- Whether the games master is able to award the bursary. (ACEITEKA)

(Set theory)

- Musa a businessman who deals in agricultural produce business, visited four markets in a certain week and he is challenged on how to arrange the records in rows and columns form.

In market A, he bought 3bags of beans, 5 bags of maize, 10bags of potato and 3bags of millet.

In market B, he bought 1 bag of beans, 4 bags of potatoes and 2 bags of millet.

In market C, he bought 5bags of beans, 1 bag of maize.

In market D, he bought 4bags of beans, 3 bags of maize, 6bags of potatoes and 1 bag of millet.

He bought each bag of beans at shs 45000; a bag of maize at shs 30000, a bag of potatoes at 15000 and a bag of millet at shs 50000. He wants to sell all the produce at shs 50000 per bag of beans, shs 35000 per bag of maize, shs 18000 per bag of potatoes and 55000 per bag of millet. Musa is not sure of total profit from the sales.

Task:

Help Musa to

- Organize the information in rows and columns form clearly stating the order of the produce and their markets.

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- b) Calculate the amount he spent in buying these produce.
- c) Find the total profit he generated (**ACEITEKA**)

(Matrices)

17. A school needs to purchase supplies for two events P and Q in term 2. The housemasters have provided their requirements. For event P, pink house needs 10 balls, 15 boxes of water and 20 kits, blue house needs 8 balls, 12 boxes of water and 16 kits, while red house asked for 6 balls, 14 kits and 10 boxes of water. For event Q, blue house needs 5 balls, 10 boxes of water and 8 kits, pink house has requested for 9 boxes of water, 7 balls and 6 kits while red house has asked for 5 kits, 8 boxes of water and 4 balls. The school supplier charges sh 60,000 for a ball, sh 12,000 for a box of water and sh 8000 for a kit. The sports master needs to organize the data so in rows and columns in brackets to present it to the finance office for funding.

Task

- a) Organize the requirements of the houses and the item costs in rows and columns in brackets giving their respective orders for the sports master.
 - b) Use your arrangement above to determine the total number of each item requested for by each house.
 - c) Determine the amount that the sports master will request for from the finance office to buy all the items needed. (**HOIMA**) **(Matrices)**
18. At a certain boarding school, it has been noted that food is wasted because some learners do not like certain food types. The school menu includes rice, cassava and matooke. The school has decided to carry out research and it will replace a food type if the probability that a learner eats only that food type is less than 0.2.

On a certain day, 208 learners ate rice, 122 ate cassava, 50 learners ate matooke and cassava only, 20 ate rice and cassava only while those who wanted matooke and rice were 25 more than those who ate matooke and cassava. The number of those who ate matooke only was 35 more than those who asked for rice only. The school policy is that no learner is allowed to eat all the food types. However, the school canteen registered 22 learners who did not want any of the foods and they ate snacks for lunch that day. The welfare master wants to determine if a food type should be replaced on the school menu.

Task

By organizing the data provided help the welfare master to make the decision. (**HOIMA**) **(Set theory)**

19. The book club of a certain school has received interest from donors who are willing to support the club by providing more books. To guide their decision, the club patron conducted a survey to find out how many members enjoy reading novels, history textbooks, and science textbooks. The donors set a condition that they would only support the club if the probability that a randomly selected member likes at least two of these types of books is greater than 50%.

The club has a total of 30 members. The survey results showed that:

- 14 members like history textbooks
- 20 members like science textbooks
- 7 members like novels and science textbooks only.
- 2 members like history and science textbooks only
- 12 members like exactly one type of book.
- The number of members who like science textbooks only is twice the number of those who like novels and history textbooks only.
- 1 member does not like any of the three types of books.

The patron also wants to determine the total number of members who like novels.

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Task:

- a) Help the patron to determine the:
 - i. total number of members who like novels.
 - ii. probability that a randomly selected member likes at least two types of books.
- b) State whether the donors will support the club. Give a clear mathematical reason for your answer. **(MATIGO) (Set theory)**

20. The Ministry of Education and Sports is seeking to recruit suitable and qualified people for a vacant position in the Education Standards Department. The human resource manager interviewed all the candidates who applied, and the results were recorded in the table below.

Scores (%)	Cumulative number of candidates
20.5 - 30.5	12
30.5 - 40.5	27
40.5 - 50.5	41
50.5 - 60.5	64
60.5 - 70.5	77
70.5 - 80.5	92
80.5 - 90.5	98
90.5 - 100.5	100

The human resource manager wants to determine:

- i. the average score of the candidates.
- ii. the score below which three-quarters of the candidates scored.
- iii. the number of candidates who scored 55% and above.

After obtaining this information, the human resource manager will consider organizing a second interview if the probability of candidates scoring 55% and above is less than 0.6.

Task

- a) Determine the:
 - i. Average score of candidates who sat the interview.
 - ii. Score obtained by three quarters of the candidates. **(MATIGO) (Statistics)**

21. A school plans to organize weekend guidance workshops for Senior Three and Senior Four learners. Learners registered for Science, Humanities and Vocational workshops. A total of 54 learners registered for science, 65 for Humanities and 45 for Vocational studies. Thirteen learners registered for both Science and Vocational studies, 20 for both Humanities and Vocational studies, and 7 for both Science and Humanities. Thirty-eight learners registered for only Science. The school administration wants to hold all workshops on the same day if the chance that a learner attends only one workshop is at least 70%. However, the school administration invites you to help them in the above-mentioned activities.

Task

Help them to:

- a) Interpret the registration records and determine the number of learners who registered for all the workshops.
- b) Establish the registration pattern and determine the chance that a learner registered for only one workshop.
- c) Determine whether the workshops should be conducted on the same day. **(UTEC) (Set theory)**

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22. The manager of a restaurant collected sales records from branches in Nansana and Kyengera during the first two weeks of May. The restaurant sells chips, burgers and chicken.

During Week 1, Nansana sold 140 packs of chips, 76 burgers and 110 pieces of chicken. During the same week, Kyengera sold 90 packs of chips, 75 burgers and 130 pieces of chicken.

In Week 2, Nansana sold 132 packs of chips, 98 burgers and 100 pieces of chicken. Kyengera sold 89 packs of chips, 90 burgers and 110 pieces of chicken. The prices were the same at both branches. A pack of chips cost shs 7,000, a burger cost shs 9,000 and a piece of chicken cost shs 10,000. The manager wants to compare performance and determine the revenue earned during Week 2.

Task

Help us to:

- Organise the Week 1 and Week 2 sales records in matrix form.
 - Determine the change in sales for each item at each branch.
 - Compute the revenue earned by each branch during Week 2. **(UTEC) (Matrices)**
23. A survey was carried out in preparation for s.4 leavers' party about which drinks they preferred. Out of 60 learners surveyed, 34 preferred juice and 28 preferred yoghurt and they are some other learners who preferred sodas though no learner preferred soda only. The number of learners who preferred soda and juice only are equal to those who didn't prefer any of the 3 drinks, and those who preferred soda and yoghurt only are four times those who preferred yoghurt only. 9 learners preferred juice and yoghurt only while 4 preferred all the three drinks. In order to make the party colourful and enjoyable, every learner took what s/he preferred. These drinks are sold in cartons of 6 bottles each and each carton of soda, juice and yoghurt costs Sh. 11,000, Sh. 17,500 and Sh. 19,000 respectively.

Task;

- Determine the probability that a learner preferred soda.
 - Determine the minimum number of cartons of each type of drinks that will be purchased such that learners enjoy soft drink.
 - Using the knowledge of matrices, determine the minimal amount of money required for drinks. **(JJEB) (set theory and matrices)**
24. An agriculture club of a certain school carried out a survey of produce harvested from the school garden over three consecutive weeks. The produce recorded were tomatoes, cabbages and green peppers. The number of baskets harvested is shown in the table below.

week	tomatoes	cabbages	green peppers
1	20	15	10
2	25	10	15
3	30	20	25

Each basket of produce is sold at the following prices;

Tomatoes: UGX 2000 per basket

Cabbages: UGX 1500 per basket

Green peppers: UGX 1000 per basket

Task

- Represent the number of baskets harvested as matrix A and prices as matrix B and state the order of each matrix
 - Using matrix multiplication, determine the total income from each week.
 - Using data provided draw a suitable statistical graph to represent the total number of baskets harvested for each type of crop over the three weeks. **(ASSHU) (Matrices and graphs)**
25. In a certain town, a survey was carried out among 80 youths to find out their involvement in three activities, farming (F), trading (T) and boda boda riding (B). The following information was obtained;

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40 were involved in farming, 35 in trading, 30 in boda boda riding, 18 in both farming and trading, 15 in both farming and boda boda riding, 12 in both trading and boda boda riding, 10 youths were not involved in any of the three activities.

Task.

- Represent the information above on a Venn diagram
- Find the number of youths who are involved in all the three activities.
- If one youth is selected at random, find the probability that the youth is involved in only two activities. (**ASSHU**) (*Set theory*)

26. A minibus travelled from town A to town B which is 360km apart. It begun the journey at 7: 00 am moving at a steady speed of 50kmhr^{-1} for 2 hours, after which it got a mechanical problem. It took them 60 minutes to fix it after which it then travelled the remaining journey to town B in 3hours. A motorist started following a minibus at 8:30am for a passenger in the minibus forgot her bag behind. He travelled at a steady speed of 20kmhr^{-1} more that of the minibus to catch up with the passenger. Meanwhile, a taxi left town B at 8: 00am heading towards town A, driving nonstop at a steady speed and completed the journey in $4\frac{1}{2}$ hours.

Task;

- Determine the difference in times of arrival at these vehicles' destination.
- Determine when and where the two vehicles met.
- With a reason, determine whether the motorist was able to catch up with the minibus for the passenger's bag. 50kmhr^{-1}
- Find the average speed for a minibus for the whole journey (**JJEB**) (*kinematics*)

THEME: GEOMETRY AND MEASURES

- On a farm, a man ties a bull and a cow to two fixed tree stamps opposite each other. The bull is tied to a point A using a rope of length 10 m. The cow is tied to another point B using a rope of length 8 m. Each of these animals grazes in a circular region centred at its tying point. Where $AB = 12$ m. The worker had to collect water from the well to give to the bull. He moved from the bull a distance of 15 m on a bearing of 60° to collect the jerry can and after he moved on a bearing of 150° for 25 m to the well. On coming back, he used a direct route so as to give water to the bull.

Task

- Determine the area of the region common to both grazing animals.
 - Find the direct distance the worker will walk from the well to the bull. (**WAKISSHA**) (*circle properties and bearing*)
- Bob wants to start a business worth Shs. 7,000,000. His friend in USA sent him Us dollars 1,400. He has been informed that current exchange rate is $\$1 = \text{UGX } 3,800$. He wants to borrow the remaining amount from the cheapest of the two banks. Bank A has accepted, to give him a loan of the remaining amount at a simple interest rate of 20% for a period of twenty-four months. Bank B has accepted to give him a loan of the remaining amount at a compound interest rate of 14% for a period of 24 months. However, he does not know which bank to use. Alex wanted to buy a car whose market price is Ugx. 32,000,000 on hire purchase since he does not have enough money to pay cash.

He has been given two alternatives;

- Pay 25% of the cash value and monthly instalments of 1,125,000 shillings monthly for 2 years.
- Pay $\frac{1}{8}$ of the cash value and shillings 315,000 weekly for 104 weeks.

He does not know which arrangement to undertake.

Task

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- a) Advise Bob on the cheapest bank to acquire the loan from.
- b) Help Alex to determine the less costly hire purchase alternative. **(WAKISSHA) (Foreign exchange, interests and hire purchase)**

3. Your uncle wants to make a design in form of intersecting circles in his compound to make it attractive for recreational purposes. He wishes to have one circle of radius 2.0 m and another of radius 1.5 m with the distance between the two intersection points as 1.8 m. His plan is to put pavers in the area shared by the two circles since it is to be used as a pathway. Each paver measures 4.0 cm by 8.2 cm and costs Shs 250. Your uncle wants to know the total cost of pavers needed but can't figure it out and this is delaying the process.

Task

Help your uncle to determine the total cost of pavers needed. [Take where necessary $\pi = 3.14$] **(KAMSSA) (Circle properties)**

4. Your uncle makes ice cream cones to ice cream sellers. He makes cones of carrying capacity 32cm^3 and vertical height 4cm costing him Shs50 to make one cone and sells it at Shs200. According to him, the selling price of the cone is directly proportional to the capacity of the cone, and its cost varies directly as the total material needed to make the ice cream cone.

Recently, he received an order from a new client of making 250 cones, similar to the previous cones he has been making, of carrying capacity 256cm^3 each, but he has never made such a cone so he is not certain of how long the diameter of the cone will be and how much material he needs to make such a cone. He also does not know how much money to charge the client for a unit of such a cone.

Task

Help your uncle to determine the;

- a) Diameter and vertical height of the cone he intends to make.
- b) Amount of material he needs to make the client's order and the cost he is likely to incur.
- c) Price to charge his client for each ice cream cone hence find how much profits he will make from this order. [Use $\pi = 3.14$] **(KAMSSA) (Areas and volumes of solids)**

5. A shoe distribution company is delivering new stock to two retail outlets before the start of a weekend sales promotion. At 7:00 a.m., the delivery truck leaves the company's warehouse and travels 150 km on a bearing of $N50^\circ S$ to deliver shoes to the first retail outlet. The truck arrives at 8:45 a.m., where the staff spend 45 minutes unloading and checking the stock. After completing the delivery, the truck leaves for the second retail outlet, which lies on a bearing of 150° from the warehouse. The truck travels at an average speed of 80km/h for 3 hours before reaching the second outlet. The staff spend 1 hour unloading the remaining stock.

To reduce fuel costs, the transport manager instructs the driver to return directly from the second outlet to the warehouse at an average speed of 60km/h. The company requires all delivery trucks to return to the warehouse not later than 5:30 p.m. Any truck that arrives later than this time will attract overtime costs and delay the next day's deliveries.

Task:

Using appropriate mathematical reasoning:

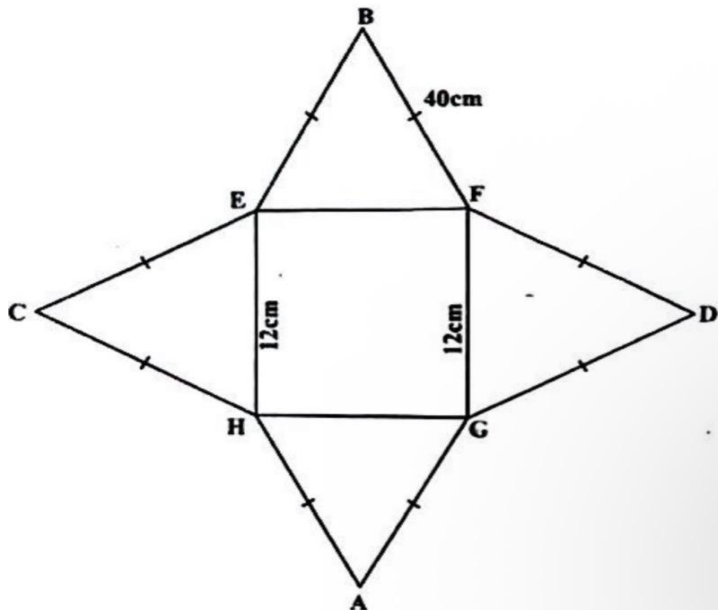
- a) Determine the distance of the direct route from the second retail outlet back to the warehouse.
- b) Advise the transport manager whether the truck will return to the warehouse by 5:30 p.m.

Justify your answer using calculations **(WAKATA) (Bearing/trigonometry 2 and kinematics)**

6. A youth group in a certain District produces handmade gifts for weddings, graduation ceremonies, and community celebrations. To make their products more attractive and environmentally friendly, the group has decided to package the gifts in pyramid-shaped boxes.

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The packaging is formed from a square base of side 12 cm and four congruent isosceles triangular faces, as shown in the net provided. The distance from the apex of a triangular face to the midpoint of its base is 40 cm as shown in the figure



The group believes that using pyramid-shaped packages will reduce material wastage while providing sufficient space for the gifts. If the space exceeds 1500cm^3 then it is sufficient. To expand their operations and create employment opportunities for other young people in the community, the group decided to obtain a loan of UGX 19.45 million from a bank at a compound interest rate of 10.5% per annum. The loan is to be repaid within two years through annum. Thenstalments. Before accepting the loan agreement, the group wants to determine how much money they will have to pay in each instalment so that they can prepare a realistic business budget and avoid defaulting on the loan.

Task:

Help the group to:

- Determine the vertical height of the pyramid-shaped package.
 - Based on the calculations, advise whether it provides enough space for packaging gifts.
 - Determine the amount to be paid in each of the 8 equal instalments. **(WAKATA) (Nets, areas and volumes of solids and interests)**
7. KCCA graphics team is working on a new triangular logo graphically with coordinates A(3,1), B(5,1) and C(5,3) with an area 2cm^2 but they are challenged with the process of finding the matrices of transformation and the area of the final images. First, they need to reflect the triangle across the line $y = x$ and then enlarge it by scale factor 2. After these transformations, they want to determine the matrix that will return this transformed triangle to its original position. Additionally, they need to know the coordinates of every transformed triangle at each stage. Another graphics team decided to sketch the triangular logo using a ruler and pair of compasses only by construction having points ABC where $BC = 8\text{cm}$, $AC = 12\text{cm}$ and angle $ABC = 105^\circ$. On this figure they want to put point D which is equidistant from A and B. If D is on the same side of AB as C and angle $ADC = 90^\circ$.

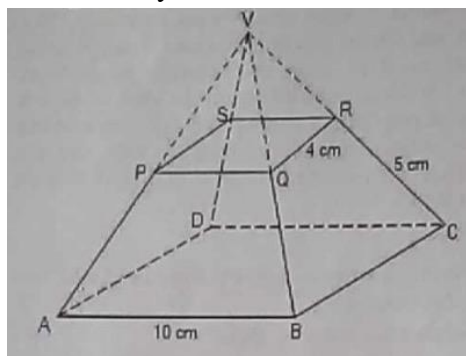
Task;

- Help this team graphically with the process and find the required matrices along with the coordinates of the images.
- Also determine the area of the transformed triangles.
- Show the exact position of D on your diagram and find length of;
 - AB
 - AD

iii. DC

(COUHEIA) (Geometry or matrices of transformation and construction)

8. A community SACCO wants to construct saving boxes for each member in form of a pyramid lamp shed ABCDPQRS as shown in the figure below. The base ABCD should be a square of side 10cm long and the top, PQRS is also a square of side 4cm and each of the short edges of the saving box is 5cm. The SACCO members must save until the box is full with coins of 500ugx only. And it is estimated that the coin has a diameter of 2.2cm and 0.2cm high. One of the members wanted to find out how much money she will have saved when her box is full



The members also have communication problems and they are planning to construct a telecom mast on top of a hill. The base of this hill is located at a distance of 80meters from the sacco office. The angle of elevation of the sacco office to the top of the hill is 50° and the angle of elevation of the office to the top of the mast is 60° . The community has set safety measures that the height of the mast should not be more than 50metres

for stability reasons.

Task;

- As a mathematics student, help the SACCO chairperson to know the height of the saving box.
 - Also help the member to know the amount of money each member will have saved when the box is full.
 - Determine the height of the hill on which the mast should be established.
 - Determine the height of the mast and comment on your result. **(COUHEAI) (areas and volumes of solids)**
9. Drake Construction Company has been awarded a contract to construct a modern water storage tank for a community in Wakiso District. The tank consists of a cylindrical section surmounted by a hemispherical dome where the hemisphere has the same radius as the cylinder. The original tank has a radius of 3.5m and a volume of $397.83cm^3$.

To meet the growing water demand, the company decides to construct a larger tank that is similar to the original tank. The larger tank has a volume of $1342.69cm^3$. The entire external surface of the larger tank will be painted. The specialised waterproof paint to be used will be imported from Kenya at a cost of KSh 6,500 per drum. One drum of paint paints 20 square metres. The company procurement officer plans to go to Kenya with UGX 32,000,000 and he is not sure whether the money will be enough for the paint. The prevailing exchange rates are shown below

currency	Buying rate	Bank selling rate
1 Ksh	UGX 130	UGX 135

To transport the imported paint, the company purchases a pickup truck for UGX 85,000,000. The truck depreciates at 15% per annum. The company intends to sell the truck when its value has depreciated to UGX 52,200,625. (Use $\pi = \frac{22}{7}$).

Task

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- a) Calculate the total area to be painted.
- b) Determine the minimum number of drums of paint required to paint the larger tank and hence advise the procurement officer whether the money will be enough.
- c) Determine how long the pickup truck should be used before it is sold. **(SHURE) (Areas and volumes of solids, business mathematics)**

10. A district planning team is designing a reliable medical supply distribution network to serve communities in a rural area. A coordinate map is used to represent the region, with the headquarters taken as the Origin.

The planning team identifies two key locations:

A medical storage facility is located at point A, which is 2km east and 4km north of the district headquarters.

A community health centre is located at point B, which is 14km east and 10km north of the district headquarters.

To optimize transportation of medical supplies during normal conditions, the planners establish a main distribution centre at P along the route joining A to B such that P divides AB internally in the ratio 2:1. However, during the rainy season, the area is normally affected by floods and therefore emergency planners propose an alternate distribution centre at Q, obtained after reflection of P along the line $y = x$ on the coordinate map.

The district chairman would also wish to know the area of triangular region bounded between A, B and Q for proper resource allocation.

Task

- a) What will be the location of the main distribution at P and that of the alternate centre at Q from the district headquarters?
- b) Help the district chairman to determine the area of triangular region in hectares (**10000 square metre are equivalent to 1hectare**) **(SHURE) (Vectors, geometry or matrices of transformation and areas of 2D)**

11. There is construction work going on at your school. The school has brought the container in the figure below to keep constructional material like metallic pipes. This container's interior measures 6ft by 20ft by 5ft. The estates manager of the school needs to know the length of the longest pipe he can put in this container and the angle it will make with the floor of the container.



There is also a generator in your compound with a rectangular base. Its corners are seated at $(-4,3)$, $(-1,6)$, $(-3,8)$ and $(-6,5)$. The compound master wants to shift this generator to a new position using a Crane fixed at one place with only its hand rotating. He wants the new positions of the original corners to be shifted to $(3,6)$, $(6,3)$, $(8,5)$ and $(5,8)$ respectively. However, the compound master has found a challenge in determining the position where to fix the Crane as well as the angle through which its arm should rotate.

Task:

Help the;

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- a) Estates manager to determine the;
 - i. length of the longest pipe he can put in this container.
 - ii. angle that will be made between the longest pipe and the floor of the container.
- b) Compound master to find the;
 - i. position where to fix the Crane.
 - ii. angle through which the arm of the Crane should rotate. (UTES) (*Lines and planes in 3D*)

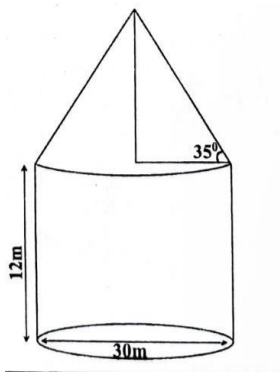
12. Mr. Kintu surveyed his land, and he realized that his neighbour constructed a circular tank base and part of it entered into his land. The neighbour constructed this circular tank base with its centre just 8ft from the straight boundary. The tank base has a radius of 10 ft. Mr. Kintu wants to file a case to courts of law, but he is not sure of the exact area of his land that the tank base entered.

Mr. Kintu wanted to frequently visit his land using a car, but he never had one and decided to buy a car at Shs 20,000,000 by getting a 5year mortgage loan from Centenary Bank at an interest rate of 12% per annum under mortgage repayment terms. He must clear this loan using equal monthly instalments. However, Mr. Kintu has failed to determine the total interest he has to pay for this loan under the mortgage system.

Task

Help Mr. Kintu to determine the;

- a) area of his land that the neighbour's tank base entered.
 - b) total interest for his loan. (UTES) (*Circle properties and mortgage*)
13. Your town Council has acquired a large piece of land to develop a community resort. The survey team has mapped three primary control points: **A**, **B** and **C**, using a local grid system and compass bearings with reference to the post office, **P**. **A** is 6 km East and 8 km North of **P**. **B** is 14 km east and 2 km North of **P**. **C** is 5 km West and 7 km North of **P**. The council wants to know the direct distances and bearings of B and C from A to include them in the resort's directory book.
- The central pavilion of the resort features a hollow right circular cone sitting perfectly on top of a solid cylinder base as illustrated below:



The exterior walls of the pavilion must be covered with weatherproofing, and the inside of the entire pavilion must be fitted with an advanced centralized climate control system. The council wants to know the area that needs weather proofing and the inside volume of the pavilion.

Task:

- a) What should the council include in the resort's directory about A, B and C.
- b) Calculate the,
 - i. area that needs weatherproofing.
 - ii. volume of air space inside the combined cylinder-and-cone pavilion structure(UMTA) (*Vector geometry and bearing, surface area and volume of solids*)

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14. There is an existing resort whose board of directors wants to expand by adding a new camping zone on a quadrilateral piece of land **ABCD**. From point A, the boundary runs 60metres on a bearing of 045° to Point B, then 80metres on a bearing of 135° to Point C. The board wants to place a security outpost exactly equidistant from the two boundary lines AB and BC, and exactly equidistant from points A and C. Part of the camping zone will feature a triangular activity field, ACD such that $CD = 110\text{metres}$ and $\angle ACD = 80^{\circ}$. There is need to run an underground power cable directly from A to D and each meter of the cable costs Shs.166,500. The board wants to know the direct distance and bearing of the security outpost from point A, and the cost of the power cable.

The expansion project will be managed by a qualified quantity surveyor on a monthly gross pay of Shs.11,523,000 subject to pay as you earn (PAYE) computed as follows.

Amount (shs)	0-335,000	335,001-410,000	410,001-485,000	485,001-1,000,000	Above 1,000,000
PAYE (%)	0	10	20	30	40

The board wants to know the surveyors' net pay.

Task:

- Using construction,
 - find the actual distance and bearing of the security outpost from point A.
 - calculate the exact cost of the power cable AD.
 - Calculate the Surveyor's net monthly pay. (**UMTA**) (*Bearing, construction and taxation*)
15. Jessica has a room that she plans to use as a beauty salon. She has wallpaper of 4.7m^2 . The wall she plans to cover with paper is 240cm by 300cm. She knows the wallpaper she has is not enough. So, she needs your advice on how much more she should buy. A roll of 10m^2 of wallpaper is sold at shillings 32,000/=
- She is working on her salon's logo based on a simple triangle with corners at A(1,1), B(4,1), and C(1,5) on a digital grid. As part of the design process, she first created a mirrored version of the triangle by reflecting it across the x-axis, resulting in a new triangle $A^1B^1C^1$. Then, to explore variations, she took this new triangle $A^1B^1C^1$ and enlarged it with scale factor 2 around the centre of the grid(origin) to get the final shape $A^{11}B^{11}C^{11}$. She needed to know the precise locations of the corners of the transformed triangles and understand the overall effect of the two steps combined.

Task:

Help Jessica to,

- determine the extra roll she must buy?
 - determine the exact coordinates of the two images.
 - describe a single geometric transformation that would map triangle ABC directly onto triangle $A^{11}B^{11}C^{11}$. (**ACEITEKA**) (*surface area, geometry or matrices of transformation*)
16. A geography department in your school hires two buses A and B to transport S.4 students for a study trip. He expects to reach the destinations at the same time. At 1400hours, the two buses left school both travelling to the destination. One bus travels at an average of 80km/h and arrives 50 minutes late. The other bus travels at an average of 100km/h and arrives 20minutes late. The H.O.D wanted to know the distance apart these buses were travelling so that he reports correctly to the head teacher. The H.O.D had also reported about underpayment in his net monthly salary to the head teacher. He receives an allowance of UGX 85,000 per month for management of geography department. Additionally, he receives housing allowances of UGX 50,000 per month, Medical UGX 939,000 per annum, transport UGX 180,000 per annum and the school pays his insurance premium of UGX

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600,000 annually. He earns a gross monthly income of UGX 1,100,000 and he is subjected to Pay As You Earn (PAYE) according to the following tax rates.

Taxable income (UGX) per month	Rate (%)
1 – 150,000	5
150,001 – 350,000	10.5
350,000 – 450,000	18.5
450,001 – 650,000	28
Above 650,000	30

Task

As a mathematics student, help the head of department:

- to determine the distance apart between bus A and B
- to determine his net income. (**ACEITEKA**) (*Kinematics and business mathematics*)

17. A team of engineers in Kampala is redesigning a small triangular plot of land that will be used as a parking space and pedestrian walkway to improve a commercial area. The plot was surveyed using a coordinate system in metres, and the corner coordinates of the original triangle are A(2, 2), B(6, 2), and C(4, 5). To improve accessibility and make better use of space, the plot is enlarged using a transformation with a scale factor of 2 about the centre (3, -1), producing a new triangular plot.

The team also plans to place rubber pavers inside the new triangular parking area. Each square metre of rubber pavers costs Shs 45,000. After completing the redesign, an engineer who is 1.5 m tall stands at a point in the new park, 10 metres away from a nearby building. The engineer measures the angle of elevation to the top of the building as 45° to check whether it meets city building regulations.

The city authority requires that buildings taller than 12 metres in this area must be removed. The engineer needs to determine whether the building meets the required height standard or should be removed.

Task:

Help the team of engineers to:

- Sketch an artistic design showing the new triangular plot.
 - Determine the coordinates of the new plot after the expansion.
 - Determine the amount of money needed to buy the rubber pavers which will be enough for the new triangular parking plot.
 - Decide whether the building near the new park should be removed or not? Give a reason for your response. (**MATIGO**) (*Transformation and trigonometry I*)
18. A dairy farmer has been facing a challenge of limited storage space for the daily milk produced on his farm. He plans to buy a larger storage tank to replace the one currently available. The new tank will be conical in shape, with a vertical height of 7.2metres and a diameter of 420cm. The curved surface of the tank will be covered with protective paint, and the cost of painting is Shs 5,000 per square metre. The farmer wants to determine the capacity of the tank and the cost of painting its curved surface. The company sells the tank at Shs 1,500,000 and offers a 5% discount to customers who pay cash. The farmer chooses this payment option. The farmer has decided to borrow Shs 2,000,000 from a bank at a compound interest rate of 10% per annum for 24 months in order to pay cash for the tank and use the remaining money for painting and transport costs. However, he needs to determine the amount of interest he will pay at the end of the loan period.

Task:

- Determine the capacity in litres of the new large tank.
- How much will he spend on buying and painting the tank altogether?

- c) Calculate the interest he will pay back to the bank. **(MATIGO) (Areas and volumes of solids and business mathematics)**

19. After struggling with monthly rent payments in Muyenga Estate, Mr. Ali and his wife decided to buy their own house. Four years ago, they deposited Shs 32,000,000 in a bank account that earns 11% compound interest per year. Recently, they found a house costing Shs 240,000,000. The seller requires a deposit of 20% of the house price. The remaining amount can be obtained through a mortgage charged at 12% per annum compounded monthly for 25 years. The couple earns Shs 5,500,000 per month and spends Shs 3,200,000 on family needs.

After settling, the couple noticed the need for the construction of a fishpond to boost their income and security. The two sides of the pond measure 45m and 35m, and the angle between them is 75° . The couple is not sure of making a financial decision about the house and the pond.

Task

- a) Determine whether their savings can cover the required deposit.
b) Compute the monthly mortgage repayment.
c) Establish whether the couple can afford the monthly repayment. **(UTEC) (Mortgage and compound interest)**

20. Two brothers disagreed about the boundary of their plots of land. To resolve the disagreement, one of them hired a surveyor to identify the correct boundaries. The surveyor setup his equipment at point O and used it as the origin of a coordinate system. He recorded two boundary points: **A (4, 5) and B (7, 0)**. According to the land records, the brother's plot formed a parallelogram OABC. Before he could complete the survey, heavy rain interrupted the exercise.

Using the data he had already collected, the surveyor decided to determine the remaining boundary point and the size of the plot. The surveyor completed the work successfully, as a result, a surveying company offered him a new job. Relatedly, the company informed him that his monthly earnings would include:

Basic salary: Shs 1,800,000, Transport allowance: Shs 200,000 and Lunch allowance: Shs 5,000 per day. The surveyor works 5 days per week and 4 weeks per month. Tax is charged on the total monthly earnings according to the table below:

Monthly income (Shs)	Tax rate (%)
0 – 300,000	0
300,001 – 600,000	10
600,000 and above	20

The surveyor currently receives a net income of Shs 1,350,000 per month. He will accept the new job only if his new net income is greater than his current net income. The surveyor is interested to understand the appropriate decisions about the land and the job offer.

Task

- a) Determine the missing boundary point.
b) Establish the size of the plot.
c) Determine whether the surveyor should accept the new job **(UTEC) (Vector geometry and taxation)**

21. A tourist from United States converted his \$12,000 to Ugandan shillings at rate of \$1 = UGX 3560. He rented in a hotel that charges UGX 20,000 daily a month. He did this because he wanted to startup a business in Uganda. At this business, he plans to employ 3 people of which he will be paying \$150

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each including UGX.280,000 non-taxable allowance per month. He will pay them according to the tax structure below;

Taxable income (UGX)	Tax rate (%)
0 – 100,000	Free
100,001 – 200,000	5
200,001 – 350,000	10
350,001 – 500,000	18
Above 500,000	25

From the hotel at the border, the tourist plans to begin his business 150km away in town P on a bearing of $S30^{\circ}E$ and he will be supplying some of his products in a town Q which is 210km away from town P but due East of the hotel at the border. To save time and fuel, he wants to use a direct route from town Q to the hotel but is not sure of how long it is. Given that a month has 30 days.

Task;

- Determine the amount of money the tourist is planning to start the business within Ugandan shillings after paying the monthly rent.
- How much do these employees receive altogether monthly?
- Determine the actual distance between the hotel and town Q. **(JIEB) (foreign exchange, taxation and bearing)**

22. Mr. Kato a householder is facing a problem of water shortages. To solve this problem, he plans to harvest rainwater, and he has contacted the tank making company for a tank with a rectangular cross-section of height 3m and the base 2m by 1.5m.

The upper part of the tank is to have a small circular inlet of radius 7.5cm where the pipe from the roof will be joined to the tank while the lower end is to have a small circular hole of diameter 4cm where the tap will be placed for easy fetching of water from the tank. The company manager realized that the material available to make a tank is only $30.5m^2$ but is not sure whether it is enough to meet Mr. Kato's order.

While standing at the top of the tank, Mr. Kato with a height of 1.5m can see his flower garden at an angle of depression of 58° .

Task;

- Determine whether this company can make this tank using the available material or not.
- Find how far the flower garden from the bottom of the tank.
- If your neighbour needs a small water tank whose material is of area $20m^2$ similar to that of Mr. Kato, determine the actual dimension of the base of this smaller water tank. **(JIEB) (Surface area and trigonometry I)**

23. Desh transit company has hired a new tour guide for a tour that will take 18 days. The company has agreed to pay him \$100 per day ($1\$ = \text{UGX } 3,720$), which includes the following allowances: UGX 40,000 for meals per day and UGX 30,000 for accommodation per night for 17 nights and the income tax will be calculated using the schedule below:

Income (UGX)	Tax rate (%)
0 – 335,000	0
335,001 – 400,000	10
400,001 – 950,000	25
950,001 – 1,500,000	30
1,500,000 - above	40

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The accountant is to deposit the rest on his bank account, but the guide wants to determine how much he should expect to receive after the tour.

Before the tour, in one of the forests, each person is given the directions for the day. On a certain day, the team had to move 4 km on a bearing of 060^0 from the office and reach a check point B; thereafter, turn through a direction of $E45^0S$ and move for 6km then turn South for 5km to a point behind a hill, thereafter, return to the office. However, you were able to notice that there was an alternative route that can be used. So, you were asked to determine if it is shorter or not so that they can decide whether to use it or not.

Task

- a) Help the tour guide to determine how much he should expect to get on his account.
- b) Would you advise the team to use the alternative route on the return journey from the forest to the office and why? **(HOIMA) (Foreign exchange, taxation and bearing)**

24. A school bought a generator at UGX 4,000,000 and it depreciates at a rate of 15% per year on reducing balance. The generator is to pump water for irrigation into their triangular garden ABC where distances $AB = 100\text{m}$, $BC = 70\text{m}$ and angle ABC is 45^0 . The school plans to pump water to a tank which will be placed at a point where the pipe bought can be able to reach all the three corners (A, B and C) of the garden from the tank at its maximum length.

Task.

- a) Calculate the value of the generator after 3 years
- b) Draw a sketch and construct an accurate drawing showing the point where the school can position the tank.
- c) Determine the maximum length of the pipe from the tank that can reach all the three corners of the garden. **(ASSHU) (Geometry construction)**

25. A contractor is designing two similar solid concrete pillars to support a water tank at a construction site.

The model pillar has a height of 1.5m and volume 0.8m^3 . The actual pillar is to be constructed such that each of its linear dimensions is 4 times those of the model and the pillars are cylindrical in shape. To access the top of the actual pillar, a ladder will be placed with its foot 3m away from the base of the pillar on level ground. Each of the pillars curved surface will be painted white.

Task:

- a) Find the volume of the actual pillar.
- b) Calculate the angle the ladder will make with the ground.
- c) Calculate the area of the curved surface that will be painted for one pillar. (Take $\pi = \frac{22}{7}$)

(ASSHU) (Scale factors and area of solid)

26. Michael earns a monthly net income of UGX 3,500,000. He had deposited UGX 21,000,000 in a trust fund 10 years back that gave him a 12% compound interest. He has found a house that he wants to buy that is valued at UGX 300,000,000 for which he has to make a 20% down payment, and for the remaining amount, his bank offers him a mortgage with an annual interest rate of 12% and a repayment period of 15 years.

He needs help to determine whether he will be able to use his money in the trust fund for the down payment and if his monthly income can cover the monthly payment for the mortgage.

He also has a metallic cylindrical tank which he wants to install for rainwater harvesting at this new house. He wants to determine the cost of the paint he will need to paint it with the bottom excluded. Its height is 3metres while it has a top whose radius is 1.5metres but with a circular opening of area 907.9 cm^2 through which the rainwater enters the tank. He has been told that 1 litre of paint costs sh 14,000 and can cover 10 m^2 .

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Task

- a) With mathematical calculations determine if:
 - i. the money he has in the trust fund be able to cover his down payment or not.
 - ii. this monthly income will enable him to pay the monthly deposits required in the mortgage agreement.
- b) Determine the cost of paint he will need to paint his tank **(HOIMA)** (*Mortgage and areas and volumes of solids*)