ADVANCED UNEB-STYLE REVISION QUESTIONS FOR S2,S3 & S4 CANDIDATES

O'LEVEL MATHEMATICS SCENARIO PACK

VOLUME 1



2027th EDITION

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INTRODUCTION

Mathematics is an essential subject that helps learners develop logical thinking, problem-solving skills, and the ability to apply knowledge to real-life situations. In the Uganda National Examinations Board (UNEB) O-Level examinations, students are increasingly required to solve scenario-based questions that test understanding beyond memorization of formulas.

This O-Level Mathematics Scenario Revision Pack has been carefully prepared to support learners in mastering mathematics through practical and realistic situations drawn from everyday life such as business transactions, transport, construction, farming, and community activities. The questions are designed to strengthen analytical skills, interpretation of information, and step-by-step reasoning.

The booklet covers key themes taught at O-Level, including Algebra, Geometry, Mensuration, Trigonometry, Statistics and Data Interpretation, Graphs, and Probability. Each section presents competency-based questions similar to those appearing in UNEB examinations, helping learners build confidence and examination readiness.

Learners are encouraged to attempt all questions independently before checking the answers provided at the end of the booklet. Teachers may also use this material for classroom discussion, assessment, and guided revision.

REUNEZ Education is committed to supporting academic excellence by providing simple, practical, and exam-focused learning materials that empower students to succeed.

We wish you success in your mathematics journey.

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ALGEBRA & EQUATIONS

ITEM 1

St. Rely is to transport students for fieldwork in Henan. All the 400 students are to be transported using either coasters or buses. A coaster can carry 40 people while a bus can carry 80 people. The transport department of the school has only 8 drivers on duty and up to 4 coasters. If the cost of hiring a coaster is shs.150, 000 and that of a bus is shs.300, 000.

While in Henan their geography teacher Mr Wuhan visited Mr Zhang`s shop from which he found out that 3 shirts and 2 trousers cost shs.105, 000 at Mr. Zhang`s shop. Two shirts and five trousers cost shs.180, 000 at the same shop.

Task

1. Write down the five inequalities representing the above information.
2. Represent the inequalities on a graph paper.
3. Find the possible numbers of coasters and buses that can be used and hence determine the minimum cost.
4. Find the cost of each shirt and each trouser.
5. Cost of three items of each type at the shop.

ITEM 2

A bakery produces cakes and cookies. A cake costs UGX15, 000, while a cookie costs UGX2, 000 and sells for UGX3, 500. The bakery has a daily budget of UGX100, 000 and can produce at most 20 items.

Tasks

1. Formulate inequalities representing the constraints on cost and production quantity.
2. Using a graphical method, determine the number of cakes and cookies that maximize daily profits.

ITEM 3

A school is hiring transport for 100 students. A coaster bus holds 30 passengers and costs UGX150, 000, while a smaller van holds 15 passengers and costs UGX80, 000.

Tasks

1. Write down the inequalities representing the number of buses and vans needed.
2. Calculate the minimum cost to transport all students.

ITEM 4

John runs a small woodworking business that specializes in making two types of wooden toys: toy cars and toy trains. The production process involves two main stages: cutting and assembly. Each toy car requires 2 hours of cutting and 1 hour of assembly, while each toy train requires 1 hour of cutting and 3 hours of assembly. The workshop has a cutting machine that can operate for up to 100 hours per week, and the assembly team can provide up to 120 hours per week. Due to a limited supply of a special type of wood used for trains, John cannot produce more than 50 trains in a week. Additionally, he has a standing order from a local toy store that requires him to supply at least 20 cars each week. The workshop also has limited storage space, so the total number of toys produced per week cannot exceed 80. The profit on each car is $8 and on each train is $10.

John wants to determine the optimal number of cars and trains to produce each week in order to maximize his total profit. He needs to consider all these constraints to make a decision that balances his resources and commitments.

Task

1. Formulate the linear programming problem. Define your variables clearly and write down the objective function and all constraints.
2. Find the coordinates of all the vertices (corner points) of the feasible region.
3. Hence, determine how many cars and trains John should produce each week to maximize his profit, and state the maximum profit.

ITEM 5

A small construction firm has two teams. Team A can build a low wall in 5 days and Team B can build the same wall in 8 days. They start together, but after 2 days Team A leaves because of another job. The foreman then assigns a new worker C who does as much work in one day as $\frac{1}{4}$ of Team B.

Task

1. Model the fraction of the wall completed after each stage.
2. Determine how many more days were needed to finish the wall.
3. Compute the share of the final payment of shs.480, 000 for each team/worker based on work done.

ITEM 6

A farmer buys bags of fertilizer in two grades: Grade X (shs.48, 000 per 50kg bag) and Grade Y (shs.30, 000 per 50kg bag). He mixes them to obtain 1,200kg of blended fertilizer priced at shs.36, 000 per 50kg bag.

Task

1. Form equations to find how many bags of each grade he used.
2. Calculate the total cost and the effective cost per kg off the final mix.

ITEM 7

A micro-entrepreneur borrowed shs.1,000,000 and agreed to repay monthly instalments such that the monthly payment decreases linearly each successive month he pays shs.2,500 less than the previous month; the total number of months is 12 and the last monthly repayment is shs.60,000.

Task

1. Determine the first month repayment.
2. Write an expression for the nth repayment, and compute total repaid.
3. Determine the effective average monthly repayment.

ITEM 8

A tank is filled using two pumps. Pump P fills in 9 hours and Pump Q in 12 hours. Due to an emergency the faster pump P runs only for the 3 hours and then stops. If pump Q and a small auxiliary pump R (which falls at half the rate of Q) finish the filling together.

Task

1. How long did they take after P stopped?
2. Write the general equation for time when P runs for t hours first.

ITEM 9

A shopkeeper sells pens at shs.750 each and notebooks at shs.2, 000 each. On one day he sold 100 items and collected shs.140, 000. However, 10 of the items were returned and he refunded a total of shs. 12,500.

Task

1. Determine how many pens and notebooks were initially sold and how many were sold after the returns. Provide the algebraic steps and check for integer solutions.

ITEM 10

A rectangular plot has length L and width W. The owner increases each dimension by the same amount x meters and the area becomes 1.44 times the original area. Given that the original width is 20m,

Task

1. Form a quadratic equation for x hence find the value of x.
2. Interpret which root is meaningful.
3. Compute the new perimeter.

ITEM 11

A baker makes cupcakes using flour and sugar in the ratio 7:2 by weight. If he wants to make a batch of cupcakes weighing 27.5kg total but he must add an extra 5% of the total weight for wastage,

Task

1. Determine how much flour and sugar to weigh before mixing. Show all steps and round ingredient weights to the nearest 10g.

ITEM 12

A community purchases two water tanks: a small one of capacity x litres and a large one of capacity 3x litres. They fill both tanks simultaneously using a hose that delivers 240 litres per minute. After 10 minutes the small tank is full, but the large tank takes 40 minutes in total.

Task

1. Determine; x.
2. the total water used
3. And propose a schedule to fill three identical large tanks using two hoses that deliver 240L/min and 160L/min.

ITEM 13

A telephone network sells data bundles where the first 2 GB cost shs.1, 500 and each additional GB costs shs.600. A user was charged shs.6, 700 for one month.

Task

1. Determine how many GB the user consumed.
2. Model the bill as a piecewise function of data usage and sketch it qualitatively.

ITEM 14

A trader mixes coffee of two grades. Grade A gives a profit margin of 25% on cost and Grade B gives 10% on cost. He sells 150kg of the mixture at a uniform selling price that yields an overall profit of 18% on total cost. If he used equal masses both grades,

Task

1. Find the cost prices of each grade per kg.
2. If instead he used twice as much B as A, what would be the final profit percent?

ITEM 15

A senior one student identified specific boarder points of different regions from his community map extract these included a swamp A(-6,0), B(-2, 0), C(-4,3), D(0,3), a bushy area E(-8,-1), F(0,-1), G(-8,-13), H(0,-13) and a community well, I(2,-1), J(4,-1), K(2,-3) and L(4,-3). (Use 1cm to represent 1 unit). The chairperson suggested that the bushy area should be partitioned into square gardens as large as possible, so that no area is left and each family gets one. James a from another community tried the same assignment using his own community map also and calculated the total area of his village on the map as 30 Square Units. When he shared his findings with a friend, they found that his answer was 25% less than the actual total area.

Four other students Aisha , Angel, Agatha and Arshad attempted the same assignment and were awarded as follows, 15 out of 25, 31 out of 40, 45 out of 60, and 35 out of 80 respectively. Arshad requested for a retake to improve his project grades, the teacher tasked him to find the total area of one of the student's findings giving his answer in base eight. The student had (1003$four$) sq $units$ for the swamp, (2015$seven$) $units$ for the bush area and (10121$three$) $units$ for the well.

Task

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

ITEM 16

A baker charges shs.4, 500 for a cake that uses x kg of flour and y kg of sugar, and his cost function is

$C = 1{,}200x + 1{,}000y + 2{,}000$ (Labour & overhead). If on a particular cake he wants a profit margin of 20% and uses 2.5kg of flour,

Task

1. Determine the required sugar y so that his asking price is met.
2. Explain practical constraints if sugar quantity seems unrealistic.

ITEM 17

A shopkeeper offers a "buy 3 get 1 free" deal on items that normally sell at shs.2, 500 each. A customer wants to buy at least shs.40, 000 worth of the items at normal price and wants to minimize spending.

Task

1. How many items should he pick?
2. What will be his actual payment?

ITEM 18

A charity organizes a marathon. Entry fees are shs.10, 000 for adults and shs. 5, 000 for students. The event raised shs.2, 150,000 from 300 entrants; part of the proceeds (shs.250, 000) were used for logistics.

Task

1. How many of the entrants were students and adults?
2. Compute the net income per entrant after expenses.

ITEM 19

A farmer wants to subdivide a rectangular field into plots for maize and beans in the ratio 5:3 by area. The total area is 3.2 hectares. He will sell maize plots at shs.120, 000 per 0.1 ha and beans at shs90, 000 per 0.1 ha.

Task

1. Determine the area for each crop.
2. Determine the number of 0.1 ha units allocated and expected revenue from each crop.

ITEM 20

Five girls whose homes when marked on a grid make a trapezium, wanted to buy clothes. They realized that if they buy them in a bunch, it will be cheaper. So they mobilized themselves and each person contributed as follows:

Girl 1: Contributed one hundred thirty-three thousand two hundred fifty shillings.

Girl 2: Contributed 20% more than that of girl 1.

Girl 3: Contributed 1 1 2 of the amount girl 1 contributed.

Girl 4: Contributed a fraction that is 1 5 less than the fraction of girl 3.

Girl 5: She contributed the balance required to make the Shs.800, 000 required.

Task

1. What amount did each girl contribute?
2. In which other way could they contribute the amount required fairly and according to that way, how much would each contribute?

ITEM 21

The school plans to hold a Parents meeting and it expects 1000 parents. It plans to hire tents of capacity 50 seats, they are to serve soda, a boiled egg and a piece of chicken. A tent is hired at sh. 100,000, a crate of soda

has 24 bottles and costs sh.20, 000, a tray of eggs consists of 30 eggs, each tray is at sh. 10,000, a chicken consists of 6 pieces, and each chicken costs sh.10, 000.

Task

1. As a senior four student, using knowledge of number bases, help the school come up with a budget flame work for the event.

ITEM 22

A couple wants to celebrate their anniversary. The wife promises to buy things worth 1.5million. And the husband promises to buy things that will cost an amount that is two quarters more than that of the wife. One of the older children promises to buy all the drinks on the budget which where, 3crates of soda each containing 24 bottles and 6 cartons of water each containing 6 bottles. To reach the venue, the couple planned to move 20km east from their home and then 30km north. However, the son plans to take the direct route from the parent's home to the venue.

Task

1. How much will the husband contribute?
2. If the total amount on the budget was two million three hundred forty-six thousand, how much did the son contribute for soda and water?
3. How many guests would you advise the couple to invite and why?
4. What distance will the son travel?

ITEM 23

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

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

Task

1. Which number system do you think he used to re-write the pin and why?
2. Use the identified number system to help your family members to regenerate the original pin.
3. At what time did will both the nurse and medical doctor check on him again at the same time?
4. How many hours of the day in a week does he spend on visiting the hospital.

ITEM 24

At Juma's enterprise, a company that makes books. A machine produces the least number of books per turn, which enable packing in boxes in equal numbers of 24, 30 and 32 without any book being left out. On a given day, a school made an order of 1440 books. Juma had UGX.750, 000 on his account and he wanted to buy a

Washing Machine. He went at the shop and the price of the machine was UGX.960, 000. He went home and waited. One month later, the price was decreased by 15% and then 9% in the second month.

Task

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

ITEM 25

Omar went to the hospital and he was given a certain number of tablets of Panadol, Paracetamal and Piroxicam to take starting from the morning. He took his first doze in the morning and given more tablets equal to those he had remained with in order to complete a dozen of 20 tablets.

Tablet	Dosage
Panadol	2 x 3
Paracetamal	3 x 2
Piroxicam	2 x 2

Task

1. Identify the number of tablets Omar took in the first doze.
2. If t represents the number of tablets he was given first, form an equation representing the above information hence find t.

ITEM 26

Anna bought three bags of beans, rice and posho weighing 144kg, 90kg, and 54kg respectively. She wishes to repackage in smaller bags of equal weight.

Anna, Betty and Mabel shared out money. Anna received $\frac{3}{5}$ of the money, Betty received $\frac{1}{6}$ of the remainder and Mabel received shs 36500 which was the actual amount of money that remained after Anita and Betty had received their shares.

Task

1. Help Anna find out the highest weight of the smaller packs she can use without leaving any food stuffs in the big bags.
2. Find how much money each received and also the total money that was shared among the three.

ITEM 27

The caterer of a school located in Mubende is required to buy food stuffs for a party. The foodstuffs to be bought include: 100 kg of rice, 150kg of meat and 200kg of Irish potatoes. The cost is UGX 4000, UGX18, 000, and UGX1, 500 per kg of rice, meat and Irish potatoes respectively in Dungu market. The same items cost UGX. 2500, UGX. 14,000 and UGX. 1,200 per kg of rice, meat and Irish potatoes respectively, in Moya market. To hire

a pick-up from Kyaliwajara market to school costs UGX 50,000 while a pick-up hire from Moya's market is UGX100, 000.

Task

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

ITEM 28

You went to the gym on 1st February 2026 with Shs.100, 000 with hope to come back with some balance of not below UGX.50, 000 to cater for home expenses. Reaching their, you met a new friend. She tells you that she comes every 4days and you come every 6 days. You ask her how much she pays so that you compare with yours and she says "I paid a member ship fee and now I only pay UGX. 30,000 a month which caters for all days I choose to come". However, when it comes to you, you pay UGX.10, 000 each day you visit the gym. And you visit the gym 5 days a month. After the gym you decide to hang out for a cup of coffee and a PIZZA and each of you had to pay UGX45, 500. Later your friend got an emergency call and left before you exchanged contacts.

Task

1. What are the fewest number of days you will have to wait for, to meet your friend again?
2. Using the number of days, mark the exact date on the calendar.
3. How much do you spend on the gym a month?
4. Comparing with how much your friend pays, what can you do and why?
5. How much did you spend that day?
6. On the money you came with, how much balance did you take back home?
7. Will you be able to cater for all home expenses? Explain why you say so.

ITEM 29

John plans to visit the shop that is 12km south of his home and then the boutique that is 5km east of his shop and after drive back home using a direct route from the boutique to home. He is to use his motorcycle that consumes 0.035liters of fuel per km and he wants to know how much fuel he will need for the whole journey. He has seven hundred fifty thousand Uganda shilling. He plans to use part in the shop and part in the boutique in the ratio of 3:2 respectively. He wants to spend UGX. 210, 000 to buy shirts and UGX.120, 000 to buy trousers. However he is not sure if his budget for the boutique will be enough. From the shop, he is to buy 24 packets of cooking oil, 12 packets of sugar and 30 packets of salt. All of these are to be used to make packages for some of his family members in the village. He wants each package to have an equal number of items in it. He needs to know the highest numbers of packages he can make from them.

Task

1. How much fuel will he need for the whole journey?
2. Will the money he plans to use in the boutique be enough for what he plans to buy? Justify your answer
3. How many packages will he make from the items he plans to buy?

ITEM 30

You decided to have a joint graduation party with your sibling. This is to cost you a total of UGX.4, 000,000. You are nearing the D-day and want to find out whether you have the amount required or not. So you decided to

revise your contributions below: Your parents contributed 12.5% of the money. Your sibling contributed 12.5% more than your parents and since you were the eldest, you contributed 2 1. 2% of the amount your sibling contributed.

Task

1. Do you have the required amount for the party or should you postpone it?

ITEM 31

You are planning a trip to visit a historic site that is 30 kilometers away from your current location. The trip will take approximately 1.75 hours by car. The speed limit on the road is 80 kilometers per hour, and the site charges an admission fee of UGX 25,000. The museum offers a 40% discount on admission fees for students with disabilities. When you arrive, you notice that the site displays some information in binary. The binary number 100101 represents the number of years since the site was established. You also notice that the site displays the current temperature in Celsius using binary number system and the temperature is 10010.11,

Task

1. What is the approximate percentage of the speed limit that you will be traveling at during the trip?
2. If you have UGX 100,000 in cash, what fraction of the admission fee will you have left after paying?
3. What is the number of years since the site was established in base 10?
4. Express the temperature of the site using the decimal base system?
5. If you have a friend who qualifies for the discount, what amount would he pay as admission fees?

ITEM 32

A parent invests shs.1, 200,000 in two accounts: one at simple interest 5% per annum and the other at 9% per annum. After 2 years, she receives shs.180, 000 interest total.

Task

1. How much was invested in each account?
2. Compare if she had invested everything at compound interest annually at 7%.
3. What would be the amount after 2 years?

ITEM 33

You are planning to remodel the flooring in your kitchen. You have already measured the dimensions of the kitchen and found that it is a rectangular space with a length of 12 feet and a width of 9 feet. As you browse through different flooring options, you come across a display that shows the following pattern of square tiles: 1 tile, 4 tiles, 9 tiles, 16 tiles, 25 tiles...

The display also shows the equations of various linear and quadratic functions. The display shows the equation of a straight line that represents the cost per square foot of a certain type of flooring.

The line passes through the points (2, 4.50) and (4, 9.00).

Tasks

1. Describe the pattern in the sequence of square tiles displayed. Determine the rule that generates the next number of tiles in the sequence.

2. Write an equation that represents the nth term of the sequence, where n represents the number of square tiles.
3. Find the slope of the line and write a mathematical statement of the line in slope intercept form.

ITEM 34

Tickets to a play at National Theater cost UGX 120,000 for students, UGX 18,000 for adults and she's. 15,000 for senior citizens. At Friday night's performance, there were 120 students, 150 adults and 38 senior citizens in attendance. At Saturday night's performance, there were 182 students, 224 adults and 64 senior citizens in attendance.

Task

1. Organize the information using matrices for attendance and ticket prices.
2. Use matrix multiplication to find the income from ticket sales for Friday and Saturday night's performances.

ITEM 35

Aisha saves money each week. In week 1, she saves $5. In week 2, she saves $8. In week 3, she saves $11. She continues this pattern.

Task

1. Write down the next two terms in the sequence.
2. Find an expression for the amount she saves in week n.
3. How much will she save in week 10?
4. In which week will she save $50?

ITEM 36

At Karl's company, a machine produces the least number of books per turn, which enable packing in boxes in equal numbers of 24, 30 and 32 without any book being left out. On a given day, a school made an order of 1440 books.

Task

1. Determine the least number of turns the machine has to make in order to supply the school.

ITEM 37

Mutebi had UGX.750, 000 on his account and he wanted to buy a Washing Machine. He went at the shop and the price of the machine was UGX.960, 000. He went home and waited. One month later, the price was decreased by 15% and then 9% in the second month.

Task

1. Was Mutebi able to buy the Machine after the decreases? If yes, was he able to remain with any balance?

ITEM 38

Kevin's goal is to find a job that provides an income of at least 40 million a year. A glass mart company offers her a job paying a basic salary of 12 million a year plus a commission of 6% of her sales.

Task

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

ITEM 39

The small individual farmers in a certain village are being cheated by the traders from towns by offering them low prices for their produce. These farmers decided to form groups and sell their produce through them at better prices. So far, they have two groups, Kamukamu and Tweziimbe. In the current season, they are selling milk, maize grain and beans. Last month, Kamukamu group had sales of 2,520 litres of milk, 35 bags of maize grain and 10 bags beans. Meanwhile the Tweziimbe group had sales of 2,314 litres of milk, 41 bags of maize and 9 bags of beans. This month, the Kamukamu group had sales of 3,254 litres of milk, 42 bags of maize and 8 bags of beans while the Tweziimbe group managed to sell 2,719 litres of milk, 32 bags of maize and 11 bags of beans. The price for 1litre of milk, 1kg of maize and 1kg of beans is UGX. 700, UGX.1, 000 and UGX.3, 500 respectively. A bag of maize and beans is estimated to have 120kg each.

Task

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

ITEM 40

On a certain village of 40 families, it was found out that 12 families keep a dog (D), 18 families keep a cat(C), 10 families keep a hen (H), 5 families keep D and, 7 keep C and H and 4 keep D and H. 3 families keep neither of the three dogs, cats or hens. This data was collected by learners, by use of a Venn – diagram, help them to find the number of families that keep all the three animals and birds. If you are tasked to share 1600kgs of feeds to families depending on the number of how much animals in that group,

Task

1. Show each section on the Venn – diagram will get.

ITEM 41

A census enumerator has been sent to count people in your village. He has been given an I-pad that is fully charged for the exercise. Unfortunately, there is a small note of the PIN to help you access the software for the exercise. The note indicates that the pin number is a two digit number in base ten. This number is equal to five times the sum of the digit. It is also nine less than the number formed by interchanging the digits. The enumerator comes to your home and seeks assistance to help him find the PIN for the I-pad. The census in Uganda is held every after 10 years. It was last held in 2014 and then previously 2004. The census in 2024 has revealed that there are 14,400, people in your village. This has increased by 60% as revealed by the census in 2014 having been previously increased by 80% earlier in 2004. The enumerator claims for transport refund every after four days, for the 4-day journey made in the exercise. He travels a certain amount on the first day, then half of that on the second day, third of that the third day and finally a quarter of that on the fourth day. The enumerator travelled a total distance of 50km during the four-day exercise. Each kilometer travelled is paid UGX28, 000.

Task

1. Help the enumerator encrypt the PIN.
2. How many people were in the village in 2004?

3. How much did she receive on each day?

ITEM 42

You are planning a party at your house and need to purchase supplies. You've made a list of the items you need, including cups, plates, and napkins. You're also to hire one tent at UGX 100,000 and a chair for each guest at 500 @. At the local party supply store, you notice that a package of 24 glasses costs UGX 192,000, a package of 20 plates costs UGX 260,000, and a package of 50 napkins costs UGX 10,500. Each guest is supposed to be served with one glass, one plate and two napkins. Earlier before the D-day for the party, you tasked your friend to come up with a mathematical statement that represents the relationship between the number of guests (x) and the number of chefs (z) required for the party. He came up with the equation y = 0.1z.

Task

1. How much will the store attendant charge a person who buys 65 glasses, 44 plates, and 120 napkins?
2. If you are expecting 200 guests at the party, what is going to be the total budget for the party including all the available expenses?
3. Write a mathematical statement that represents the relationship between the total expenditure (y) for any given number of guests (x).
4. Find the number of chefs needed for 200 guests.
5. The store offers a 15% discount on the total cost of the supplies if you purchase more than UGX 5 million worth of items.
6. Do you qualify for the discount if you purchase items enough to be supplied to the 200 guests?
7. If yes, what would the new total cost be after the discount is applied?

ITEM 43

Mr. Karim the head of mathematics department organized a mathematics study trip to Namanve where assembling of Toyota vehicle and manufacturing of Coca-Cola products are done, and in his report to the members of mathematics department shows the cost of hiring a school bus is constant for any a bus and other varies as the distance covered by the bus. He later reviled that if a bus covers 100km then charged kshs.4500 and kshs.4000 for a distance of 60km. The distance between the school and Namanve is 480km and they expected to live the school at 8:00am at an average speed of 100 /h according to the school's study trip rules and procedures and after the trip they students would rest for forty-five minutes and then proceed back to school.

Task

1. As the treasure of the mathematics department help Mr. Karim to know total expenses for the total journey.
2. By representing the journeys on a suitable graph explain the motion of the bus to the bus to the school administrators.

ITEM 44

A micro-entrepreneur runs a phone-bundle business. She buys bundles in packages of 5 GB and 10 GB priced at Shs 1,800 and Shs 3,400 respectively. She sells data by the GB at a uniform retail price P per GB, rounding up partial GBs sold. On one busy day she sold an unknown number of customers many of whom purchased partial GBs summing to 385.4 GB total retail; after rounding-up policy the provider's router shows 392 GB sold. Her stock before start of day was 120 × 5 GB packs and 80 × 10 GB packs. After day's sales she has 100 × 5 GB packs

and 60 × 10 GB packs remaining. She pays a fixed daily rent Shs 4,000 and wants a net profit of at least Shs 60,000 that day.

Task

1. Using algebra, compute the GB supplied from stock and reconcile with router reading; show how many GB were actually sold.
2. Find the retail price per GB P required to meet the profit target (assume cost is proportional to pack prices and ignore VAT).
3. If the seller decides to introduce a loyalty discount of 10% for customers buying ≥ 10 GB in one purchase, model its effect on P to maintain the same profit.
4. Recommend a bookkeeping trick for tracking fractional GB sales.

ITEM 45

A contractor is quoting for tiling a rectangular courtyard. The courtyard measures $(x + 8)$ m by $(2x - 4)$ m, and the contractor will leave a square ornamental patch of side $(x - 2)$ m in the Centre un-tiled. The tiles are sold in boxes each covering 1.44 m². Each box costs Shs 24,000 and the contractor must add 6% for wastage. The client requires the contractor to propose two price options: (i) labour included as a single lump Shs L, (ii) labour charged as Shs 1,800 per 10 m². The contractor estimates L from experience as Shs 150,000.

Task

1. Write expressions for courtyard area, square patch area and the net tiled area in terms of x.
2. If tile boxes must be whole numbers and the quoted price with lump labour is Shs 1,200,000, solve for x.
3. Compute the number of boxes needed and the alternative price using per-area labour.
4. Discuss sensitivity to changes in x and how to present options to client.

ITEM 46

A farmer mixes two brands of fertilizer to get a blend for a field. Brand P comes in 50 kg bags costing Shs 48,000 per bag and Brand Q in 25 kg bags costing Shs 26,000 per bag. The farmer needs exactly 1,350 kg of blend which must have a nutrient ratio that makes the sale price Shs 42,000 per 50 kg bag. He knows that when he uses twice as many kg of Q as P, his overall profit margin (profit/cost) is 18% at that selling price. The supplier offers a bulk rebate R shs per 50 kg bag of P if more than 10 bags are ordered.

Task

1. Let p and q be numbers of 50 kg-equivalent bags of P and Q (express Q in 50 kg equivalents). Write the mass equation and the profit equation algebraically.
2. Solve for p and q under the "twice as many kg of Q" condition.
3. If rebate R = Shs 2,400 per 50 kg P bag applies, re-compute the profit margin.
4. Discuss practical rounding and packaging constraints when buying whole bags.

ITEM 47

A community water committee installs two water pumps to fill a new storage tank. Pump A alone takes 9 hours to fill the tank; Pump B alone takes 14 hours. Due to power constraints they agree to run Pump A for x hours each day and Pump B for ($x + 1$) hours each day until the tank is full. On day 2 they had run only Pump A for an additional 2 hours because pump B was under maintenance, and the tank was completed 1 day earlier than

the planned schedule. The committee paid the operator Shs 30,000 per day and agreed to share labor cost proportional to total pump-running hours.

Task

1. Form an equation for the fraction of the tank filled per day in terms of x.
2. Determine x and the planned total number of days before the maintenance delay.
3. Calculate how the operator's pay should be split between the days before and after maintenance if the operator worked every day.
4. Explain what happens to x if pump A's rate improves by 10%.

ITEM 48

A small bakery produces three sizes of loaves: small, medium, and large. Weekly sales data show medium loaves sell at 1.5 times the number of small loaves; large loaves sell at half the number of medium loaves. The daily flour usage is 180 kg and each small loaf uses 0.5 kg flour, medium 0.9 kg and large 1.6 kg. The baker's profit per loaf is Shs 200 (small), Shs 350 (medium), and Shs 600 (large). The bakery runs 6 days a week and wants weekly flour cost (Shs per kg provided by you) to stay under a budget so they may adjust production by proportionally scaling the numbers.

Task

1. Form simultaneous equations linking loaf counts and flour usage for one week.
2. Determine weekly counts of each loaf type.
3. Compute weekly profit and average profit per kg of flour.
4. If flour price increases 20%, find the proportional scaling factor to keep weekly flour spend unchanged and show new weekly profit.

ITEM 49

The fundraising committee at Ntare School is organizing a cultural gala to raise money for a new science laboratory. They are selling two types of tickets: regular tickets for students and VIP tickets for parents and guests. On the first day of sales, they sold 45 student tickets and 20 VIP tickets, collecting a total of Uganda Shillings (UGX) 570,000. On the second day, they sold 30 student tickets and 25 VIP tickets, collecting UGX 495,000. The committee needs to determine the price of each ticket type to report their financial projections to the head teacher.

Task

1. Let the price of a student ticket be x and a VIP ticket be y. Form two equations to represent the ticket sales for the two days.
2. Solve the simultaneous equations to find the price of one student ticket and one VIP ticket.
3. If 100 student tickets and 50 VIP tickets are sold on the final day, calculate the total revenue for that day.

ITEM 50

The committee's goal is to raise UGX 2,500,000. After the three days of sales, they have raised UGX 1,950,000. Form an equation to find how many more VIP tickets at the price found in (b) must be sold to reach their goal, assuming no more student tickets are sold.

As part of a school agricultural project at Mount St. Mary's College, students are cultivating a rectangular plot of land to grow maize and beans. The length of the plot is 15 meters more than its width. To fence the entire plot, the students need 150 meters of fencing wire. They must calculate the dimensions of the plot to buy the right amount of seeds and fertilizer. Later, they plan to divide the plot diagonally into two sections for different crops.

Task

1. Let the width of the plot be w meters. Express the length in terms of w.
2. Form an equation for the perimeter of the plot and solve it to find the width and length.
3. Calculate the area of the entire plot in square meters.
4. If they want to put a fence along one diagonal of the plot, use Pythagoras' theorem to form an equation and calculate the length of the diagonal, correct to one decimal place.

ITEM 51

The canteen at St. Joseph's SSS is preparing lunch for students. The cook knows that a recipe for beans requires three times as much water as the quantity of beans. For a large batch, the total volume of beans and water combined is 80 liters. The beans expand when cooked, but for planning, they use the dry measurements. The canteen budget allows for 2,000 packets of juice. They have already bought 1,250 packets.

Task

1. Let the quantity of dry beans be b liters. Write an expression for the amount of water needed.
2. Form an equation for the total volume of the mixture and solve for b and the amount of water.
3. The remaining budget for juice is for x packets. Write an equation to represent the total packets and find how many more packets can be bought.
4. If each packet of juice costs UGX 1,500, form an expression for the total cost of the remaining packets.

ITEM 52

The Debating Society of Reals High school wants to hire a bus for a trip to Lubaga. They contacted two transport companies. Company A charges a fixed fee of UGX 200,000 plus UGX 5,000 per kilometer traveled. Company B charges a fixed fee of UGX 150,000 plus UGX 6,000 per kilometer traveled. The society needs to decide which company is cheaper depending on the total distance of the trip. They estimate the round trip to Lubaga is 180 km.

Task

1. Let d represent the distance in kilometers. Write expressions for the total cost from Company A and Company B.
2. Form an equation to find the distance for which both companies charge the same amount. Solve this equation.
3. For the estimated distance of 180 km, which company is cheaper and by how much?
4. If the society has a maximum budget of UGX 800,000, form an inequality for Company B's charges and find the maximum distance they can travel with this company.

ITEM 53

The librarian at Gunjan High School is organizing books on two shelves. Currently, the top shelf contains 5 times as many books as the bottom shelf. To balance the shelves, the librarian moves 12 books from the top shelf to

the bottom shelf. After moving them, both shelves have the same number of books. The librarian needs to know the original number of books on each shelf for inventory purposes.

Task

1. Let the original number of books on the bottom shelf be b. Express the original number of books on the top shelf in terms of b.
2. After moving the books, write expressions for the new number of books on each shelf.
3. Form an equation based on the fact that the shelves are now equal, and solve it to find the original number of books on each shelf.
4. Calculate the total number of books in the library (from these two shelves).

ITEM54

At the UNEB O'Level Mathematics contest, students were given a set of problems. There were two types of problems: multiple-choice and essay. The contest had a total of 30 problems. It was worth a total of 100 marks. Each multiple-choice question was worth 2 marks, and each essay question was worth 5 marks. A student from Trinity College Nabbingo correctly answered all the multiple-choice questions but only half of the essay questions.

Task

1. Let m be the number of multiple-choice questions and e the number of essay questions. Form two equations to represent the total number of questions and the total marks available.
2. Solve the equations to find the number of each type of question.
3. Calculate the total marks obtained by the student from Trinity College.
4. If another student scored 82 marks, form an equation in x and y to represent this, where x and y are the number of multiple-choice and essay questions they got right, respectively. Can this equation be solved uniquely? Explain why or why not.

ITEM 55

Kibuli SSS has a beautiful rectangular flower garden measuring 12 meters by 8 meters. The school wants to construct a concrete pathway of uniform width around the garden for visitors to walk on. The total area of the garden and the pathway combined will be 192 square meters. The prefects need to calculate the width of the pathway to buy the necessary materials.

Task

1. If the width of the pathway is x meters, draw a rough sketch and write expressions for the total length and total width of the garden plus pathway.
2. Form an equation for the total area and show that it simplifies to $4x^2 + 40x - 96 = 0$.
3. Solve this quadratic equation by factorization or the quadratic formula.
4. Which value of x is the correct width of the path? Give a reason for your answer.

ITEM 56

During a math club meeting at Seeta High School, the patron gives the students a puzzle. He tells them that there are two numbers. The sum of these two numbers is 28, and the sum of their squares is 394. He challenges them to find the numbers. The club president decides to use his algebra skills to solve it.

Task

1. Let the two numbers be a and b. Write two equations based on the information given.
2. Express a in terms of b from the first equation.
3. By substituting this into the second equation, form a quadratic equation in terms of b.
4. Solve the quadratic equation to find the two possible values for b, and hence find the corresponding values for a. Identify the two numbers.

ITEM 57

The entrepreneurship class at Namasagali College is making and selling crafts. They initially made 200 crafts and sold them at a profit. They find that if they increase the production by x items per week, the profit per item decreases by x shillings. Initially, their profit per item was UGX 2,000. Their total weekly profit, P, is modeled by the equation $P = (200 + x)(2000 - x)$.

Task

1. Expand the brackets to write the profit function in the form $P = ax^2 + bx + c$.
2. The students want to know the maximum profit possible. Find the value of x that maximizes the profit. (Hint: For a quadratic $ax^2 + bx + c$, the maximum occurs at $x = -\frac{b}{2a}$.
3. Calculate the maximum weekly profit.
4. Form an equation to find how many extra items x they must make to achieve a profit of exactly UGX 390,000. Solve for x.

ITEM 58

In a physics practical at St. Mary's College Kibuli, students are studying the motion of a ball thrown upwards. They find that the height, h meters, of the ball after t seconds is given by the formula $h = 20t - 5t^2$. they need to analyze the motion of the ball.

Task

1. What is the height of the ball after 1 second? After 3 seconds?
2. Form an equation to find the time t when the ball returns to the ground (i.e., h = 0). Solve this equation.
3. What do the two solutions for t from part (b) represent in the context of the ball's motion?
4. Form another equation to find the times when the ball is at a height of 15 meters. Solve the equation and explain why there are two possible answers.

ITEM 59

A cylindrical water tank at a school in Mbarara has a height of 4 meters. The volume of the tank is given by the formula $V = \pi r^2 h$, where r is the radius. The school needs to replace the tank, and a supplier quotes a price based on the surface area. The volume of the tank is 78.54m^3 (use $\pi = 3.14$).

Task

1. Substitute the values of V, h, and π into the formula to form an equation for r^2.
2. Solve this equation to find the radius r of the tank.

3. The surface area of the cylindrical part (excluding the top and bottom) is $2\pi rh$. Calculate this surface area.
4. If paint costs UGX 5,000 per square meter, form an expression for the total cost of painting the cylindrical part and calculate the cost.

ITEM 60

At a family gathering in Kabila, a grandmother is talking about her age and the age of her grandson. She says, "In 20 years, I will be twice as old as my grandson." The grandson, a clever O-Level student, replies, "But Grandmother, five years ago, you were three times as old as I was." The family is amused and challenges the grandson to find their current ages.

Task

1. Let the grandmother's current age be G and the grandson's current age be S. Write an equation based on the grandmother's statement about their ages in 20 years.
2. Write another equation based on the grandson's statement about their ages 5 years ago.
3. Solve these two simultaneous equations to find their current ages.
4. In how many more years will the ratio of the grandmother's age to the grandson's age be 2:1? (Form an equation and solve).

GEOMETRY AND MENSURATION

ITEM 1

A school wants to build a circular running track around an existing rectangular field measuring 90m by 60m. The track will be a uniform width w and its outer boundary will be a rectangle with rounded corners (i.e. the track consists of four straight strips and four quarter-circles at corners).

Task

1. Design the track so the running distance around the inner rectangle is 400m.
2. Determine the width w, the total area occupied by the track, and the cost to turf the track at shs.12, 000 per m^2.

ITEM 2

A conical grain silo has a cylindrical body of height 10m and radius 3m topped by a cone of height 2.5m. The owner plans to line the inside with a waterproof layer of thickness negligible but wants to paint the insides (excluding the floor).

Task

1. Calculate the total area to paint.
2. Calculate the volume of grain held if filled 90%.
3. If paint costs shs.18, 000 per liter and each liter covers $12m^2$, estimate paint cost.

ITEM 3

A triangular plot with sides 85m, 132m and 157m is to be divided into three smaller plots by building two fences from one vertex to points on the opposite side so that the three resulting triangles have areas in ratio 2:3:5.

Task

1. Determine the positions on the opposite side where the fences should meet. Give the construction approach and numerical answers.

ITEM 4

A rectangular swimming pool is 25m long and 10m wide. Its slopes uniformly from depth 0.5m at shallow end to 2.5m at deep end. The pool is to be filled and then drained for maintenance.

Task

1. Calculate the volume of water in cubic meters.
2. Calculate the surface area to be tiled, and the number of 0.5m x 0.5m tiles required if 3% extra tiles are bought for breakage.

ITEM 5

A garden path in the shape of a quarter circle has inner radius 4m and outer radius 6m. The inner edge is along two perpendicular fences.

Task

1. Calculate the area of the path.
2. Calculate the length of the outer edge, and the length of paving stones needed if stones are laid along the outer edge at 0.5m per stone.

ITEM 6

A triangular prism is used as a planter. Its triangular cross-section is an isosceles triangle with equal sides 8m and base 6m; the planter length is 2.5m.

Task

1. Compute the cross-sectional area, total volume, mass of soil needed (soil density 1,200kg/m^3) and cost if soil is shs.40, 000 per tonne.

ITEM 7

You work in an art and design shop. You print different objects on clothes as requested by your customers. A customer comes and requests you to print triangles, circles and squares on his cloth following a particular pattern that will make the cloth beautiful. However, he first gives you a piece of paper that is 12cm in length and 8cm in width to illustrate how you plan to arrange the shapes on the cloth. As you are still talking to the customer, someone calls you requesting you to compute something, so you request the customer to assist you with his phone calculator and on opening it you find a figure 455.

Task

1. Show how your illustration will look like.
2. Which input and operation do you think the customer would have put in the calculator to get the figure you found on the screen?

ITEM 8

An architect designs a roof consisting of two identical isosceles triangular gables each with base 8m and sloping sides 6m (forming a ridge at the top).

Task

1. Calculate the roof pitch (angle from horizontal) and the height of the ridge above the base.
2. Calculate the total area of roof tiles required if length of the building is 12m and a 10% overlap is included.

ITEM 9

A triangular island has vertices at coordinates (0, 0), (120, 0) and (0, 80) meters. A lighthouse is to be placed at a point inside the triangle such that it is equidistant from the hypotenuse.

Task

1. Find the coordinates of this point and then compute the minimal length of road from the nearest shore at (0, 0) to the lighthouse.

ITEM 10

Jordan is a businessman who deals in purchase and sales of mattresses. He is constructing a ware house where he is to store the mattresses. The floor of the ware house has its width shorter than its length by 20m and the

whole floor occupies an area of $800m^2$. According to the plan the ware house has a ceiling whose height from the floor is a quarter the length of the floor.

Jordan is going to use this ware house to store two types of mattresses he is to purchase; type A and type B. He is going to purchase at most 200 mattresses of type and less than 100 mattresses of type B. Each mattress of type A occupies $20m^3$ and each mattress of type B occupies a volume of $50m^3$. These mattresses are to occupy a total volume of the ware house.

Task

1. Help Jordan to determine the dimensions of the ware house.
2. What will be the volume of the ware house?
3. Write down the mathematical relationships representing the number of each type of mattress Joram is to purchase.
4. Represent the relationship on a rectangular Cartesian plane to show the feasible region.
5. Help Joram to know the number of mattresses of each type that will be stored so that the ware house can have the highest capacity of mattresses.

ITEM 11

You are the CEO of a certain construction company that has been contracted to construct a bridge in a swamp. The map of the area covered by the swamp has a scale reading 1:250,000. On this map, the swamp is of area $7.36m^2$. According to the plan, you will use either a bull dozer vehicle if the actual area of the swamp is less than $40km^2$or an excavator vehicle if the actual area of the swamp is greater than $50km^2$.

If you are to use a bull dozer, 25 operators will be needed each being paid ugx 65,000 per day and if you are to use an excavator, 14 operators will be needed each being paid ugx 125,000 per day. The company has been given 50 million shillings to do the work in only two weeks. After paying the operators` expenses, the balance is to be used in: 40% as your pay, 18% to go to maintenance and repair of the vehicles and the remaining amount to the director.

Task

1. Calculate the actual area of the swamp.
2. Which type of vehicle are you going to use?
3. How much money will be paid to the operators for the duration you will construct the bridge?
4. What's the difference between your payment and director's payment?

ITEM 12

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

Task

1. Where are the homes of the other two boys on the grid?
2. On which coordinate will they meet?

ITEM 13

You moved 5km from your class while walking in the northwest direction to the staffroom looking for the teacher. Reaching the staffroom, you were told that the teacher is in the park so you turned in the 1800 direction and moved 6km towards the teacher. Reaching the park, you realized that you had a wrong book! You want to go back to class to get the actual book but using a different pathway since the school has many pathways.

Task

1. Accurately illustrate how you moved from the class to the teacher in the beginning.
2. From your illustration, which other path way will you take to return to class?
3. On which bearing will you turn for you to take that pathway?
4. How far is the park from the class using that path way?
5. In comparison to the first distance you moved, is it wise to choose that pathway? Give a reason for your answer.

ITEM 14

A circular water tank with diameter 10m is partially filled to a depth of 3.2m. A float sensor is placed 0.3m below the top; it signals when the volume falls below 40% capacity.

Task

1. Determine the current volume, the percentage full and the depth at which the sensor will trigger.

ITEM 15

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

Project	Vale of project	Insurance premium
Poultry	45% of the loan	15% of the project value
Kennel	20% of the loan	5% of the project value
pigeon	¼ of the loan	

Tasks

1. If he used a direct route from home to the village, what course would he take and how far would he move?
2. Of the two routes, which one is shorter?
3. If he travelled at an average speed of 60km/h how much time does he save by travelling along the shorter route? Hint; use a scale of 2cm = 10km where suitable.
4. Using a pigpen as a point of reference, what is the position of the kennel?

5. How long is the kennel from the pigpen?
6. How much in total will he pay back to the bank after the 5 years?
7. Find out the total insurance premium he will pay every year.

ITEM 16

There is a quarantine of all cattle and goats in some parts of Western Uganda especially Mbarara District. The area honorable Member of Parliament (M.P) wants to throw for his constituents a celebration party for the success of the Parish Development Model (PDM) and he has invited a lot of guests. However due t the quarantine he cannot buy any animals from Mbarara and he has been advised to go to Kayunga where cheap cattle and good Yoghurt can be found. He moves from Mbarara to Masaka which is 160 km North of Mbarara. From Masaka he moves west wards 150 km to Kampala. From Kampala he heads to Mukono which is in the direction S75^{o}W which is 90 km from Kampala. From Kampala he heads to Kayunga which is 148 km and south of Mukono.

When he reached Kayunga he bought 400 cows and each costs UGX 850,000 per cow. The farmer and owner of the cow first gives a 5% discount on each cow plus an additional 10% discount for any number of cows bought in excess of 250. In order to package the yoghurt, he bought two identical types of buckets. A smaller bucket with a base radius of 30 cm and a larger bucket with a base radius of 50cm. He intends to use the buckets to keep the Yoghurt for his guests. The capacity of the smaller bucket is 45 litres and he is to buy 4 smaller buckets and 2 larger buckets.

Tasks

1. Direct the honorable MP on the shortest route he should take and the shortest distance between Mbarara and Kayunga.
2. Find the total cost he incurred in purchasing the cows.
3. What is the maximum amount of Yoghurt be bought for his guests.

ITEM 17

A rectangle has length 4 cm more than its width. A square has sides equal to the width of the rectangle. The area of the rectangle is 45 cm² more than the area of the square.

Task

1. Let the width of the rectangle be w cm. Write expressions for:
   - The length of the rectangle
   - The area of the rectangle
   - The area of the square
2. Form an equation and solve it to find w.
3. Find the dimensions of the rectangle.

ITEM 18

Your family is designing a parking lot for day and night parking of motorcycles using the piece of land that has been just been bought in the middle of the city Centre. The land is rectangular in shape with a length of 3m longer than the width and the area of this portion is 108m^{3}. The other portion of the land is a car park that will have only taxi and bus. Taxis are allowed 100m^{2} and buses are allowed 200m^{2} and there is only 500m^{2} of parking space available. Not more than 40 vehicles are allowed at a time. There are always both types of

vehicles and at most 15 taxis are allowed at a time. There are always both types of vehicles and at most 15 taxis are allowed at a time. The parking fee for taxis is UGX5, 000, and that of a bus is UGX8, 000. Each bus carries 78 passengers when full. The bus has a total of 30 seats, some of the seats are for 3 passengers and others are for 2 passengers.

Task

1. Find the dimensions of the portion of the parking space for the motorcycles.
2. How many vehicles of each type should be parked in the parking lot to maximize income?
3. Determine the number of seats for the three passengers and for the two passengers.
4. In your view what precautions should be taken when putting in place the parking lot?

ITEM 19

A community plans a rectangular recreational court with length 48 m and width 30 m. Around the court they will build a uniform paved border of width 3 m. At one corner of the border they reserve a circular seating area of radius 2.5 m whose Centre lies on the corner of the inner court.

The court surface is to be asphalted while the border will be paved with interlocking tiles.

Task

1. Find the total area to be asphalted and the total paved area.
2. Calculate the number of 0.5 m × 0.5 m tiles needed for the border, allowing 5% for cutting and waste.
3. If asphalt costs Shs 120,000 per 100 m² and tiles cost Shs 2,400 each, compute total material cost.
4. Sketch the plan and state assumptions about overlaps and edges.

ITEM 20

A farmer has a circular irrigation pivot of radius 40 m. He decides to partition the irrigated area into three sectors by two radial fences from the Centre to the rim so that the sector areas are in ratio 2:3:4.

The farmer will build a low stone wall along the two radial fences and along the rim between the fence end-points.

Task

1. Find the central angles of each sector in degrees and radians.
2. Compute the lengths of the radial walls and the rim segment lengths.
3. If the stone wall costs Shs 18,000 per metre, estimate the total cost.
4. Discuss how you would lay out the fences on the ground practically.

ITEM 21

A rectangular water tank measures 6.2 m by 4.5 m and is 2.8 m deep. The owner installs an inner concrete lining that reduces internal dimensions by 0.05 m on every side and by 0.06 m in depth.

There is also a circular access manhole of diameter 0.9 m on the top.

Task

1. Find the original internal volume and the lined internal volume in cubic meters.

2. Calculate the volume of concrete needed for the lining assuming a uniform thickness of 0.08 m over the internal surface (ignore the manhole).
3. Determine the percentage loss of usable water volume because of the lining and manhole.
4. Suggest measures to minimize volume loss while ensuring structural strength.

ITEM 22

A triangular plot has vertices A, B, C with AB = 84 m, BC = 65 m and AC = 107 m. The owner wants to fence the plot and plant a hedge along AB and AC only, leaving BC open for access.

Task

1. Verify whether the triangle is obtuse, right-angled, or acute.
2. Compute the area of the triangular plot.
3. Find the length of the perpendicular from B to AC and the distance from B to the in center if the in radius is known to be 12 m.
4. If hedging costs Shs 1,500 per metre and fencing Shs 900 per metre, compute total cost.

ITEM 23

A cylindrical grain silo has external diameter 6 m and height 10 m. It stands on a circular concrete base slab 2.0 m larger in diameter than the silo and 0.25 m thick.

A spiral walkway of uniform width 1 m and slope rising 3 m from bottom to top winds around the silo from ground level to the top.

Task

1. Compute the external surface area of the silo (curved surface only).
2. Find the slab volume and mass of concrete if density is 2,400 kg/m^3.
3. Estimate the length of the spiral walkway and its surface area.
4. Discuss drainage considerations for the slab edge.

ITEM 24

A triangular roof truss consists of an isosceles triangle with base 14 m and equal sides 10 m.

The owner fits rectangular solar panels each 1.6 m × 0.9 m on one slope leaving a margin of 0.8 m at the eaves and 0.5 m at the ridge.

Task

1. Determine the height of the triangle (roof rise) and the slope angle at the eaves.
2. Compute the available slope area for panels on one side after margins.
3. Find how many full panels fit and the leftover unused area.
4. If each panel generates 300 W, estimate total peak power.

ITEM 25

A garden layout is a regular hexagon of side 12 m. Inside it a central circular fountain of radius 3 m is to be placed and six rectangular flower beds surround it, each bed touching two sides of the hexagon and the circle.

Task

1. Compute the area of the hexagon and the area available for beds after placing the fountain.
2. Determine the width of each rectangular bed if their long sides align with the hexagon sides and they all have equal width.
3. If turfing the remaining area costs Shs 2,200 per 10 m², compute the cost.
4. Sketch cross-sections showing dimensions.

ITEM 26

A rectangular classroom measures 9.6 m by 7.2 m.

The teacher wants to install a circular rug centered in the room touching two adjacent walls and a rectangular teacher's desk tangent to the rug and 1.2 m from the opposite wall.

Task

1. Find the radius of the largest possible rug satisfying these constraints.
2. Compute the coordinates of the rug center relative to the room corner.
3. Determine the maximum desk dimensions possible without overlapping the rug.
4. Discuss ergonomic placement and walking space.

ITEM 27

A conical water tank has radius 2.5 m and height 4.8 m. It is to be fitted with a cylindrical float inside that must occupy 10% of the conical volume when the tank is full. The float is a cylinder of height h equal to its diameter.

Task

1. Compute the cone volume and the required float volume.
2. Find the float diameter and height.
3. If the float material displaces 5% extra volume due to support brackets, adjust float dimensions.
4. Explain stability considerations for the float.

ITEM 28

A circular playground has diameter 60 m. The school wants to mark three concentric running lanes: inner lane width 1.2 m, middle lane width 1.5 m, outer lane width 2.0 m.

There is a semicircular seating terrace outside the outer lane matching the circle's outer circumference and 4 m deep.

Task

1. Find the area of each lane.
2. Compute the inner edge lengths (circumferences) for lane start lines.
3. Calculate the volume of soil required to raise the seating terrace by 0.5 m if its top is level with lane edge.
4. Suggest safety measures for lane-to-terrace transitions.

ITEM 29

A rectangular field is to be subdivided into 12 equal smaller rectangles by cutting with parallel strips along the length and width. The whole field measures 120 m by 84 m.

A farmer wants to allocate the 12 plots such that 7 plots are for maize (each to be drained) and 5 for vegetables (each to be irrigated).

Task

1. Determine the dimensions of each small rectangle.
2. For the maize plots compute total perimeter length to be drained and the length of drainage pipe needed if pipe goes around each plot once.
3. For vegetable plots calculate area to be irrigated and number of 20 L/min sprinklers needed if each sprinkler covers 150 m^2 at recommended rate.
4. Propose a layout minimizing pipe length.

ITEM 30

A triangular pond has vertices at coordinates (0,0), (72,0), and (20, 48). The owner wants a uniformly wide path of width w inside the triangle parallel to all sides so the inner triangle has area 60% of original.

Task

1. Compute the area of the original triangle.
2. Determine the scale factor of linear dimensions for the inner triangle and hence find w.
3. Calculate the area of the path and estimate the quantity of gravel needed at 0.05 m depth.
4. Discuss edge conditions near vertices.

ITEM 31

A rectangular plot 50 m by 30 m has a semicircular pond with diameter 12 m located so that the pond's diameter lies along the longer side and the pond is tangent to the short side.

The owner keeps a border path of uniform width around the pond within the plot.

Task

1. Compute the maximum possible width of the path before it touches the short side.
2. If the path is built using paving stones each 0.6 m × 0.4 m, compute the number of stones required for full coverage allowing 7% waste.
3. Calculate how much land remains for planting after the pond and path.
4. Suggest a planting plan for the leftover area.

ITEM 32

A cylindrical oil drum 1.2 m tall and 0.75 m in radius is standing upright. It is to be tilted and rolled so that it moves along a straight line and rests with its axis making 30° with vertical.

Task

1. Determine the height of the highest point of the drum above ground when tilted.
2. Compute the horizontal projection of the drum's footprint along the ground before and after tilting.
3. If the drum contains liquid to 0.9 m depth upright, calculate the new liquid depth along the drum length when tilted.
4. Discuss spillage risk and how baffles might help during tilt transport.

ITEM 33

A regular pentagonal plaza has side 22 m.

1. At the center a circular stage is to be built of radius equal to one-quarter of the circumradius of the pentagon. Around the stage six identical isosceles trapezoidal seating areas are arranged between the stage and the pentagon sides.

Task

1. Compute the circumradius and in radius of the pentagon.
2. Find the stage radius and the area of one trapezoidal seating section.
3. If each seat occupies 0.6 m^2, determine seating capacity.
4. Provide a plan for entrances and wheelchair access.

ITEM 34

A rectangular water channel has width 2.5 m and depth 1.2 m.

The bottom is lined by concrete of thickness 0.15 m and the two sides by concrete thickness 0.10 m. The channel runs 150 m long.

Task

1. Determine the volume of concrete required for the lining.
2. Calculate the internal water-carrying cross-sectional area and total water volume when full.
3. If concrete density is 2,400 kg/m^3, compute total mass of lining.
4. Discuss thermal expansion joints spacing for such a concrete lining.

ITEM 35

A triangular tent panel is an isosceles triangle with base 3.2 m and equal sides 2.4 m.

Twelve panels are stitched together to form a dome.

Task

1. Calculate the area of one panel and total fabric area required, allowing 10% for seams.
2. Compute the angle at the apex of the isosceles triangle.
3. If waterproof coating adds 0.02 mm thickness and fabric density increases by 5%, compute additional mass per panel for a given fabric density.
4. Discuss ventilation openings placement while maintaining structural integrity.

ITEM 36

A farmer needs to build a circular corral to hold 160 sheep, allowing 1.2 m^2 per sheep.

The fence is concentric with a feed trough corridor of width 1.2 m around an inner feeding circle of radius 5 m.

Task

1. Compute the required corral radius and fence circumference.
2. Find the length of trough corridor and area of grazing ring between trough and fence.
3. If fence posts are placed every 2 m and each post costs Shs 4,500, compute total post cost.

4. Suggest drainage placement for heavy rains.

ITEM 37

A gardener carves a rockery made from three stacked regular tetrahedral stone blocks each of edge 1.2 m.

The blocks are stacked such that each sits centered on the one below.

Task

1. Calculate the total external surface area exposed (ignore contact faces).
2. Determine the volume of rock used.
3. If a decorative soil cover of 0.15 m thickness is placed on the top exposed faces, compute soil volume needed.
4. Discuss stability regarding center of mass and slip.

ITEM 38

A circular arena has an inner radius 20 m and outer radius 28 m. The seating is formed by concentric tiers each 1.2 m deep; each spectator needs 0.55 m of linear seat width.

Task

1. Determine how many complete tiers fit between the radii and the capacity per tier.
2. If aisles of width 2 m are placed radially every 20 m on the arc, compute capacity reduction.
3. Find total seated capacity and required exit width assuming 0.5 m per 100 people.
4. Recommend lighting placement for even illumination.

ITEM 39

A rectangular cake 48 cm by 36 cm is to be cut into identical circular cupcakes of diameter 6 cm with minimum waste.

Task

1. Determine the maximum number of cupcakes obtained by optimal packing in rectangular grid.
2. Compute leftover cake area.
3. If frosting consumes 12 g per cupcake and frosting density is 0.8 g/cm³, compute frosting volume needed.
4. Suggest an improved packing if cutter size changes.

ITEM 40

A triangular road sign is equilateral with side 1.8 m and mounted so that its plane is inclined at 15° from vertical for visibility.

Task

1. Compute the area and centroid height above the mounting point for structural fixing.
2. If wind load is 0.6 kN/m² on the sign normal to its plane, compute bending moment at base.
3. Propose bolt spacing and diameter given allowable shear.
4. Discuss corrosion protection for bolts.

ITEM 41

A farmer has a rectangular grain clamp 24 m × 8 m with arched roof in the shape of a semicircle across the width.

The arch height above the top of the clamp wall is 2.5 m.

Task

1. Determine roof internal volume.
2. If grain is stored to 85% of the clamp volume capacity, compute mass stored at bulk density 720 kg/m³.
3. Design a ventilation opening area equal to 1% of roof area and compute required louver sizes.
4. Discuss moisture migration risks.

ITEM 42

A water pipeline passes under a viaduct in a semicircular tunnel of radius 3 m.

The pipe of diameter 0.6 m is laid along the tunnel floor and supported by concrete saddles every 1.5 m.

Task

1. Compute the saddle cross-section contact length along the pipe when viewed in cross-section.
2. Determine the volume of concrete needed for 40 saddles each of thickness 0.15 m and width 0.4 m.
3. If pipe expansion needs 1% length allowance over 200 m, compute expansion gap required.
4. Recommend inspection access spacing.

ITEM 43

A house plan shows a rectangular lounge 7.5 m × 5.2 m with a semicircular bay window of radius 1.6 m on one long side.

The owner wants to carpet the lounge including bay but excluding a rectangular fireplace area 1.2 m × 0.6 m.

Task

1. Compute total carpet area required.
2. If carpet rolls are 4 m wide, compute number and cutting plan to minimize waste.
3. Estimate underlay volume if 8 mm thick.
4. Discuss thermal insulation benefit from bay window glazing area.

ITEM 44

A triangular agricultural terrace cross-section has heights 1.2 m, 1.5 m and base widths 4 m, 3.5 m respectively for two terraces stepped up.

Task

1. Model the combined cross-section area and compute earthworks volume for a 30 m terrace length.
2. If retaining walls are built of masonry 0.3 m thick, compute masonry volume.
3. Suggest drainage weep-hole spacing and compute total number.
4. Comment on seepage and filtration layer thickness.

ITEM 45

A circular water feature consists of three concentric rings: inner pool radius 2.5 m, middle decorative ring width 1.2 m with pebbles, and an outer walkway 2.0 m wide.

Around the pool, 18 bollard lights are equally spaced on the walkway outer edge.

Task

1. Compute areas of pool, pebble ring, and walkway.
2. Find spacing between lights along outer circumference.
3. If pebbles require 0.05 m^3 per m^2 of coverage, compute total pebbles needed.
4. Discuss maintenance considerations for lighting and pebbles.

ITEM 46

A trapezoidal dam cross-section has parallel sides 6 m and 12 m separated by vertical height 8 m.

The dam extends 25 m in length along the river.

Task

1. Compute cross-sectional area and volume of concrete if full length filled.
2. If upstream face requires waterproof membrane covering area equal to longitudinal surface area, compute membrane area.
3. Determine total mass of concrete if density 2,400 kg/m^3.
4. Suggest reinforcement bar length estimate assuming 0.5% of concrete volume.

ITEM 47

A football pitch of dimensions 105 m × 68 m includes a running track around it with inner edge 1.5 m from the pitch boundary and outer edge 3.5 m from the pitch boundary with semicircular ends.

Task

1. Compute area of the track.
2. Determine the length of the inner and outer lane start lines for sprint races.
3. If the track surface requires 0.06 m depth of material, compute volume and mass of material (density 1,800 kg/m^3).
4. Discuss drainage slope required across track width.

ITEM 48

A hexagonal water tank (regular) has side 4.2 m and vertical walls.

To reduce evaporation a floating circular pontoon cover of radius 3.5 m is fitted in the center.

Task

1. Compute tank floor area and water volume at depth 3.0 m.
2. Determine uncovered water area and fraction covered by pontoon.
3. Calculate potential evaporation reduction if covered area reduces evaporation rate by 70% and original evaporation is 6 mm/day.
4. Discuss support and anchoring forces on the pontoon.

ITEM 49

A rectangular swimming pool 25 m × 12 m slopes from depth 1.0 m to 2.6 m uniformly.

A lane of width 2 m along one side is reserved for aqua therapy and has a submerged bench of dimensions 2 m × 0.5 m × 0.4 m at depth 1.2 m.

Task

1. Compute total water volume.
2. Determine volume occupied by the bench and percentage of pool volume it reduces.
3. If tiling costs Shs 3,500 per m² for floor and 2,200 per m² for walls, compute total tiling cost.
4. Suggest step placement to satisfy accessibility codes.

ITEM 50

A triangular garden has sides 24 m, 26 m and 10 m.

The owner wishes to build a circular path of width 1.5 m inside the garden parallel to the boundary so that inner triangle formed is similar to original.

Task

1. Find area of the original triangle and the inner similar triangle if the path area equals 25% of original.
2. Compute path inner offset distance from each side.
3. Determine length of edging required for the path.
4. Recommend planting layout for triangular beds.

ITEM 51

A spherical water storage tank of diameter 8 m sits on a conical support whose apex is truncation so the sphere center is 6 m above ground.

The support cone has its top truncated at diameter 3 m and base diameter 5 m with height 2 m.

Task

1. Compute total volume of water in the sphere.
2. Find volume of conical support.
3. Calculate surface area in contact between sphere and support if contact circle diameter is 3 m.
4. Discuss load distribution and foundation bearing pressure if foundation area is 12 m².

ITEM 52

A house roof requires gutters along two sloping sides of a symmetrical gable roof of span 10 m and rise 2.5 m.

Each gable slope length is $\sqrt{(\ (5)^2\ +\ (2.5)^2\ )}$.

Task

1. Compute each slope length and total gutter length.
2. If gutter capacity must handle 100 mm/hr rainfall over roof area, calculate required gutter cross-section area per side assuming runoff coefficient 0.9.
3. Determine downpipe diameter if maximum velocity allowed is 2 m/s.

4. Suggest leaf-screen design briefly.

ITEM 53

A circular carousel platform of radius 6 m is to be paved with wooden planks radiating from center.

Each plank is 0.12 m wide at inner radius and 0.18 m wide at outer rim, length equals radius.

Task

1. Estimate number of planks needed and area covered.
2. Compute wood volume if plank thickness 0.04 m.
3. If each plank is pre-cut in standard lengths of 3 m, determine waste due to cutting and suggest optimization.
4. Consider drainage gaps spacing.

ITEM 54

A roadway cross-section is an isosceles trapezoid 12 m wide at the top and 6 m at the carriageway with side slopes 1:3 vertical: horizontal to shoulders.

Task

1. Compute trapezoid area and volume of sub-base material for 200 m length.
2. Determine slope angles of the side faces.
3. If road camber is 2%, compute height difference across carriageway.
4. Suggest compaction layers needed and thickness.

ITEM 55

A circular lawn has area equal to the area of an inscribed square plus the area of a ring 1.5 m wide outside the square but within the circle.

The side of the square is 10 m.

Task

1. Compute the radius of the circle.
2. Determine the width of the ring and verify consistency.
3. If edging requires metal borders of 0.05 m length segments, determine number of segments for the ring outer edge.
4. Suggest turf mix for center square and ring differences.

ITEM 56

A rectangular silo with rounded corners (quarter circles of radius 2 m at each corner) has outer dimensions 24 m × 18 m.

The owner wants to pave the area inside with permeable pavers leaving 1.2 m gap from walls.

Task

1. Compute usable paving area after corner rounding and gap.
2. Determine number of pavers of size 0.2 m × 0.1 m required including 6% waste.

3. If drainage cells occupy 10% of paved area, compute remaining paved area.
4. Discuss wheel-load considerations for paving thick

ITEM 57

The Agriculture Club at Kitebi Secondary School has a rectangular garden plot next to the classroom block. The length of the garden is 15 meters longer than its width. The club members measured the width to be 25 meters. They plan to fence the entire garden to keep out stray animals, but they need to leave a 2-metre wide gate on one of the longer sides. They also want to apply a layer of manure evenly across the whole garden. The manure is sold in bags, and each bag can cover 10 square meters of land.

Task

1. Calculate the length and the perimeter of the rectangular garden.
2. Determine the exact length of the fencing wire required, remembering to account for the gate.
3. Find the area of the garden and calculate how many bags of manure the club needs to buy.

ITEM 58

Residents of a small village in central Uganda have constructed a new cylindrical water tank to collect rainwater from a nearby church roof. The tank has an internal diameter of 2 meters and a height of 3 meters. They need to paint the outside curved surface of the tank with a waterproof sealant to prevent rust. A tin of sealant covers 10 square meters. The village chairman also wants to know how much water the tank can hold when full, in litres, to help with water rationing during the dry season. (Use $\pi = 3.14$ and remember $1m^3 = 1000$ litres).

Task

1. Calculate the radius of the tank and the area of the curved surface to be painted.
2. How many tins of sealant are needed, assuming you can only buy whole tins?
3. Calculate the volume of the tank in cubic meters and convert this to litres.

ITEM 59

A homeowner wants to create a circular flower bed in the middle of their lawn. They have bought a decorative edging strip that is 31.4 meters long to go around the border of the flower bed. After creating the circle, they plan to cover the entire flower bed with a layer of special topsoil. A truckload of topsoil covers 20 square meters.

Task

1. Using the length of the edging strip as the circumference, find the radius of the flower bed. (Use $\pi = 3.14$)
2. Calculate the area of the circular flower bed.
3. If the homeowner orders 4 truckloads of topsoil, will it be enough to cover the entire flower bed? Show your working.

ITEM 60

A farmer in Fort Portal owns a piece of land in the shape of a trapezium used for growing maize. The two parallel sides of the farm measure 80 metres and 120 metres. The distance between these two parallel sides

(the perpendicular height) is 50 metres. The farmer wants to estimate his harvest. He knows that on average, one maize plant needs 2 square metres of space to grow well, and each plant will produce one cob of maize.

Task

1. Calculate the total area of the maize farm.
2. What is the maximum number of maize plants the farmer can expect to plant on this farm?
3. If the farmer sells each cob of maize for Ugx 500, calculate his total expected income from a good harvest.

ITEM 61

A surveyor is mapping a piece of land that has a right-angled triangular shape. One of the shorter sides (the base) is 60 metres long. The other shorter side (the height) is 80 metres. The longest side, called the hypotenuse, has not yet been measured. The owner wants to build a fence along the hypotenuse, which costs Ugx 35,000 per metre.

Task

1. Using Pythagoras' theorem, calculate the length of the missing hypotenuse.
2. Find the total perimeter of the triangular plot.
3. Calculate the total cost of building the fence along the hypotenuse only.

ITEM 62

A school's sports field is made up of a rectangle with two semicircles at each end. The rectangular part is 100 metres long and 70 metres wide. The semicircles at the ends have a diameter equal to the width of the rectangle. The grounds maintenance team needs to re-turf the entire field (the rectangle and the two semicircles combined). Grass turf is sold in rolls that cover 1.5 square metres each. They also plan to mark a running lane around the very edge of the whole field, which means they need the total perimeter. (Use $\pi = \frac{22}{7}$).

Task

1. Calculate the area of the rectangular part and the area of the two semicircles (which together make one full circle) to find the total area of the field.
2. Determine the total length of the edge of the field (the perimeter), which will be the running lane.
3. How many rolls of turf are needed to cover the entire field?

ITEM 63

A community hall has a small storage room that is a perfect cube. The floor of the room has an area of 16 square metres. The health inspector has advised that the room needs to be sprayed with disinfectant. The disinfectant is effective if it is used to cover the total surface area of all four walls and the ceiling (the floor does not need spraying). A single can of disinfectant spray covers 12 square metres.

Task

1. What is the length of one side of the cube-shaped room?
2. Calculate the total surface area of the four walls and the ceiling that need to be sprayed.
3. How many cans of disinfectant are required for the job?

ITEM 64

A juice company packs its small juice boxes into a large carton for transport. Each small juice box is a cuboid with a length of 8 cm, a width of 5 cm, and a height of 12 cm. The large carton is also a cuboid with an inside length of 40 cm, a width of 30 cm, and a height of 24 cm. The company wants to maximize the number of small boxes that fit into the large carton.

Task

1. Calculate the volume of one small juice box.
2. Calculate the volume of the large carton.
3. Using the dimensions, determine the maximum number of small juice boxes that can fit into the large carton. (Hint: Think about how many boxes can fit along the length, width, and height of the carton, not just by dividing the volumes).

TRIGONOMETRY

ITEM 1

From the top of a building 64m high, an observer measures the angle of depression to three boats on level water as 18^o, 22^o and 35^o.

Task

1. Calculate the distances of the boats from the base of the building.
2. Determine the area of the triangle formed by joining the three boats (assume straight-line distances).
3. Discuss navigation safety implications if the nearest boat is approaching at 12km/h.

ITEM 2

A communications tower of unknown height stands on a hill whose slope makes an angle of 8^o to the horizontal. From a point 200m away horizontally from the foot of the hill, the angle of elevation to the top of the tower is 14^o. The tower sits on the hilltop which is 24m above the base.

Task

1. Determine the tower height.
2. Calculate the line-of-sight distance from the observation point to the top.

ITEM 3

A ladder leans against a vertical wall and the top reaches a window 9m high when the ladder makes an angle of 70^o with the ground. Later the ladder is moved so that the foot is 1.5m further from the wall and slides down to a height 7.2m.

Task

1. Find the ladder length to the nearest 0.01m and the two angles it made with the ground.
2. Discuss safety margins for ladder use.

ITEM 4

A triangular roof truss has two rafters meeting at the ridge at angle 2Θ. The rafters are each 6m long and the ridge height above the wall plate is 2.5m.

Task

1. Determine Θ.
2. Determine the building width spanned by the rafters.
3. Determine the horizontal projection of each rafter. If insulation requires cutting boards at 30^o to the rafters.
4. Compute the bevel length for one board 1.2m wide.

ITEM 5

A surveyor measures the angle of elevation to the top of a tall tree to be 38^o from a point on level ground. He walks 40m towards the tree and observes the angle as 55^o.

Task

1. Use trigonometry to find the tree height and an original distance from the tree.
2. Estimate the length of the shadow when sun elevation is 25°.

ITEM 6

A drone hovers above a field at a certain altitude and photographs two points A and B that are 300m apart along the ground. The camera records angles of depression 24° and 37° to A and B respectively.

Task

1. Determine the drone altitude and horizontal distance from A.
2. Compute the angle between the lines of sight to A and B as seen from the drone.

ITEM 7

A communications engineer needs to mount a dish such that the main lobe points at an elevation angle of 22° and azimuth 120°. From the roof (6m above ground) she measures a slope;

Task

1. Design the tilt and height adjustments required for an unobstructed line-of-sight over a 4km distance where intervening ground rises at 0.5% gradient.

ITEM 8

An engineer standing on a ramp at (400ft, 300ft). The ramp rises 195 feet over a horizontal distance of 3000 feet to reach the top car parking yard.

Task

1. Determine the equation that would help the engineer know the displacement for any other position on the ramp.

ITEM 9

From point P on level ground the angle of elevation to the top of a tower is 28°.

A surveyor walks 40 m towards the tower to point Q and measures the angle of elevation as 46°.

Using these two observations,

Task

1. Calculate the height of the tower and the original horizontal distance PQ.
2. Show the algebraic setup and any substitution you use.
3. Give your answers correct to two decimal places and state units.
4. Explain why two different angles from two points on the same line are sufficient to determine the height uniquely.
5. Finally, compute the angle of depression from the top of the tower to point Q.
6. State any assumptions you make about ground level and instrument height.

ITEM 10

A ladder rests against a vertical wall reaching a window 10.8 m high when the ladder makes an angle of 72° with the ground. The base of the ladder is then moved 1.8 m further from the wall and the top slides down to 9.6 m above the ground.

Task

1. Find the original length of the ladder and the two angles it made with the ground (original and new), giving answers to two decimal places.
2. Discuss whether the ladder length changes during sliding and why your equations reflect that.
3. State any safety margin you would recommend if the ladder is to be used for working at 10 m height.

ITEM 11

A surveyor stands on a cliff and takes bearings to two buoys at sea. The bearing to buoy A is S 32° E and to buoy B is S 12° E. The horizontal distance between the two buoys measured along the sea is found by another boat to be 420 m.

From the surveyor's point, the horizontal angle between the two lines of sight is therefore known.

Task

1. Using trigonometry, determine the perpendicular distance from the surveyor's point on the cliff to the line joining the two buoys
2. The distances from the surveyor to each buoy.
3. State all steps and diagram assumptions.

ITEM 12

A television mast stands on top of a gentle hill. From a point A on level ground downhill the angle of elevation to the top of the mast is 13°.From a point B 200 m nearer the mast (along the straight line toward the mast) the angle of elevation is 19°. The mast itself is 35 m high.

Task

1. Determine the height of the hill above point A and find the horizontal distance from A to the base of the mast.
2. Show how you separate the mast height from the hill height in your calculation.

ITEM 13

A road climbs a hill at a constant incline making an angle θ to the horizontal. A car travels up 3.2 km along the road and gains a vertical height of 256 m.

Task

1. Determine θ to the nearest minute (use degrees and minutes), and compute the horizontal projection (map distance) of the road to the nearest metre.
2. Next, if the maximum safe road gradient for heavy trucks is 8°, decide whether the road meets the safety standard.
3. Explain the steps and any rounding rules you use.

ITEM 14

A triangular billboard is fixed to a wall so that its base is flush with the ground and one vertex touches the wall 6.5 m above ground. The base of the billboard is 3.2 m from the wall.

Task

1. Using trig, determine the two base angles of the triangle and the length of the sloping edges to two decimal places.
2. Calculate the area of the triangular billboard.
3. Discuss how wind pressure acting horizontally at the centroid might affect the mounting design.

ITEM 15

A telecommunications engineer sets up an antenna of unknown height on level ground. From point X, the measured angle of elevation to the top is 37° and from point Y, 90 m further from X along the same straight line away from the antenna, the angle is 25°.

Task

1. Compute the antenna height and the distance from X to the antenna base.
2. If the engineer must install a guy-wire from the top to a ground anchor 12 m from the base, compute the angle the guy-wire makes with the ground and the wire length.

ITEM 16

A lighthouse stands on a small island. From a point P on a ship the angle of elevation to the light is 7°.The captain sails directly toward the island for 12 minutes at 18 km/h and notes that the angle of elevation becomes 12°.

Task

1. Assuming the ship remains at sea level, calculate the height of the light and the initial distance from P to the island.
2. State any unit conversions and round final answers appropriately.

ITEM 17

A vertical mast on a roof casts a shadow whose length changes during the day. At 9:00 am the shadow measures 13 m when the angle of elevation of the sun is α. At 12:00 noon the angle of elevation is β and the shadow is 6.5 m.

Task

1. Determine the mast height in terms of α and β and compute its numerical value if tan α = 0.6 and tan β = 1.0.
2. Explain why mast height does not depend on the time of day even though shadow length changes.

ITEM 18

A surveyor needs to find the height of a tree on sloping ground. From point A at the lower slope the angle of elevation to the top of the tree is 29°. From point B, 45 m upslope measured along the incline toward the tree, the angle of elevation is 36°.

If the slope angle of the ground between A and B is 6°,

Task

1. Compute the height of the tree and the horizontal distance from A to the tree base.
2. Show the transformation from incline distances to horizontal projections in your working.

ITEM 19

A 30 m ladder is placed against a wall and makes an angle of 60° with the ground. A painter climbs up to a point 10 m from the top along the ladder and drops a tool which falls to the ground.

Task

1. Using trig and geometry, determine how far horizontally from the wall the tool lands (assume no horizontal motion during fall).
2. Provide the vertical height from ground where the tool was released and the time of fall assuming g = 10 m/s².

ITEM 20

A rectangular water tank is placed on a sloped concrete platform. One corner of the tank is 0.6 m higher than the opposite corner along the diagonal. The diagonal length of the tank base is 4.0 m.

Task

1. Compute the angle of tilt of the base and the tilt expressed as a percentage gradient.
2. Describe briefly how this tilt might affect fluid levels and free-surface measurements.

ITEM 21

A road forms part of a detour around a collapsed bridge. The detour consists of two straight segments meeting at point C. From A to C the road is at bearing N 40° E and from C to B it is at bearing N 10° E. The distance AC is 600 m and CB is 450 m.

Task

1. Calculate the straight-line distance AB and the bearing from A to B.
2. Show a clear diagram and justify each trig relation used.

ITEM 22

A radio mast is to be guyed with three symmetric wires attached at 2/3 of its height. If the mast is 90 m tall and the anchors are placed on the ground in a circle of radius 30 m,

Task

1. Find the length of each guy-wire and the angle it makes with the horizontal.
2. If wind loading increases the required tension such that an additional 2 m of horizontal anchor spread is needed, compute the new angle and wire length.
3. Discuss the effect of placing the anchor closer to the mast on wire tension.

ITEM 23

From the top of a cliff 120 m high the angle of depression to a buoy is 8°. Another boy is observed such that the angle of depression to it is 5°, and the two buoys are in the same line of sight from the cliff.

Task

1. Calculate the horizontal distance between the two buoys and the distance from the cliff base to the nearer buoy. Provide answers to three significant figures and explain any approximations.

ITEM 24

A triangular support frame for a sign has base 4.8 m and two equal sloping members meeting at the apex. The apex must be at height 3.6 m above the base.

Task

1. Determine the angle each slope makes with the horizontal and the length of each sloping member.
2. If the frame is set on a ground that falls away at 5° from one end to the other, compute the adjustment in member lengths needed to keep the apex at the same vertical height.

ITEM 25

Engineers are surveying a valley. From point A on one side they measure angles of depression to three distinct points on the valley floor as 3.5°, 4.2°, and 6.0°. The distances along the horizontal from A to the vertical projections of these points are 2,400 m, 1,900 m, and 1,000 m respectively.

Task

1. Compute the vertical depth of the valley at each point and discuss whether the valley profile can be approximated by a quadratic curve.

ITEM 26

A trapezoidal roof has eaves at two different heights: the lower eave at 3.0 m and the higher eave at 5.4 m over a horizontal span of 6.0 m. The roof ridge runs perpendicular to the span.

Task

1. Compute the pitch angle of the roof, the length of each rafter from eave to ridge if the roof overhang adds 0.5 m horizontally, and the projected roof area for a building length of 12 m.
2. State any assumptions and rounding.

ITEM 27

A surveyor uses triangulation to find a mountain peak height. From station P the angle of elevation is 11° and from Q, which is on the same straight baseline 2,500 m closer to the mountain, the angle is 14°.

Task

1. Determine the mountain height above the baseline level and the horizontal distance from P to the mountain base.
2. Discuss sources of error in such measurements and how they can be minimized.

ITEM 28

A wind turbine blade at the top of a tower of height 60 m reaches a maximum elevation of 102 m above ground at the blade tip. When the blade makes an angle of 40° to the horizontal on the upstroke, the tip is observed from a point 80 m from the tower base at an elevation angle of 28°.

Task

1. Using these observations, verify the tower height and calculate the blade length.
2. Explain any inconsistency and how measurement error could influence results.

ITEM 29

A pedestrian walks from point A due east for 300 m, then turns left and walks due north for 400 m to point C. From C he notices a tower at bearing S 60° E.

Task

1. Calculate the straight-line distance from A to the tower and the bearing from A to the tower, assuming the tower lies in the same horizontal plane.
2. Use trig to locate the tower relative to A by solving the triangle formed and state coordinates relative to A.

ITEM 30

An inclined conveyor belt rises at an angle of 18° and carries sacks of grain. Each sack rests on the belt with its center 0.8 m above the belt surface vertically.

If a sack at the lower end is at belt coordinate x = 0 and another sack 15 m along the belt is considered, Task

1. Compute the vertical rise of the belt between the sacks and the change in vertical position of the sack centers.
2. Discuss how the incline affects stacking stability during transport.

ITEM 31

A reservoir overflow pipe runs from the top of a circular tank outward at 12° to the horizontal for 8 m before turning downwards. The tank top is 2.4 m above the surrounding platform.

Task

1. Determine the height above the platform where the pipe turns downwards and the horizontal projection of the pipe.
2. If the pipe must be cut into two lengths for transport (one of 5 m and one of 3 m), compute the angle between the jointed pieces when laid flat.

ITEM 32

A highway engineer designs a sight-line at a bend that requires a clear view of 200 m along the road for stopping visibility. The road cross-falls and camber create an effective eye height of 1.2 m and the object height (tail lamp) is 0.6 m.

Task

1. Determine the minimum angle of elevation from the driver's eye to see the tail lamp at 200 m and conclude whether a barrier of height 0.9 m placed at the roadside would obstruct the sight-line.
2. Provide trigonometric justification and sketch the scenario.

ITEM 33

A tower casts a shadow of length s on level ground. When the sun elevation angle increases by 10°, the shadow length reduces to $\frac{s}{2}$.

Task

1. Find the original sun elevation angle and express it in degrees to one decimal place.
2. Discuss how small errors in measuring shadow length affect computed angles.

ITEM 34

A triangular footbridge spans a ravine with supports at A and B 24 m apart. From a point mid-span the bridge deck makes angles of elevation 12° and 15° to the tops of two pylons.

Task

1. Find the heights of the pylons relative to the deck and the difference in their heights.
2. If the deck sags by 0.15 m at mid-span under load, recalculate the pylon heights needed to restore original sight-lines.

ITEM 35

A slope stabilization project requires measuring the angle of repose of spoil kept in a conical heap. A pile base radius is measured as 6.0 m and the heap height is 2.8 m.

Task

1. Calculate the slope angle (angle between the sloping side and horizontal) and the length of the sloping side.
2. If the allowable slope angle for material safety is 26°, evaluate whether the heap is stable and recommend an action if not.

ITEM 36

A surveyor measures a horizontal distance of 1,600 m to a point at the base of a tower. From a point 480 m further back the angle of elevation to the top is 7°, and from the nearer point the angle is 15°.

Task

1. Using these two angles and distances, calculate the actual tower height and check consistency of the given distances.
2. If inconsistent, propose which measurement is the likely source of error and why.

ITEM 37

A pedestrian bridge ramp cannot exceed a gradient of 1:20 for accessibility. The ramp must rise 2.1 m from ground to platform level.

Task

1. Determine the minimum horizontal length required and the angle of inclination.
2. If space allows only 38 m of ramp, compute the vertical rise achievable and whether a series of switchbacks could meet the requirement.

ITEM 38

A radio engineer measures the direction cosines to a satellite reflection point; the elevation angle measured from the horizon is 9° and the slant distance is 15,000 km.

Task

1. Compute the vertical height of the reflection point above the observer and the horizontal distance projected on Earth's surface, assuming local flatness for the small angle.
2. Discuss why for such large distances curvature of the Earth must normally be considered and estimate at what distance the flat-earth approximation fails.

ITEM 39

A triangular mast is braced by a cross-member that makes angle 37° with the mast.

The brace is 7.2 m long and attaches 4.8 m up the mast from the base.

Task

1. Calculate the horizontal offset from the mast base to the brace anchor point and the angle the brace makes with the horizontal.
2. If the anchor point is moved 0.6 m further out, compute the new brace length.

ITEM 40

A vineyard worker stands between two poles set 45 m apart and measures angles to the top of each pole as 38° and 52°.

Task

1. Determine the worker's distances from each pole and find his position relative to the midpoint between poles.
2. Using these positions, calculate a third pole height at the midpoint so that all three tops lie in a straight line. Explain each step with a clear diagram.

ITEM 41

A sloped conveyor carries material up to a hopper which feeds a crusher. The hopper mouth is 4.5 m above the level ground and the conveyor incline is 22°.

Task

1. Calculate the required conveyor length and the horizontal distance from hopper base to the conveyor start.
2. If the conveyor has a clearance requirement that the belt tension line remain within ±0.2 m of a design path, determine the allowable tolerance in incline angle in degrees.

ITEM 42

A student on a hill measures the bearing and angle of elevation to a distant weather mast as N 75° E and 16°. She walks 600 m east then measures the angle of elevation as 21°.

Task

1. Determine the mast height and its original horizontal distance from the student.

2. Discuss how bearing information changes the triangulation compared to purely collinear observations.

ITEM 43

A cable car line spans between two towers at different heights. The horizontal distance between tower bases is 1,800 m. From the lower tower top the angle up to the higher tower top is 2.5°.

Task

1. Compute the difference in tower heights and the steepness of the cable (angle with horizontal) from the lower tower's top.
2. If engineers need the cable angle to be no more than 5°, determine acceptable height differences for the given span.

ITEM 44

A solar panel array is mounted on a roof pitched at 14°. For optimal performance at a location, the panels should face the sun at an incidence angle of approximately 6° at midday.

Task

1. Determine the tilt adjustment from the roof plane needed and compute the altitude angle of the sun at midday for which this is true.
2. Explain how seasonal solar elevation changes would alter the required adjustment.

ITEM 45

A triangular drainage channel with side slopes 3:1 (horizontal: vertical) and bottom width 1.2 m carries water; the channel bed drops 0.02 m per metre along the flow. At a cross-section, the water surface forms an angle with the horizontal; compute that angle given a normal depth of 0.9 m.

Task

1. Determine the wetted perimeter and hydraulic radius for use in Manning's formula.
2. Discuss briefly how channel slope and angle affect flow velocity.

ITEM 46

A rectangular billboard of width 12 m is seen from a motorway. From a point on the road directly opposite the billboard's Centre the angle subtended by the top and bottom edges is 2.8°.

Task

1. Calculate the billboard height.
2. If the viewer approaches within 80 m of the billboard Centre, compute the new subtended angle.
3. Discuss how angle of view relates to visual impact in roadside advertising.

ITEM 47

A tall building has two observation windows at heights 72 m and 90 m. From a point on level ground the angles of elevation to the lower and upper windows are observed to be 38° and 44°.

Task

1. Determine the distance from the observer to the building and confirm the window heights.

2. If the building facade is inclined backwards at 2°, compute the horizontal shift needed to maintain sight-lines.

ITEM 48

A pipeline runs across a hillside and follows a straight line between two manholes at different elevations. The horizontal separation is 260 m and the elevation difference is 8.6 m. An engineer measures from a point midway the angles of elevation to the two manholes as +1.9° and −1.9°.

Task

1. Verify the elevation difference using these angular readings and the known mid-distance, and discuss measurement symmetry.

ITEM 49

A flagpole is to be erected on a slope. From a point downhill the angle to the pole top is 52° and to the base 18°. The horizontal distance from the observer to the foot of the pole is unknown; the observer moves 30 m towards the pole and finds the corresponding angles are 58° and 25°.

Task

1. Using these pairs of elevation angles, compute the pole height and the original horizontal distance.
2. Discuss the advantages of using two observations versus one.

ITEM 50

A steeple casts a shadow which, together with a nearby wall, forms a right triangle on level ground. The angles from one triangle corner to the steeple top and wall top are 41° and 29° respectively, and the distance between the steeple and the wall base is 22 m.

Task

1. Determine heights of both steeple and wall and the angle between the lines of sight from the corner.
2. Discuss how obstructing objects would change the practical surveying procedure.

ITEM 51

A surveyor needs to place a new mast equidistant in angle from two existing masts. The existing mast tops lie at bearings N 20° E and N 50° E from the proposed site and are at heights 36 m and 46 m respectively, at horizontal distances 240 m and 360 m.

Task

1. Determine the bearing from the site at which a new mast top of height 40 m would appear exactly halfway in elevation angle between the two existing tops.

STATISTICS AND DATA INTERPRETATION

ITEM 1

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

Tasks:

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

ITEM 2

In order to improve on the livelihood among the community, the government has embarked on distribution of improved seeds to boost the yield of agricultural product in Moya district, Gama sub-county which has 4 wards. The wards are A, B, C and D. Basing on the size of land in each ward for every 100 packets of seed, ward A gets 30 packets, ward B gets 20 packets, ward C gets 40 packets and ward D gets 10 packets. The government has procured 45,000 packets which are all to be shared equitably according to the community.

Task

1. By using a statistical graph, help the local leaders to distribute these seeds to the community in wards. (Hint: Use a pie chart)

ITEM 3

In the press release by the Uganda bureau of Statistics, presented all Items Index and related Annual Inflation rates for 3 major components, from February 2015 to February 2016. The Annual Food Inflation decreased to 10.1 per cent for the year ending February 2016 compared to 12.8 per cent recorded for the year ended January 2016. On the other hand, the Annual Nonfood Inflation increased to 6.7 percent for the year ending February 2016, compared to the 5.8 percent recorded for the year ended January 2016. Key Drivers for higher Non-Food inflation were Transport (10.7 percent), Clothing and Footwear (13.1 percent) and Miscellaneous Goods and Services (6.3 percent). Source: Final press release Feb 2016.

Year		2015										2016	
Month	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NO	DEC	JAN	FEB
Rated inflation (%)	Food	2.0	3.2	0.6	8.0	6.4	7.2	6.4	8.8	12.4	13.2	13.6	12.0
	Non-food	4.4	4.8	5.2	4.4	3.2	6.0	6.4	7.2	7.2	7.6	8.0	7.2
	Headline	3.6	4.0	6.0	6.0	6.4	6.8	7.2	8.4	7.8	8.0	8.8	8.0

Task

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

ITEM 4

The population of Uganda is estimated to be the fastest growing population in Africa. It is estimated to be increasing by over 1,340,000 people every year since 2020 whose population was estimated to be 49,718,000 people. The research team finds it difficult to present such big population values in 2020 and 2022 on a chart.

Task

1. Advise the search team on some other way they can present these big population values in a reduced way without changing the meaning.

ITEM 5

The table below shows the number of livestock and the annual milk production (in litres) in three villages over two years. Each cow produces an average of 10 litres of milk per day for 300 days a year.

Village	Goats (2023)	Cows (2023)	Chickens (2023)	Milk Production (Litres 2024)
A	120	50	400	165, 000
B	150	40	350	132, 000
C	90	65	500	214, 500

Task

1. Calculate the total number of livestock in village C for 2023.
2. Which village had the highest ratio of cows to goats in 2023?
3. If a chicken is worth Shs 18,000, and a goat is worth Shs 250,000, what is the total value of chickens and goats in village A?
4. Determine the percentage increase or decrease in the number of cows in village B if, in 2024, the number of cows increased by 15%.
5. Using the milk production data for 2024, calculate the average daily milk production per cow in village C (assuming a 300-day milking cycle). Compare this with the given average of 10 litres per day and comment on the performance.

ITEM 6

The pie charts below show the distribution of students in a mixed secondary school offering different subjects in the S3 and S4 classes. The total number of students in S3 is 360, and in S4 is 400. In S3, the angles are: History 60°, Geography 90°, Biology 120°, and Chemistry the remainder. In S4, the angles are: History 45°, Geography 80°, Biology 130°, and Chemistry 105°.

Task

1. Calculate the number of students offering Chemistry in S3.
2. How many more students offer Biology in S4 than in S3?
3. Express the number of students offering Geography in S3 as a fraction of the total S3 students and simplify.

4. If 60% of the S4 Chemistry students are boys, how many girls are in S4 Chemistry?
5. In the following year, 10% of the S3 Biology students switch to Chemistry. Find the new number of Chemistry students in S3.

ITEM 7

The line graph below shows a school's monthly maize flour consumption (in kg) for the first half of the year. The data points are: Jan (50), Feb (45), Mar (60), Apr (70), May (65), Jun (80). The school buys flour at a price that varies: Shs 3,200 per kg from Jan-Mar, and Shs 3,500 per kg from Apr-Jun.

Task

1. In which month was the consumption highest and what was the expenditure that month?
2. Calculate the percentage increase in consumption from February to April.
3. Calculate the total cost of flour for the entire first half of the year.
4. If the school stores 20% of its June consumption as a reserve for the holidays, how many kg is that?
5. The school's population increases by 10% in the second half of the year. If consumption is directly proportional to the population, estimate the consumption for July.

ITEM 8

The table shows the performance of four schools in the 2023 UCE mock exam for four subjects. The maximum score for each subject is 100.

School	No. of candidates	Average Math score	Average English score	Average Science score	Average SST score
A	120	65	58	72	60
B	85	58	62	68	55
C	150	70	55	65	72
D	95	62	70	58	68

Task

1. Calculate the overall mean score for School A across all four subjects.
2. Which school had the highest average in SST and what is the difference compared to the lowest average in SST?
3. If the pass mark in each subject is 50%, how many students in School B are estimated to have passed Math, assuming the average is representative?
4. School D claims to be the best in English. By how many marks is their English average above the combined average of the other three schools?
5. In School C, the top 10% of students in Science had an average of 90. Calculate the average for the remaining 90% of students.

ITEM 9

A bookshop recorded sales of textbooks for a week. The selling price of a Math book is Shs 25,000, an English book is Shs 22,000, and a Science book is Shs 30,000.

Day	Math Books Sold	English Books Sold	Science Books Sold
Mon	25	30	15
Tue	30	28	20
Wed	20	35	18
Thu	35	25	22
Fri	40	40	30
Sat	55	45	35

Task

1. Calculate the total revenue from Math books for the week.
2. What is the ratio of English books sold on Monday to Science books sold on Saturday?
3. Calculate the mean number of Science books sold per day.
4. On which day was the total revenue from all books the highest? Show your working.
5. If the bookshop makes a 20% profit on each Science book, what is the total profit from Science books for the week?

ITEM 10

The compound bar chart below shows the number of boys and girls in four classes who participate in at least one co-curricular activity. The total students in each class are: S1 (Boys 20, Girls 25), S2 (Boys 25, Girls 20), S3 (Boys 30, Girls 15), S4 (Boys 15, Girls 30). The chart indicates that 80% of all boys and 75% of all girls participate.

Task

1. Calculate the total number of boys who participate in co-curricular activities.
2. How many girls in S4 do NOT participate in any activity?
3. Find the ratio of participating boys to participating girls in S3.
4. What is the overall participation rate for the entire school?
5. If the school wants to increase overall participation to 85%, how many more students (in total) need to join activities, assuming the number of non-participants is reduced?

ITEM 11

The table shows the production of coffee (in tonnes) and its average annual price (in '000 Shs per kg) for a farmer over five years.

Year	2019	2020	2021	2022	2023
Coffee (tonnes)	2.5	3.0	2.0	4.0	3.5
Avg. Price (Shs '000/kg)	4.5	4.0	5.0	5.5	6.0

Task

1. In which year was the revenue from coffee the highest? (Revenue = Production in kg * Price per kg)

2. Calculate the total revenue for the five-year period.
3. What was the percentage decrease in production from 2022 to 2023?
4. If production costs are Shs 3,000 per kg, in which year was the profit margin (Price - Cost) the highest?
5. The farmer reinvests 15% of his 2023 revenue into buying more land. How much money does he reinvest?

ITEM 12

A survey was conducted on 250 households in a town about their primary source of energy for cooking. The results were: 120 use firewood, 90 use charcoal, 25 use electricity, and the rest use gas. The average monthly cost for firewood users is Shs 80,000, for charcoal users is Shs 120,000, and for electricity users is Shs 150,000.

Task

1. How many households use gas?
2. What fraction of the households use charcoal? Simplify your answer.
3. Draw a pie chart scale showing the angle for firewood users.
4. Calculate the total monthly expenditure on energy for all the households surveyed, based on the averages given.
5. If the price of charcoal increases by 15%, what will be the new average monthly cost for a charcoal user?

ITEM 13

The scores of 15 students in a Mathematics test were: 12, 15, 10, 18, 15, 20, 11, 15, 14, 10, 17, 16, 12, 19, 13.

Task

1. Arrange the data in ascending order and find the median score.
2. Find the mode of the scores.
3. Calculate the range of the scores.
4. If the passing mark was 12, calculate the percentage of students who passed.
5. A student who scored 20 is absent for a re-test and is given 5 bonus points. What is the new mean of all 15 scores?

ITEM 14

The table shows the age distribution of patients who visited a health Centre over a weekend and the number of malaria cases reported per age group.

Age (Years)	0-10	11-20	21-30	31-40	41-50
Total Patients	15	25	30	20	10
Malaria Cases	10	15	18	8	2

Task

1. How many patients were below 21 years of age?
2. Which age group has the highest incidence rate of malaria (malaria cases as a percentage of total patients in that group)?
3. Calculate the total number of patients treated over the weekend.

4. What is the probability that a randomly chosen patient from the 21-30 age group has malaria?
5. If 40% of the malaria cases in the 0-10 age group are severe, how many severe malaria cases were there in that group?

ITEM 15

The mean weight of six students in a sports club is 54 kg. The weights of five of them are 48 kg, 52 kg, 55 kg, 58 kg, and 51 kg.

Task

1. Calculate the weight of the sixth student.
2. What is the median weight of all six students after including the sixth student's weight?
3. If a seventh student, who weighs 62 kg, joins the club, what is the new mean weight?
4. By how much does the mean increase after the seventh student joins?
5. If the coach wants the team's mean weight to be exactly 56 kg, what weight should an eighth student be?

ITEM 16

A market vendor sells eggs in trays. She sold 12 trays at Shs 14,000 per tray, 18 trays at Shs 15,000 per tray, and 10 trays at a discounted price of Shs 12,000 per tray because they were small-sized. Each tray contains 30 eggs.

Task

1. Calculate the total revenue from the egg sales.
2. Find the mean price per tray sold.
3. What is the mean price per egg sold across all sales?
4. If she bought all the eggs at a cost of Shs 350 per egg, calculate her overall percentage profit.
5. If she had sold all the trays at the highest price, how much more revenue would she have earned?

ITEM 17

In a class of 35 students, the average score in a Science test was 62. The teacher discovered an error and had to add 4 bonus points to every student's score. Later, she also deducted 2 points from the top 10 students' original scores for a correction.

Task

1. What is the new average for the whole class after adding the 4 bonus points, but before the deduction?
2. After the deduction for the top 10 students, the average for the remaining 25 students is 64. Calculate the new average for the entire class.
3. What was the original total score for the top 10 students?
4. Find the average of the top 10 students after the 2-point deduction.
5. What is the modal score likely to do after these adjustments? (Explain briefly).

ITEM 18

The frequency distribution table below shows the marks obtained by a group of learners in a test.

Marks	3	4	5	6	7	8
Frequency	3	5	x	8	6	4

The total number of learners is 35, and the sum of all the marks is 195.

Task

1. Find the value of x.
2. Verify the mean mark using the given sum of marks.
3. If a learner who scored 8 transfers to another school, what is the new mean mark for the remaining students?
4. What is the median mark of the original distribution?
5. How many students scored below the original mean mark?

ITEM 19

A small business owner recorded her monthly profits (in Uganda Shillings) for the first half of the year: Jan (2.2M), Feb (1.8M), Mar (2.5M), Apr (3.0M), May (2.8M), Jun (2.5M).

Task

1. Determine the median profit for the six months.
2. Calculate the mean monthly profit.
3. What is the range of the profits?
4. In July, she makes a profit of 3.5M. What is the new mean profit for the seven months?
5. If her target for the year is a mean monthly profit of 2.8M, what must her total profit be for the remaining five months (July to December)?

ITEM 20

The mean age of 8 teachers at a small school is 38 years. A new teacher aged 28 joins the staff, and at the same time, a teacher aged 58 retires.

Task

1. Calculate the total age of the original 8 teachers.
2. What is the total age of the new group of 8 teachers (after the join and retirement)?
3. Find the new mean age of the teachers.
4. By how many years did the mean age change?
5. If two more teachers, both aged 32, join the group of 8, what is the new mean age?

ITEM 21

In a test, the mean score of 12 boys is 15 and the mean score of 8 girls is 17. Two more girls join the class late and take the test, scoring 19 and 15.

Task

1. Find the total score for the boys.

2. Calculate the overall mean score for all students (boys, original girls, and new girls).
3. What is the new mean score for the girls only?
4. By how much did the overall mean increase after the two girls joined?
5. If the passing mark was 14, and all boys passed, what percentage of the final total of girls passed?

ITEM 22

A shop's sales for the first five days of a week were Shs 220,000, Shs 250,000, Shs 180,000, Shs 300,000, and Shs 270,000. The shop targets a mean sales of Shs 280,000 for the whole week (7 days). The sales on Saturday are Shs 350,000.

Task

1. Calculate the mean sales for the first five days.
2. What must the sales be on Sunday to achieve the weekly target?
3. If the shop actually achieved sales of Shs 320,000 on Sunday, by how much did they exceed their weekly target?
4. Calculate the median sales for the entire week (using the actual sales including Sunday's 320,000).
5. What is the percentage increase in sales from the worst day to the best day in the week (Mon-Fri + actual Sat 350,000 & Sun 320,000)?

ITEM 23

A bag contains 6 red pens, 5 blue pens, and 4 green pens. A pen is picked at random and then replaced. A second pen is then picked.

Task

1. What is the probability of picking a blue pen on the first draw?
2. What is the probability of NOT picking a red pen on the first draw?
3. What is the probability of picking a red pen first and then a green pen?
4. What is the probability of picking two pens of the same color?
5. If the first pen was NOT replaced, what would be the probability of picking two red pens in a row?

ITEM 24

The probability that a bus from Kampala to Masaka arrives on time on any given day is 0.75. The probability that it is overcrowded is 0.4. The probability that it is both on time and overcrowded is 0.25.

Task

1. What is the probability that the bus is not on time?
2. Represent this information in a Venn diagram (or a two-way table conceptually).
3. What is the probability that on a randomly chosen day, the bus is either on time or overcrowded (or both)?
4. What is the probability that the bus is on time but NOT overcrowded?
5. Are the events "on time" and "overcrowded" mutually exclusive? Justify your answer with a calculation.

ITEM 25

In a school of 500 students, the distribution is as follows: S1 (120), S2 (150), S3 (100), S4 (130). The number of students in the school band is 80, distributed as: 20 from S1, 25 from S2, 20 from S3, and 15 from S4. A student is chosen at random.

Task

1. Find the probability that the student is in S2.
2. Find the probability that the student is in the school band.
3. Find the probability that the student is in S3 AND in the band.
4. If the student chosen is from S4, what is the probability that they are in the band?
5. Are the events "being in S1" and "being in the band" independent? Show your reasoning.

ITEM 26

The double bar graph below shows the number of students in a mixed school who like three different sports: Football, Netball, and Volleyball. For Football: Boys 70, Girls 30. For Netball: Boys 15, Girls 65. For Volleyball: Boys 40, Girls 40.

Task

1. How many students like Netball in total?
2. What is the ratio of boys who like Volleyball to girls who like Volleyball?
3. What is the probability that a randomly chosen boy likes Football?
4. What is the probability that a randomly chosen student who likes Netball is a girl?
5. If a student is chosen at random from the school, and the total school population is 300 (including students who may not like these three sports), and the graph represents all students, find the probability that the student is a boy who likes Volleyball.

ITEM 27

A fair six-sided die is rolled twice. The first roll's outcome is recorded, and then the second roll's outcome is recorded.

Task

1. What is the probability of getting a prime number on the first roll?
2. What is the probability of getting a number greater than 4 on the second roll?
3. What is the probability of getting a total score of 7 from the two rolls?
4. What is the probability of getting a total score of at least 10?
5. If you know that the first roll was a 3, what is the probability that the total score is 8?

ITEM 28

The histogram below shows the distribution of heights (in cm) of 50 sunflower plants. The groups and frequencies are: 0-20 (5 plants), 20-40 (15 plants), 40-60 (18 plants), 60-80 (10 plants), 80-100 (2 plants). A plant is chosen at random for an experiment.

Task

1. What is the probability that it is in the 40-60 cm height group?

2. How many plants are at least 40 cm tall?
3. What is the probability that the plant is less than 60 cm tall?
4. If a plant is chosen and found to be taller than 60 cm, what is the probability that it is from the 60-80 cm group?
5. Estimate the mean height of the sunflowers using the midpoints of the class intervals.

ITEM 29

The price of a bag of maize flour is Shs 120,000. During the harvest season, the price decreases by 15%. After the harvest season, the price increases by 20% from the post-harvest price.

Task

1. Calculate the price of the maize flour after the harvest season decrease.
2. Find the price after the subsequent 20% increase.
3. What is the single percentage increase or decrease from the original price to the final price?
4. If a school bought 10 bags at the original price and 15 bags at the final price, what was their total expenditure?
5. What is the average price paid per bag by the school?

ITEM 30

A student's marks in four subjects are 65, 72, 58, and 69. To be admitted to a certain program, he needs an average of at least 70 in five subjects, and no individual subject mark below 60.

Task

1. Find his current average for the four subjects.
2. What is the minimum mark he must get in the fifth subject to achieve an average of 70?
3. If he scores the mark calculated in (b), does he meet the condition of no subject below 60? Explain.
4. If the fifth subject's exam had a maximum of 50 marks (due to a different grading system), would it be possible for him to meet the average requirement? Explain.
5. He scores 80 in the fifth subject. What is his new average, and by how much does it exceed the requirement?

ITEM 31

In 2021, a sub-county had a population of 25,000 people. In 2022, the population increased by 8%. In 2023, it decreased by 3% due to migration. In 2024, it increased by 5%.

Task

1. Find the population at the end of 2022.
2. Find the population at the end of 2023.
3. Find the population at the end of 2024.
4. What is the overall percentage change in population from 2021 to 2024?
5. If the birth rate in 2024 was 25 per 1000 people, how many births were there in 2024?

ITEM 32

The table shows the time (in minutes) taken by 40 students to travel to school.

Time (min)	0-9	10-19	20-29	30-39	40-49
Frequency	4	12	14	6	4

Task

1. State the modal class.
2. Estimate the mean travel time, using midpoints.
3. Draw a cumulative frequency curve (O give) for this data (describe the points you would plot).
4. Using your O give, estimate the median travel time.
5. How many students take more than 35 minutes to travel to school? (Estimate using your ogive or calculation).

ITEM 33

Kibuli Secondary School established a school farm project in 2020 to supplement the school feeding program and generate income. The farm has different sections for crop farming and animal rearing. The agriculture teacher, Mr. Lubega, maintains detailed records of all farm activities. The table below shows the monthly harvest of maize (in kilograms) for the first half of 2023 and the number of students who participated in the farming activities each month.

Month	Jan	Feb	Mar	Apr	May	June
Maize Harvest (kg)	240	280	310	290	350	420
Students Participating	45	48	52	50	55	60

The school sells the maize at Shs 1,500 per kilogram to local traders. Part of the harvest is reserved for the school kitchen, which uses 30 kilograms of maize flour daily. The school operates for 5 days a week throughout the year, except during April and August holidays when the kitchen is closed for 4 weeks in total. The farm also keeps 25 cows, each producing an average of 8 litres of milk per day. The milk is sold to the school community at Shs 3,000 per litre.

Task

1. Calculate the total revenue from maize sales for the first half of 2023, assuming all harvested maize was sold.
2. Determine the total milk production from the farm in a week and its corresponding value.
3. If the school kitchen uses maize flour for 40 weeks in a year, how many kilograms of maize should be reserved annually, and what percentage of the total annual harvest (assuming the second half harvest equals the first half) does this represent?

ITEM 34

In Jinja Municipal Market, a cooperative of 50 women vendors deals in fresh produce. The cooperative secretary, Madam Nambi, collected data on the daily sales (in thousands of shillings) of 15 randomly selected members on a particular Saturday. The sales figures were recorded as follows:

35, 42, 28, 51, 39, 44, 37, 53, 41, 29, 38, 46, 33, 49, 40

The cooperative charges each member a daily fee of Shs 2,000 for market dues. Additionally, each member contributes 5% of her daily sales to a joint savings scheme. The cooperative also runs a small loan scheme where members can borrow money at a simple interest rate of 10% per month. Last month, three members borrowed Shs 200,000 each and repaid after 3 months.

Task

1. Arrange the sales data in ascending order and determine the median daily sales.
2. Calculate the mean daily sales for these 15 members and find the total contribution made by these members to the joint savings scheme on that day.
3. Calculate the total interest paid by the three members who borrowed money, and determine how much each member paid back in total.

ITEM 35

Kampala Coach Bus Company operates daily services between Kampala and several upcountry towns. The company manager is analyzing the performance of the Kampala-Mbarara route. The table below shows the number of passengers, the distance covered, and the fuel consumption for five trips conducted last week.

Trip	Distance (km)	Number of Passengers	Fuel Used (litres)	Fare per Passenger (Shs)
1	280	52	70	25,000
2	280	48	68	25,000
3	280	55	72	25,000
4	280	45	65	25,000
5	280	50	69	25,000

The bus has a seating capacity of 60 passengers. The company spends Shs 5,200 per litre of diesel. Other costs per trip include driver's allowance Shs 50,000, conductor's allowance Shs 30,000, and routine maintenance Shs 80,000. The bus makes one round trip per day (Kampala-Mbarara-Kampala).

Task

1. Calculate the total revenue from passengers for the five trips.
2. Determine the total fuel cost for all five trips and the average fuel consumption per 100 kilometers.
3. Calculate the total profit or loss made on this route for the five trips, considering all costs mentioned.

ITEM 36

Rukungiri Health Centre III serves a population of approximately 25,000 people from the surrounding sub-counties. The health center in-charge compiled the following data on outpatient attendance and disease patterns for the month of June 2023. The health center operates 6 days a week.

Week	Week 1	Week 2	Week 3	Week 4
Outpatient Attendance	420	485	510	395

The disease breakdown for the month was as follows: Malaria (850 cases), Respiratory Infections (620 cases), Diarrheal Diseases (340 cases), Intestinal Worms (280 cases), and other conditions (the rest). The health center has 3 clinical officers, 5 nurses, and 2 midwives. Each clinical officer can attend to an average of 15 patients per day, each nurse 10 patients per day, and each midwife 8 patients per day (maternal cases only, not included in general outpatient count). The maternal cases seen during the month were 180.

Task

1. Calculate the total outpatient attendance for June and determine the average daily attendance.
2. Find the number of patients treated for "other conditions" and express this as a percentage of the total outpatient attendance.
3. Based on the staff capacity, did the health center have enough human resources to handle the outpatient load in June? Support your answer with calculations.

ITEM 37

Bukoto Farmers' Savings and Credit Cooperative Organization (SACCO) held its Annual General Meeting where the treasurer presented the financial performance for the year 2023. The SACCO has 800 registered members. The table below shows the loan disbursement and repayment records for four quarters.

Quarter	Loans Disbursed (Shs)	Loans Repaid (Shs)	Number of Borrowers
1st Quarter	12,500,000	8,200,000	65
2nd Quarter	15,800,000	10,500,000	72
3rd Quarter	18,200,000	14,600,000	84
4th Quarter	20,500,000	11,300,000	90

The SACCO charges an interest rate of 12% per annum on loans, calculated on a reducing balance basis. Members save at least Shs 20,000 per month, and the SACCO offers an annual dividend of 8% on members' savings. The total savings by members at the beginning of 2023 was Shs 95,000,000. During the year, total savings increased by 15%.

Task

1. Calculate the total loans disbursed in 2023 and the total loans repaid during the same period. What is the outstanding loan balance at the end of the year?
2. Assuming all loans were taken for one year, estimate the total interest income the SACCO earned from the loans disbursed in the 1st Quarter only (use simple interest for approximation).
3. Calculate the total savings at the end of 2023 and determine the total dividend paid out to members.

ITEM 38

Masaka Secondary School presented 240 candidates for the UCE examinations last year. The table below shows the distribution of grades obtained in Mathematics and English.

Grade	Distinction 1	Credit 2	Credit 3	Credit 4	Pass 5	Pass 6	Fail 7	Fail 8	Fail 9
Mathematics	18	24	36	42	30	28	22	20	20
English	22	28	40	48	32	25	18	15	12

The school head teacher wants to analyze the performance to identify areas for improvement. The Ministry of Education defines a pass as Grade 1 to 6, and a credit as Grade 1 to 4. The school targets that at least 60% of candidates should obtain a credit in both Mathematics and English. The performance in Science and Social Studies was also recorded, with 156 candidates obtaining at least a credit in Science and 168 obtaining at least a credit in Social Studies.

Task

1. Calculate the percentage of candidates who obtained a credit (Grade 1-4) in Mathematics and in English separately.
2. Determine the number of candidates who passed (Grade 1-6) in both Mathematics and English.
3. Compare the performance in Mathematics and Science by calculating how many more candidates obtained a credit in Science than in Mathematics. Does the school meet its target of 60% credits in Mathematics?

ITEM 39

A community in Kotido District is implementing a water project funded by a non-governmental organization. The project involves drilling boreholes and constructing protected springs. The table below shows the progress of the project over five months.

Month	Boreholes Drilled	Springs Protected	Households Gaining Access	Project Expenditure (Shs)
Jan	2	3	450	18,500,000
Feb	3	4	620	24,800,000
Mar	4	5	810	31,200,000
Apr	3	3	540	22,600,000
May	5	6	980	38,500,000

Each borehole serves an average of 120 households, while each protected spring serves an average of 70 households. The project target is to provide clean water to 3,500 households by the end of May. The NGO releases funds in phases based on milestones achieved. The initial budget for the five months was Shs 150,000,000.

Task

1. Calculate the total number of boreholes drilled and springs protected by the end of May.
2. Based on the average household coverage per facility, determine the total number of households that have gained access to clean water. Does this meet the project target?
3. Compare the total project expenditure with the budget. What is the variance, and what percentage of the budget was spent?

ITEM 40

Jinja Progressive Academy has been tracking its student enrollment for the past five years across the four senior classes. The data is presented in the table below.

Year	2019	2020	2021	2022	2023
Senior 1	180	195	210	225	240
Senior 2	165	175	190	205	220
Senior 3	150	160	170	185	200
Senior 4	140	145	155	165	180

The school charges annual tuition fees of Shs 1,200,000 per student in Senior One and Two, and Shs 1,500,000 per student in Senior Three and Four. Other revenue sources include a one-time development fee of Shs 200,000 for each new Senior One student, and income from the school canteen which averages Shs 4,500,000 per term. The school operates for three terms in a year. The school's annual expenditure includes teachers' salaries Shs 280,000,000, administrative costs Shs 65,000,000, and utility bills Shs 18,000,000.

Task

1. Calculate the total school enrollment for each year and determine the percentage increase in total enrollment from 2019 to 2023.
2. Calculate the total tuition revenue for the year 2023, clearly showing the contribution from each class.
3. Determine the school's total revenue for 2023 (including tuition, development fees, and canteen income) and calculate whether the school made a profit or loss after meeting its expenditures.

ITEM 41

Kayonza Growers Coffee Cooperative has 350 active members who deliver processed coffee to the society. The table below shows the coffee deliveries (in kilograms) and the average coffee prices (per kilogram) for the years 2020 to 2024.

Year	2020	2021	2022	2023	2024
Coffee Delivered (kg)	12,500	14,800	16,200	15,400	18,500
Average Price (Shs/kg)	4,200	4,500	5,000	5,800	6,200

The cooperative deducts 8% of the total sales value for administrative costs and a further 5% for the cooperative development fund. The remaining amount is paid to members based on the quantity of coffee each delivered. The cooperative also runs a nursery bed where it sells coffee seedlings to members at Shs 800 each. In 2024, the cooperative sold 12,000 seedlings.

Task

1. Calculate the total sales value of coffee for each year from 2020 to 2024.
2. Determine the total amount paid to members in 2024 after all deductions.
3. Calculate the total revenue from seedling sales in 2024 and express this as a percentage of the coffee sales value for the same year.

ITEM 42

A research student from Makerere University is studying the relationship between rainfall and maize yield in Tororo District. She collected data from five different sub-counties for the year 2023, as shown in the table below.

Sub-County	Annual Rainfall (mm)	Maize Yield (tonnes per hectare)	Area Planted (hectares)	Fertilizer Used (kg/hectare)
A	850	2.8	120	50
B	920	3.2	95	65
C	780	2.4	150	40
D	1,050	3.5	80	70
E	690	2.1	110	35

The researcher knows that the average maize consumption per person per year in Uganda is approximately 45 kilograms. The population of the five sub-counties combined is estimated at 85,000 people. The researcher also noted that the recommended fertilizer application rate for optimal maize yield is 60 kg per hectare, and the minimum rainfall requirement for maize is 800 mm per year.

Task

1. Calculate the total maize production (in tonnes) for each sub-county and the overall total production for all five sub-counties.
2. Determine whether the total maize production is sufficient to meet the annual consumption needs of the population in these five sub-counties. Show your calculations.
3. Identify the sub-counties that did not meet the minimum rainfall requirement and calculate the average yield for those sub-counties compared to those that met the requirement.

ITEM 43

Charles operates a mobile money agent business in a busy trading center. He recorded his daily transactions for two weeks (14 days) as follows (in thousands of shillings):

Week 1: 450, 520, 380, 610, 490, 570, 620

Week 2: 580, 630, 510, 590, 470, 650, 710

Charles earns a commission of 0.8% on all withdrawals and 0.5% on all deposits. On average, 40% of his daily transaction value represents withdrawals, and 60% represents deposits. He incurs daily costs of Shs 15,000 for airtime and data, Shs 10,000 for security, and Shs 5,000 for other incidentals. He also pays a monthly license fee of Shs 50,000 to the local council.

Task

1. Arrange the daily transactions in ascending order and determine the median daily transaction value for the two-week period.
2. Calculate Charles's average daily commission from both withdrawals and deposits.
3. Determine his total profit for the two weeks after deducting all daily costs and accounting for the monthly license fee (apportion appropriately for two weeks).

ITEM 44

Nambi started a small poultry farm with 500 layers in 2022. She records the egg production daily. The table below shows the average monthly egg production (in trays, where 1 tray = 30 eggs) for the year 2023.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trays of Eggs	380	360	410	400	420	390	380	410	430	440	450	460

Each tray of eggs is sold at Shs 18,000 to local retailers. The farm's monthly expenses include: feeds Shs 1,800,000, veterinary services Shs 250,000, labor Shs 600,000, and miscellaneous Shs 150,000. In August, she replaced 50 old hens with new ones at a cost of Shs 25,000 each. In December, she sold 100 mature hens for meat at Shs 35,000 each.

Task

1. Calculate the total number of eggs produced in 2023 and the total revenue from egg sales.
2. Determine the farm's total expenses for the year 2023, including the cost of new hens purchased.
3. Calculate the farm's net profit for the year, including revenue from both eggs and the sale of mature hens.

ITEM 45

The Uganda National Roads Authority (UNRA) is overseeing the tarmacking of a 95-kilometer road connecting two districts. The project is scheduled to take 24 months. The table below shows the progress after 12 months.

Section	Distance (km)	Contractor	Work Completed (km)	Budget Allocated (Shs billions)	Actual Spent (Shs billions)
A	30	Company X	18	45	42
B	35	Company Y	22	52	55
C	30	Company Z	15	48	40

The project requires that each contractor completes at least 60% of their assigned section by the 12-month mark to avoid penalties. The total project budget for 24 months is Shs 180 billion. The remaining work is to be completed in the second year. UNRA also spends Shs 2.5 billion annually on project supervision and administration.

Task

1. Calculate the percentage of work completed by each contractor after 12 months. Which contractors are at risk of penalties?
2. Determine the total amount spent on the project in the first 12 months (including contractor payments and supervision).
3. Assuming the remaining work is completed at the same average cost per kilometer as in the first 12 months, estimate whether the total project will exceed the budget.

ITEM 46

Mr. Okello, the class teacher of Senior Four A at Gulu High School, analyzed the results of the mock examinations for his class of 35 students. The scores in Mathematics and Science were recorded, and their distribution is shown below.

Mathematics Scores:

45, 62, 71, 38, 55, 68, 73, 49, 52, 65, 59, 61, 70, 47, 54, 63, 67, 58, 72, 50, 43, 64, 69, 56, 60, 66, 57, 53, 48, 74, 51, 46, 75, 42, 41

Science Scores:

The mean score for Science was 58, and the total scores for all students in Science was 2,030. The teacher wants to award a prize to the top 10% of students based on their average score in both subjects. To be considered for the prize, a student must also have no score below 50 in either subject.

Task

1. Calculate the mean and median score for Mathematics.
2. Determine the total score for Mathematics and, using the Science total, calculate the combined mean score for both subjects for the entire class.
3. Determine the minimum average score required to be in the top 10% of the class, and state how many students qualify for the prize considering the additional condition.

ITEM 47

The Uganda Bureau of Statistics (UBOS) released data for a hypothetical district showing its population growth over five census years. The district planning committee uses this data to plan for social services.

Census Year	2002	2010	2014	2020	2024
Population	120,000	145,000	162,000	185,000	208,000
Number of Health Centers	8	10	12	15	18
Number of Primary Schools	45	52	58	65	72

The district plans to have one health center for every 12,000 people and one primary school for every 2,500 school-going children. School-going children constitute 25% of the total population. The district budget allocates Shs 450,000,000 for constructing new health centers and Shs 380,000,000 for new primary schools in the next planning period (2024-2030). The average cost of constructing one health center is Shs 280,000,000 and one primary school is Shs 190,000,000.

Task

1. Calculate the percentage increase in population from 2002 to 2024.
2. Based on the 2024 population, determine whether the district meets its planning target for health centers and primary schools. How many additional facilities of each type are needed?
3. If the population continues to grow at the same average annual rate as between 2020 and 2024, estimate the population in 2030. Then, determine if the allocated budget is sufficient to meet the facility targets for the projected 2030 population.

ITEM 48

A market researcher was hired by a company that produces cooking oil to study consumer preferences in Gulu town. The researcher interviewed 240 randomly selected households about their cooking oil purchasing habits. From the survey, 120 households reported that they use vegetable oil exclusively, while 80 households reported using only palm oil. The researcher discovered that 30 households use both types of oil depending on availability and price. The remaining households reported that they do not use any type of cooking oil because they primarily use other cooking fats or rarely cook at home. The company wants to understand the market structure before launching a new brand. Additionally, the researcher noted that among households that use vegetable oil, 60% prefer the 2-litre bottle size, while among palm oil users, only 40% prefer the 2-litre size. The company plans to target households that use at least one type of cooking oil with a special promotion.

Task

1. Represent this information in a Venn diagram showing the number of households that use vegetable oil, palm oil, both, and neither. Then determine the probability that a randomly selected household from the survey uses exactly one type of cooking oil.
2. If a household is selected at random from those that use vegetable oil, what is the probability that they prefer the 2-litre bottle size? Similarly, if a household is selected from palm oil users, what is the probability they prefer the 2-litre size?
3. The company decides to randomly select 3 households from those that use both types of oil for a focus group discussion. What is the probability that all 3 selected households prefer the 2-litre size, assuming preference is independent and based on the vegetable oil preference rate? (Assume the preference rate for both-users follows the vegetable oil pattern).
4. Calculate the total number of households that prefer the 2-litre bottle size based on the survey data, and express this as a percentage of all households that use cooking oil.

ITEM 49

During a disease outbreak investigation in a rural sub-county of Kabale District, health officials recorded data from 500 households. They were investigating the spread of a waterborne disease and its correlation with water sources. The officials found that 210 households use protected springs as their primary water source, while 180 households use boreholes. The remaining households use unprotected surface water from streams and ponds. Among all households, 85 reported cases of the disease. Further analysis revealed that among households using unprotected water, 40 reported disease cases. Among households using protected springs, 25 reported cases. The investigation also found that 10 households using boreholes reported disease cases. The health team wants to understand the risk factors associated with different water sources. The district health officer plans to conduct a follow-up study by randomly selecting households for detailed interviews. The probability of disease occurrence is a critical factor in targeting interventions.

Task

1. Construct a contingency table (two-way table) showing water source categories and disease status. Then determine the probability that a randomly selected household from the survey uses unprotected water.
2. If a household is randomly selected from those that use boreholes, what is the probability that they reported a disease case? Compare this with the probability of disease for households using unprotected water.
3. Calculate the probability that a household either uses protected springs OR reported a disease case (or both). Are these two events mutually exclusive? Justify your answer with calculations.
4. During the follow-up study, the health officer randomly selects 4 households from those that reported disease cases for in-depth interviews. What is the probability that at least 3 of these selected households come from unprotected water sources?

ITEM 50

At Kololo High School, a mixed secondary school with 600 students in Senior One to Senior Four, elections for head prefect were conducted. The student population is distributed as follows: Senior One has 180 students (95 boys and 85 girls), Senior Two has 160 students (75 boys and 85 girls), Senior Three has 140 students (65 boys and 75 girls), and Senior Four has 120 students (55 boys and 65 girls). Three candidates contested for the position of head prefect: Akello from Senior Three, Ochieng from Senior Four, and Nabatanzi from Senior Two. After the voting, which was conducted secretly, the results showed that Akello received 220 votes, Ochieng received 210 votes, and Nabatanzi received 150 votes. Twenty students did not vote. The elections committee later analyzed voting patterns by class and gender. They discovered that among Senior One students, 70 voted for Akello, 50 for Ochieng, and 40 for Nabatanzi, with the rest not voting. Among Senior Two students, 50 voted for Akello, 60 for Ochieng, and 40 for Nabatanzi. Among Senior Three students, 60 voted for Akello, 40 for Ochieng, and 30 for Nabatanzi. The remaining votes came from Senior Four. The committee also noted that 55% of all votes cast by girls went to Akello, while Ochieng received 40% of the boys' votes.

Task

1. Construct a table showing the distribution of votes by class for each candidate, including those who did not vote. Then determine the probability that a randomly selected student from the school voted for Nabatanzi.
2. If a student is randomly selected from those who voted for Ochieng, what is the probability that they are from Senior Four? Show your working.
3. Calculate the probability that a randomly selected student is a girl AND voted for Akello. Then determine whether the events "being a girl" and "voting for Akello" are independent. Support your answer with probability calculations.
4. If two students are randomly selected from those who did not vote, what is the probability that both are from Senior One?

ITEM 51

A transport company operating along the Kampala-Mbale route collects data on the punctuality and condition of its buses. The company has a fleet of 15 buses that make daily trips. Over a period of 60 days, the operations manager recorded the following information: On 42 days, buses departed on time from Kampala. On 36 days, buses arrived on time in Mbale. On 30 days, buses both departed on time from Kampala and arrived on time in

Mbale. On 8 days, buses experienced mechanical breakdowns during the journey. Among the days when mechanical breakdowns occurred, only 2 days had on-time departures from Kampala, and only 1 day had on-time arrival in Mbale. The company wants to assess its reliability to improve customer satisfaction. The manager also noted that when buses break down, they are delayed by an average of 4 hours, and compensation of Shs 20,000 is paid to each passenger on such trips. Each bus carries an average of 50 passengers per trip. The company is considering introducing an express service that would guarantee on-time arrival with a probability of 0.85, but this would require purchasing new buses at a cost of Shs 450,000,000 each.

Task

1. Using the given information, determine the probability that on a randomly selected day, a bus either departed on time OR arrived on time (or both). Also, find the probability of a mechanical breakdown occurring on any given day.
2. Calculate the probability that on a day when a mechanical breakdown occurred, the bus had also departed on time. Compare this with the overall probability of on-time departure and comment on the relationship.
3. If a passenger travels on this route for 5 consecutive days, what is the probability that they experience exactly 2 days with mechanical breakdowns? (Assume breakdowns occur independently each day).
4. Based on the 60-day data, estimate the total amount the company paid in passenger compensation due to breakdowns, and determine the probability that on any given trip, a passenger will receive compensation.

ITEM 52

An agricultural extension officer in Masaka District conducted a training program for 300 farmers on improved banana farming techniques. Six months after the training, the officer visited the farmers to assess adoption rates and yields. Among the 300 farmers, 180 had adopted at least one of the recommended practices: proper spacing, mulching, or pest control. Specifically, 100 farmers adopted proper spacing, 90 adopted mulching, and 70 adopted pest control. The officer discovered that 40 farmers adopted both proper spacing and mulching, 30 adopted both proper spacing and pest control, 25 adopted both mulching and pest control, and 15 adopted all three practices. The remaining farmers adopted none of the practices despite the training. The officer also measured banana yields and found that among farmers who adopted at least two practices, the average yield was 22 tonnes per hectare, while among those who adopted one or no practices, the average yield was only 14 tonnes per hectare. The extension officer plans to select farmers for a follow-up demonstration plot.

Task

1. Using a Venn diagram approach (conceptually), determine the number of farmers who adopted exactly one practice, exactly two practices, and all three practices. Then calculate the probability that a randomly selected farmer from the 300 adopted at least two practices.
2. If a farmer is randomly selected from those who adopted mulching, what is the probability that they also adopted pest control? Show your calculation.
3. The extension officer randomly selects 5 farmers from those who adopted all three practices for a special recognition ceremony. What is the probability that at least 4 of them are among the farmers who also achieved yields above 20 tonnes per hectare, assuming that 80% of farmers who adopted all three practices achieved such yields?

4. Based on the yield data, estimate the total banana production from all 300 farmers if the average farm size is 0.8 hectares per farmer. Then determine the probability that a randomly selected farmer has a yield below 15 tonnes per hectare, assuming yields are normally distributed with the given averages (make a reasonable assumption about spread).

ITEM 53

A mobile telecommunications company conducted a survey of 800 subscribers in a urban area to understand usage patterns and satisfaction levels. The survey found that 500 subscribers use smartphones, while the rest use basic phones. Among smartphone users, 350 use mobile money services regularly, while among basic phone users, only 120 use mobile money services. The company also assessed network satisfaction: 420 subscribers reported being satisfied with the network quality. Further analysis showed that among smartphone users who use mobile money, 280 are satisfied with the network. Among basic phone users who do not use mobile money, 50 are satisfied. The company also noted that 60% of all subscribers who use mobile money are smartphone users. The marketing department wants to target specific subscriber segments with new products. The probability of a subscriber using mobile money is a key factor in designing mobile banking products. The company plans to launch a new data bundle targeted at satisfied smartphone users who use mobile money.

Task

1. Construct a two-way table showing the relationship between phone type (smartphone/basic) and mobile money usage (use/do not use). Then calculate the probability that a randomly selected subscriber uses mobile money.
2. If a subscriber is randomly selected from those who are satisfied with the network, what is the probability that they are a smartphone user who uses mobile money?
3. Determine whether the events "using a smartphone" and "using mobile money" are independent. Use probability calculations to justify your answer.
4. The company randomly selects 10 subscribers from those who use mobile money for a focus group. What is the probability that exactly 7 of them are smartphone users? (Assume selections are independent and the proportion holds).

ITEM 54

In the 2023 UCE examinations, a large school presented 400 candidates. The results showed that 280 candidates passed Mathematics, 300 passed English, and 260 passed both Mathematics and English. The school also recorded that 320 candidates passed at least one of these two subjects. The head teacher wants to analyze the performance pattern to identify students who need remedial support. Additionally, the school noted that among candidates who passed both Mathematics and English, 180 also passed Science, while among those who passed only one of Mathematics or English, 90 passed Science. Among candidates who failed both Mathematics and English, only 20 passed Science. The school's target is to have at least 75% of candidates passing all three subjects. The performance in these three subjects is often used to predict overall success. The head teacher plans to randomly select candidates for an award ceremony based on their performance.

Task

1. Using set theory concepts, determine the number of candidates who failed both Mathematics and English. Then calculate the probability that a randomly selected candidate passed exactly one of Mathematics or English.

2. If a candidate is randomly selected from those who passed Science, what is the probability that they passed both Mathematics and English? Show your working.
3. Construct a probability tree diagram for the events of passing Mathematics and passing English, showing all branches and their probabilities. Then determine the probability that a randomly selected candidate passes Mathematics given that they passed English.
4. The school randomly selects 8 candidates from those who passed all three subjects for a special recognition. What is the probability that at least 6 of them are girls, if 65% of candidates who passed all three subjects are girls?

ITEM 55

A meteorological station in Entebbe has been recording weather patterns for the past 500 days. The records show that on 320 days, it was sunny; on 180 days, it was rainy; and on 100 days, it was both sunny and rainy (meaning sunny periods followed by rain later in the day). On 50 days, it was neither sunny nor rainy (overcast but no rain). The station also recorded temperature data: on 280 days, the maximum temperature exceeded 28°C. Among the sunny days, 240 had maximum temperatures above 28°C. Among the rainy days, only 40 had maximum temperatures above 28°C. The meteorologist wants to understand the relationship between sunshine, rain, and temperature to improve forecasting accuracy. Farmers in the region rely on these forecasts for planting decisions. The probability of a sunny day with high temperature is important for crop planning. The station also issues warnings when there is a 70% chance of rain following a sunny morning.

Task

1. Determine the probability that on a randomly selected day, it was rainy but not sunny. Also, calculate the probability of a day being neither sunny nor rainy.
2. If a day is selected at random from those with maximum temperature above 28°C, what is the probability that it was a sunny day? Compare this with the overall probability of a sunny day.
3. Calculate the probability that on a randomly selected day, it was either sunny OR had maximum temperature above 28°C (or both). Are these two events mutually exclusive? Justify.
4. Based on the data, if the station observes a sunny morning (which occurs on 70% of all sunny days), the probability of rain later that day is 0.25. Using this conditional probability, determine the overall probability that a randomly selected day has a sunny morning followed by rain. How does this compare with the given probability of both sunny and rainy days?

ITEM 56

During the annual inter-house sports tournament at Busoga College Mwiri, 240 students participated in various events. The houses are Nile, Victoria, and Albert. The distribution of participants by house was: Nile 90 students, Victoria 80 students, and Albert 70 students. Students could participate in athletics, football, or both. The records show that 150 students participated in athletics, 130 in football, and 60 participated in both athletics and football. Among Nile house students, 40 participated in athletics only, 30 in football only, and 15 in both. Among Victoria house students, 35 participated in athletics only, 25 in football only, and 12 in both. The remaining participants from Albert house had their own distribution. The sports master wants to award prizes to outstanding performers. He randomly selects students for drug testing. The probability of selecting students from specific categories is important for fair representation. Additionally, the master noted that among students who participated in both sports, 70% are in Senior Four, while among those who participated in only one sport, 45% are in Senior Four.

Task

1. Construct a table showing the distribution of participants by house and by sport participation category (athletics only, football only, both, neither). Then determine the number of Albert house students who participated in neither sport.
2. If a student is randomly selected from those who participated in athletics, what is the probability that they are from Victoria house? Show your working.
3. Calculate the probability that a randomly selected participant is from Nile house OR participated in football (or both). Are these events independent? Support your answer with calculations.
4. The sports master randomly selects 6 students from those who participated in both sports for a special training camp. What is the probability that exactly 4 of them are from Senior Four, given the stated proportions?

ITEM 57

A commercial bank with branches in Kampala surveyed 1,200 customers about their banking preferences. The survey found that 750 customers use mobile banking, 600 use internet banking, and 400 use both mobile and internet banking. The bank also offers agency banking through local agents, and 500 customers reported using agency banking. Further analysis revealed that among customers who use both mobile and internet banking, 300 also use agency banking. Among those who use only mobile banking (not internet), 120 use agency banking. Among those who use only internet banking (not mobile), 80 use agency banking. The remaining agency banking users come from customers who use neither mobile nor internet banking. The bank wants to understand the overlap between different banking channels to improve its digital strategy. The probability of a customer using multiple channels affects how the bank allocates resources. The marketing department plans to target customers who use at least two channels with a special promotion.

Task

1. Using set theory, determine the number of customers who use exactly one of mobile or internet banking, and the number who use neither mobile nor internet banking. Then calculate the probability that a randomly selected customer uses agency banking.
2. If a customer is randomly selected from those who use internet banking, what is the probability that they a

ITEM 58

An environmental agency conducted a study on waste disposal practices in 500 households in a municipality. The study categorized households by their primary waste disposal method: burning, composting, or municipal collection. The results showed that 220 households burn their waste, 180 households compost organic waste, and 250 households use municipal collection services. Some households use multiple methods: 80 households both burn and compost, 70 households both burn and use municipal collection, 60 households both compost and use municipal collection, and 30 households use all three methods. The agency also assessed environmental awareness levels and found that 300 households were classified as "environmentally conscious" based on a separate survey. Among households that use composting, 150 are environmentally conscious. Among households that use municipal collection only (not burning or composting), 80 are environmentally conscious. The agency wants to identify target groups for environmental education campaigns. The probability

of a household being environmentally conscious varies by waste disposal method. The agency plans to randomly select households for a follow-up interview.

Task

1. Using a Venn diagram approach, determine the number of households that use exactly one waste disposal method. Then calculate the probability that a randomly selected household uses exactly two methods.
2. If a household is randomly selected from those that are environmentally conscious, what is the probability that they use composting? Show your working.
3. Calculate the probability that a randomly selected household either uses municipal collection OR is environmentally conscious (or both). Determine whether these events are independent.
4. The agency randomly selects 8 households from those that use all three waste disposal methods for a detailed case study. What is the probability that exactly 5 of them are environmentally conscious, if 70% of households using all three methods are environmentally conscious?

ITEM 59

The traffic police department in a major city analyzed accident reports for 600 accidents that occurred over a one-year period. The analysis considered three factors: speeding, drunk driving, and night time. The records showed that speeding was a factor in 320 accidents, drunk driving in 280 accidents, and night time in 240 accidents. Multiple factors were often present: 150 accidents involved both speeding and drunk driving, 130 involved both speeding and night time, 110 involved both drunk driving and night time, and 70 involved all three factors. The department also recorded the severity of accidents: 200 accidents resulted in serious injuries or fatalities. Among accidents involving all three factors, 50 were serious. Among accidents involving exactly two factors, 80 were serious. Among accidents involving exactly one factor, 60 were serious. The remaining serious accidents involved none of these three factors. The police want to understand the relationship between these factors and accident severity to design targeted enforcement campaigns. The probability of a serious accident given certain conditions is crucial for resource allocation.

Task

1. Determine the number of accidents that involved exactly one of the three factors, exactly two factors, and none of the factors. Then calculate the probability that a randomly selected accident involved at least two factors.
2. If an accident is randomly selected from those that involved speeding, what is the probability that it also involved drunk driving? Compare this with the probability for night time.
3. Calculate the probability that a randomly selected accident was serious given that it involved all three factors. Compare this with the overall probability of a serious accident and comment on the finding.
4. The police randomly select 4 accidents from those that involved drunk driving for detailed reconstruction. What is the probability that at least 2 of them also involved speeding, assuming the proportion holds?

ITEM 60

The canteen at a large secondary school conducted a survey of 400 students to determine their lunch preferences. The canteen offers three main dishes: rice, matooke, and posho. Students can choose one main dish each day. The survey found that over a one-month period, 220 students preferred rice, 180 preferred

matooke, and 160 preferred posho. Some students had multiple preferences depending on the day, so the survey allowed students to select more than one favorite. The results showed that 90 students preferred both rice and matooke, 80 preferred both rice and posho, 70 preferred both matooke and posho, and 40 preferred all three dishes. The canteen manager also collected data on students' boarding status: 250 students are boarders, and 150 are day scholars. Among boarders, 150 preferred rice, 120 preferred matooke, and 100 preferred posho. Among day scholars, 70 preferred rice, 60 preferred matooke, and 60 preferred posho. The canteen wants to plan its food purchases based on these preferences. The probability of a student preferring a particular dish affects ordering quantities. The manager plans to introduce a new dish and wants to understand current preference patterns.

Task

1. Using set theory, determine the number of students who preferred exactly one dish, exactly two dishes, and all three dishes. Then calculate the probability that a randomly selected student preferred exactly two dishes.
2. If a student is randomly selected from those who preferred rice, what is the probability that they are a boarder? Show your working.
3. Calculate the probability that a randomly selected student preferred matooke OR posho (or both). Are these events mutually exclusive? Justify.
4. The canteen randomly selects 6 students from those who preferred all three dishes for a taste test of a new recipe. What is the probability that exactly 4 of them are boarders, if 65% of students who preferred all three dishes are boarders?

ITEM 61

A health organization conducted a survey of 800 adults in a district to assess awareness of three diseases: malaria, HIV/AIDS, and tuberculosis. The survey found that 520 respondents were aware of malaria, 480 were aware of HIV/AIDS, and 400 were aware of tuberculosis. Multiple awareness was common: 320 were aware of both malaria and HIV/AIDS, 280 were aware of both malaria and tuberculosis, 260 were aware of both HIV/AIDS and tuberculosis, and 200 were aware of all three diseases. The organization also assessed whether respondents had been tested for these diseases: 350 respondents had been tested for at least one disease. Among those aware of all three diseases, 150 had been tested. Among those aware of exactly two diseases, 120 had been tested. Among those aware of exactly one disease, 70 had been tested. The remaining tested respondents came from those aware of none of the diseases. The organization wants to target awareness campaigns to increase testing rates. The probability of being tested given awareness levels is important for intervention design. The organization plans to randomly select respondents for in-depth interviews.

Task

1. Determine the number of respondents who were aware of exactly one disease, exactly two diseases, and none of the diseases. Then calculate the probability that a randomly selected respondent was aware of at least two diseases.
2. If a respondent is randomly selected from those who were aware of HIV/AIDS, what is the probability that they were also aware of tuberculosis? Show your working.
3. Calculate the probability that a respondent had been tested given that they were aware of all three diseases. Compare this with the probability for those aware of exactly one disease.

4. The organization randomly selects 5 respondents from those who were aware of exactly two diseases for a focus group discussion. What is the probability that at least 3 of them had been tested, if 40% of respondents aware of exactly two diseases had been tested?

ITEM 62

A labor statistics office conducted a survey of 1,000 working-age adults in a city to study employment patterns across three sectors: agriculture, manufacturing, and services. The survey found that 350 people worked in agriculture, 400 in manufacturing, and 450 in services. Some people worked in multiple sectors, especially in informal employment: 150 worked in both agriculture and manufacturing, 180 worked in both agriculture and services, 200 worked in both manufacturing and services, and 100 worked in all three sectors. The survey also collected data on education levels: 600 respondents had completed secondary education. Among those who worked in all three sectors, 80 had completed secondary education. Among those who worked in exactly two sectors, 220 had completed secondary education. Among those who worked in exactly one sector, 250 had completed secondary education. The remaining respondents with secondary education worked in none of these sectors (unemployed or in other sectors). The office wants to understand the relationship between multiple sector employment and education. The probability of a person having secondary education varies by employment category. The office plans to select respondents for a follow-up skills assessment.

Task

1. Using set theory, determine the number of respondents who worked in exactly one sector, exactly two sectors, and none of these three sectors. Then calculate the probability that a randomly selected respondent worked in at least two sectors.
2. If a respondent is randomly selected from those who worked in services, what is the probability that they also worked in manufacturing? Show your working.
3. Calculate the probability that a respondent had completed secondary education given that they worked in exactly two sectors. Compare this with the probability for those working in all three sectors.
4. The labor office randomly selects 7 respondents from those who worked in agriculture for a training program. What is the probability that exactly 5 of them had completed secondary education, if 55% of agricultural workers had completed secondary education?

BUSINESS MATHEMATICS

ITEM 1

Your father has decided to explore other options for your A-level education since the expenses at the previous school were beyond the budget. After some research, he has found another school that offers a more affordable option. He drove 30km east and 40km north to reach the school and found out that the details of the new school were as follows: The school fees are Shs 750,000 per term, an admission fee of Shs 80,000 and the uniform cost is Shs 300,000. The school offers a 60% bursary on the school fees for students who scored a first grade in their O-level exams, and you qualify for this bursary. Your father is considering the following two payment plans offered by the new school: ¬ Paying the full amount (school fees, admission, and uniform) at the beginning of the term. Paying the school fees in three equal instalments at the beginning of the term, on visitation day, and at the end of the term, while paying the admission and uniform fees upfront.

Task

1. Calculate the total cost of attending the new school, considering that you qualify for the bursary.
2. Determine which payment plan would be more suitable for your father's budget and explain your reasoning.
3. If your father chooses the three-installment plan, calculate the amount to be paid in each installment.
4. How far is it from your home to school if you travel through the direct route?

ITEM 2

Mubarak had UGX.750, 000 on his account and he wanted to buy a Washing Machine. He went at the shop and the price of the machine was UGX.960, 000. He went home and waited. One month later, the price was decreased by 15% and then 9% in the second month.

Task

1. Was Mubarak able to buy the Machine after the decreases? If yes, was he able to remain with any balance?

ITEM 3

Your mom is planning to enroll you in a boarding school for your O-level education. She has a budget of Shs 5,000,000 for your school expenses. To visit the school, she decides to take bodaboda. The bodaboda travels 3 km west from your home to the main road, then 4 km south to re ach the school. However, you later realize there's a shortcut path that leads directly from your home to the school. Upon reaching the school, your mom learns that the school fees are Shs 3,000,000, boarding fees are Shs 1,500,000, and the cost of school supplies is Shs 500,000. Fortunately, the school offers a scholarship program. Students with excellent primary school leaving exam results receive a 50% discount on school fees, a Shs 200,000 reduction in boarding fees, and a reduction of Shs 150,000 for school supplies. You are eligible for this scholarship based on your outstanding performance. The school also offers two payment options for school fees:

Option 1: Two Installments - Pay two-fifths of the school fees at the beginning of the term and the remaining balance before the mid-term exams.

Option 2: Four Installments - Pay equal amounts at the beginning of the term, before mid-term exams, after midterm, and before final exams.

Task

1. What is the distance from your home to the school using the direct path?
2. Considering the scholarship, calculate the total amount your aunt will pay for your school expenses.
3. Can your mom afford the school expenses based on her budget?
4. For those paying the full school fees amount, calculate the amount paid per installment for each payment option.
5. Which payment option would you recommend? Give reasons.

ITEM 4

Paul and Sons Enterprise buys 50kg bags of sugar, 25kg bags of rice and 100kg bags of maize flour from a factory at UGX 225,000, UGX 100,000 and UGX 250,000 per bag respectively. He then sells each bag of sugar, rice and maize flour at UGX 250,000, UGX 112,500 and UGX 300,000 respectively. Paul pays an income tax of 15% of the monthly profit, a commission of 8% of the profit made on a monthly basis to his shop attendant and 10% of the monthly profit to SWICO insurance company. SWICO insurance company offers a discount of 6% of the basic premium expense to clients with CCTV cameras in their businesses. Given that Paul installed CCTV cameras in his shop and sells 75 bags of sugar, 45 bags of rice and 60 bags of maize flour per month.

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

Task

1. Calculate Paul's net profit per month.
2. Help Paul to find out which bank to choose to apply for the loan given that she will pay the loan after 2 years.

ITEM 5

TY FM is hosting a highly anticipated concert, funny, at Kakuya grounds. It's expected to attract a large audience and the organizers have set two different ticket prices to cater for different income levels. The concert tickets are being sold at two different prices: - Tickets for the VIP area are priced at Sh. 10,000 each. - Tickets for the general area are priced at Sh. 5,000 each. While the organizers have a total of 30 tickets available. After the initial sales period, the total amount raised from the ticket sales is Sh. 800,000.

Task

1. As the finance manager for the funny, estimate how many tickets were sold at the price of Sh. 5,000 and Sh. 10,000.
2. What could be done by organizers to maximize concert attendances?

ITEM 6

Bbuye is an employee working in a private company in Uganda. He earns a gross monthly income of UGX 1,500,000. Bbuye is married and has six children - two aged 6 and 8, three aged 15, and one aged 19. Walugosi receives various allowances from his employer, including:

- Insurance and relief: UGX 222,000 per annum

- Water and electricity: UGX 21,000 per month

- Medical: UGX 318,000 per annum

- Housing allowance: UGX 55,000 per month

- Transport allowance: UGX 42,000 per month

- Family allowance for the three children under 18 years old. Bbuye is concerned about the amount of income tax he has to pay each month and wants to understand how it is calculated based on the tax structure below;

Taxable income(UGX) per month	Tax rate (%)
1 - 40,000	8.0
40,0001 - 100,000	16.5
100,001 - 200,000	24.0
200,001 - 350,000	32.5
350,001 - 510,000	43.0
Above 510,000	48.5

Task

1. As an expert in tax calculations, help him determine, the income tax he has to pay monthly.
2. His net income.
3. What percentage of his gross monthly income goes to tax?
4. With the help of two relevant example(s), help Bbuye understand why it is important to pay tax.

ITEM 7

A shopkeeper buys a consignment of shirts at Shs 48,000 per dozen and sells them individually. He orders 120 shirts and finds that 6 shirts are damaged and must be sold at 40% of the normal sale price. He wants to achieve an overall profit margin of 25% on cost after taking damaged shirts into account.

Task

1. Calculate the required selling price per good shirt and the total revenue if he sells all good shirts at that price.
2. Also compute the break-even selling price per good shirt if he cannot recover anything from the damaged shirts.
3. Show how this changes if supplier gives a 10% discount on the original cost for bulk orders over 100 shirts.

ITEM 8

A baker mixes two types of flour: grade A costs Shs 3,600 per 25 kg bag and grade B costs Shs 2,400 per 25 kg bag. She wants to make 625 kg of a mixture that sells at Shs 160 per kg to local schools and give a 15% profit on total cost.

Task

1. Determine how many bags of each grade she should mix if she uses twice as much B by mass as A.
2. Calculate total cost, total selling price, and profit in Shs.
3. If schools demand packaging in 5-kg sacks, compute how many sacks and the revenue per sack.
4. Discuss what happens to required selling price if flour B price rises by 20%.

ITEM 9

A wholesaler imports 2,000 units of an electronics accessory at a landed cost of US$2.50 per unit. Import duties and clearance add 18% on the CIF value and inland transport is Shs 400,000 in total. The wholesaler sets a local selling price in Shs such that he makes a 30% profit on cost.

Given an exchange rate of US$1 = Shs 3,800,

Task

1. Compute the unit cost in Shs, the selling price per unit, and total expected profit if all stock is sold.
2. Also calculate the new selling price if the exchange rate weakens to Shs 4,100 per US$. Consider how to present round prices for marketing (e.g., ending in 900 or 500).

ITEM 10

The factory's fixed costs are Shs 120,000 per day and variable cost is Shs 90 per bottle. Management considers raising price from Shs 200 to Shs 230 per bottle and wants to know the new daily profit.

Task

1. Also compute the break-even number of bottles at the current price and at the proposed price.
2. If a 5% drop in demand occurs when price increases, determine the new profit and advise whether to increase price. Include a sensitivity check for variable cost rising by 10%.

ITEM 11

A salon purchases shampoo in drums and repackages into 500 ml bottles for resale. A 200-litre drum costs Shs 240,000 and yields 400 bottles of 500 ml each after losses. Repackaging (bottles and labels) costs Shs 200 per bottle. The salon sells each bottle at Shs 900 and records 8% spoilage during handling.

Task

1. Compute the actual number of saleable bottles, unit cost per bottle, total daily revenue if 120 bottles are sold, and net profit per drum.
2. Explain how packaging cost or spoilage percentage changes affect profit margin.

ITEM 12

A trader offers a "buy 2 get 1 free" on a product normally sold at Shs 6,000 each. She buys stock at Shs 3,600 per piece. A school orders 150 pieces and wants them delivered in equal cartons of 10.

Task

1. Determine how many free items the school receives and the effective cost per piece paid by the school.
2. Compute the trader's gross profit on the order and the inventory units remaining if she had 200 pieces initially.
3. If the trader instead applied a flat 25% discount on all items, compare total revenue and profit to the bundle offer.

ITEM 13

A retailer applies Value Added Tax (VAT) of 18% on taxable sales. An item's price tag is Shs 4,720 inclusive of VAT.

Task

1. Compute the VAT-exclusive price and the VAT amount.
2. Then consider a bulk buyer who gets a 12% trade discount on the VAT-exclusive price; compute the final invoice the buyer pays.
3. If the retailer mistakenly treats the discount as applied after VAT, show the difference and explain which is legally correct.

ITEM 14

A small garment business uses a simple overhead allocation method: overheads Shs 600,000 per month allocated by machine hours.

There are two products: trousers (machine hours 0.5 per piece) and shirts (0.25 per piece).

In a month they make 2,000 trousers and 3,000 shirts. Direct material and labour cost per trouser is Shs 6,000 and per shirt Shs 2,800.

Task

1. Compute the overhead rate per machine hour, total unit cost for each product, and suggest a selling price with 20% markup on cost.
2. If the firm changes to activity-based costing and finds trousers use more setup time, discuss how allocation might change prices.

ITEM 15

A manufacturer has a capacity to produce 1,200 units per week and fixed weekly costs of Shs 480,000. Variable cost per unit is Shs 220.

A competitor sells a similar product at Shs 420 and the manufacturer considers a penetration price of Shs 380 for the first 8 weeks to capture market share.

Task

1. Determine weekly profit or loss at the penetration price assuming 1,000 units are sold.
2. Compute the margin and payback period if the manufacturer expects to raise price to Shs 460 after 8 weeks.
3. Discuss risks and when penetration pricing works.

ITEM 16

A fruit vendor buys mangoes in bulk and uses a 10% waste allowance for bruised fruit. He pays Shs 120,000 for 100 kg and wants a 35% markup on cost after waste.

Task

1. Determine the sale price per kg of good mangoes.
2. If he sells in 2-kg bundles with a promotional discount of Shs 200 per bundle, compute new effective price per kg and profit margin.
3. Show consequences if waste unexpectedly rises to 15%.

ITEM 17

A business owner takes a loan of Shs 4,000,000 at simple interest of 12% per annum for 18 months to buy equipment. She repays in lump sum at the end.

Task

1. Compute total interest and total repayment.
2. An alternative is a reducing-balance loan with same nominal annual rate but monthly repayments—explain why total interest is less and show the formula setup for monthly payment.
3. If equipment is expected to produce Shs 250,000 per month net, calculate how long to break even on the purchase including interest.

ITEM 18

An online seller faces shipping fees: flat Shs 5,000 per order plus Shs 70 per kg.

She sells a product weighing 1.8 kg and wants to price competitively while keeping 18% margin after shipping and platform fees of 3% of sale price.

Task

1. Compute minimum sale price and recommend a round price for marketing.
2. If she bundles two products together shipping per kg stays same but flat fee still applies, compute price per item in the bundle for same margin.

ITEM 19

A retailer issues credit to customers and charges 2% interest per month on overdue balances.

One customer buys Shs 120,000 worth of goods on credit and pays in three instalments: Shs 40,000 after 30 days, Shs 40,000 after 60 days, and remaining after 90 days.

Task

1. Compute total interest charged and effective annual interest rate approximated from these payments.
2. If the retailer offers a 2% cash discount for early payment within 7 days, compare the net receipt versus the instalment plan for the same customer.

ITEM 20

A courier company uses tiered pricing: first 2 kg Shs 2,500, next up to 5 kg Shs 700 per kg, and above 5 kg Shs 500 per kg.

Task

1. A customer ships 8.4 kg. Compute total shipping fee.
2. The company introduces a frequent-customer discount of 10% off total fee after the first 10 shipments per month; calculate fee with discount.
3. Consider how rounding weight to the next 0.1 or 0.5 kg affects revenue and customer fairness.

ITEM 21

A retailer wants to compare two suppliers: Supplier X charges Shs 480 per unit with free delivery for orders above 1,000 units; Supplier Y charges Shs 450 per unit but charges Shs 60,000 delivery per order.

Task

1. For an order of 1,200 units, determine which supplier is cheaper.
2. Compute break-even order quantity where both suppliers cost the same.
3. Include the effect of a supplier rebate of Shs 10 per unit for orders above 2,000 units.

ITEM 22

A trader marks up goods by 40% on cost price. During a busy season she advertises 20% off the marked price.

Task

1. Calculate the effective discount on cost price and the resulting profit margin.
2. If the trader wants to guarantee at least 15% profit after discount, find the minimum markup she should set.
3. Show algebraic derivation and give a general formula connecting markup on cost to final margin after discount.

ITEM 23

A retailer experiments with repeated discounts: an item has sticker price Shs 5,000, then 10% off then further 5% off the discounted price and then a Shs 200 coupon.

Task

1. Compute final price and effective total discount percent.
2. Show shortcut by combining percentage discounts multiplicatively and then subtract fixed coupon.
3. Explain why 10% + 5% ≠ 15% off the original.

ITEM 24

A supermarket uses loyalty points: customers earn 1 point per Shs 100 spent and 500 points give Shs 5,000 off next purchase.

Task

1. A shopper spends Shs 72,350 in a month. Compute points earned and effective discount rate when points redeemed.
2. If average marginal profit on goods is 20% of selling price, calculate net effect on margin when points redeemed on a Shs 40,000 purchase.

ITEM 25

A printing shop quotes jobs by page and colour usage. Black & white page Shs 30, colour page Shs 180, plus setup Shs 6,000 per job.

A school orders a 120-page booklet: 10 pages colour and the rest black & white; they need 200 copies.

Task

1. Compute total printing cost, unit cost per booklet, and recommended selling price with 25% margin.
2. If the shop offers a 10% discount for orders > 300 copies, compute new unit cost and margin.

ITEM 26

A food processing plant experiences yield loss: raw cassava 1,000 kg produces 620 kg of final product. Raw cost Shs 180 per kg and processing cost Shs 25 per kg raw.

Task

1. Compute cost per kg of finished product.
2. If product packaged in 1-kg packs and sold at Shs 200, compute profit per pack and margin.
3. Evaluate effect on margin if yield improves to 660 kg.

ITEM 27

A company pays commission: 5% on first Shs 1,000,000 sales, 3% on next Shs 2,000,000, and 1% thereafter.

Task

1. An agent sells Shs 3,800,000 in a month. Compute commission and net receipts if tax withheld at 10% on commission.
2. Propose how to structure sliding-scale commission to encourage higher sales while controlling company margins.

ITEM 28

A saleswoman earns a basic salary of Shs 500,000 per month. She also earns a commission of 6% on all sales above Shs 3,000,000. In a particular month, she sold goods worth Shs 7,500,000. She also received a bonus of Shs 150,000 for being the top salesperson.

Task

1. Calculate the value of sales on which she earns commission.
2. Calculate her commission for the month.
3. What are her total earnings for that month?
4. If she wants her total earnings to be Shs 1,200,000 next month, what must be her total sales?
5. Express her commission as a percentage of her total sales for the month.

ITEM 29

Okello, a farmer in Gulu, harvested 2,500 kg of maize. He plans to sell it in sacks. Each sack can hold 50 kg of maize. He also grew 1,200 kg of beans, which he packs in 25 kg bags. The local miller buys maize at Shs 1,500 per kg and beans at Shs 3,200 per kg. Okello also has to pay a market levy of Shs 5,000 for his stall and Shs 20,000 for transport to the market.

Tasks

1. Calculate the total number of sacks needed for the maize and bags for the beans.
2. Find the total revenue from selling all the maize and beans.
3. Determine the total profit Okello makes after deducting all his costs.

ITEM 30

A trading center in Kabale was recently connected to the national grid. A family wants to install solar panels as a backup. The initial cost of the solar system is Shs 2,500,000. They currently spend Shs 150,000 per month on electricity from the grid. They estimate that with the solar system, their monthly bill will reduce by 80%.

Task

1. Calculate their new estimated monthly electricity bill after installing solar.
2. Determine their total savings on electricity in one year.
3. Find the number of years it will take for the savings to cover the initial cost of the solar system.

ITEM 31

A small retail shop in Arua buys 10 cartons of cooking oil. Each carton contains 12 bottles, and the shop pays Shs 360,000 for all the cartons. The shop owner plans to sell each bottle at a 25% profit margin based on the cost price per bottle. Unfortunately, during transport, 5 bottles broke and could not be sold.

Task

1. Find the cost price of one bottle of cooking oil.
2. Calculate the intended selling price of one bottle.
3. Determine the actual selling price per bottle if the owner wants to maintain the same total profit he would have made if none had broken.

ITEM 32

Namubiru runs a catering service in Jinja. She is preparing food for a wedding reception with 600 guests. She plans to serve 0.25 kg of meat per person. The meat costs Shs 12,000 per kg. She also needs to buy 2,500 buns, with each bun costing Shs 500. She hires 10 waiters for the event, each at a cost of Shs 25,000.

Task

1. Calculate the total kilograms of meat required.
2. Find the total cost of the meat and the buns.
3. If she adds the cost of waiters to the food costs, what is the total expenditure for the event?

ITEM 33

A school in Mbarara wants to buy new desks for its 480 students. They plan to put 3 students at each desk. A furniture workshop offers two payment plans. Plan A: Cash payment of Shs 95,000 per desk. Plan B: A down payment of 25% of the total cash price and then the remainder paid in 6 equal monthly installments.

Task

1. How many desks does the school need to buy?
2. Calculate the total cost of all the desks under Plan A.
3. For Plan B, find the amount of the down payment and the value of each monthly installment.

ITEM 34

Katusabe is a coffee trader in Mbale. He bought 800 kg of Robusta coffee at Shs 4,500 per kg. He then spent Shs 200,000 on transportation and Shs 150,000 on processing the beans. To make a profit, he decides to sell the coffee at a price that gives him a 30% profit on his total cost of buying, transporting, and processing.

Task

1. Calculate Katusabe's total cost for the coffee.
2. Determine the total selling price he needs to achieve his 30% profit.

3. Find the selling price per kg of the coffee.

ITEM 35

A savings and credit cooperative organization (SACCO) in Lira offers its members a loan with a simple interest rate of 12% per annum. A member, Acen, borrows Shs 3,000,000 to renovate her house. She agrees to repay the loan plus interest in one lump sum after 3 years.

Task

1. Calculate the simple interest Acen will pay on the loan.
2. Find the total amount (principal + interest) she will repay to the SACCO.
3. If she wants to repay the loan in 4 years instead of 3, how much more interest would she pay?

ITEM 36

Mukasa runs a roadside stall selling roasted chicken. He buys 5 live chickens for a total of Shs 150,000. Each chicken, when prepared, yields 1.2 kg of meat. He sells the roasted meat at Shs 35,000 per kg. He also spends Shs 15,000 on charcoal and spices for roasting all the chickens.

Task

1. What is the total weight of meat Mukasa gets from the 5 chickens?
2. Calculate his total revenue from selling all the meat.
3. Find his net profit after subtracting the cost of the chickens and the roasting expenses.

ITEM 37

A group of 8 friends in Kampala decide to start a small poultry project. They contribute equally to buy 200 chicks at Shs 5,000 each. They also spend a total of Shs 400,000 on feed and medication for the chicks until they are mature. They later sell all the mature birds at Shs 15,000 each.

Task

1. Find the total amount the group spent on buying the chicks and raising them.
2. Calculate their total revenue from selling the birds.
3. Determine the total profit made and find how much each friend gets if they share the profit equally.

ITEM 38

A textile shop in Fort Portal is having a clearance sale. A suit originally priced at Shs 250,000 is given a discount of 15%. Another customer is interested in a gown whose price after a 10% discount is Shs 135,000.

Task

1. Calculate the sale price of the suit after the 15% discount.
2. Find the original price of the gown before the discount.
3. If a customer buys both the suit (at sale price) and the gown (at its discounted price), and then gets a further 5% loyalty discount on this total, how much does he pay?

ITEM 39

A bus company operating between Kampala and Gulu sells tickets. An adult ticket costs Shs 35,000 and a child ticket costs half the price of an adult ticket. On one trip, the bus, which has 60 seats, was full. The total revenue from ticket sales for that trip was Shs 1,800,000.

Task

1. What is the price of a child ticket?
2. Taking the number of adults as a and children as c, form two equations to represent the total number of passengers and the total revenue.
3. Solve the equations to find the number of adults and children on the bus.

ITEM 40

Nambi wants to save money to buy a new smartphone costing Shs 1,200,000. She deposits her money in a bank that offers compound interest at a rate of 5% per annum, compounded annually. She makes an initial deposit of Shs 1,000,000 and plans to leave it in the bank for 2 years.

Task

1. Calculate the amount in her account at the end of the first year.
2. Find the total amount in her account at the end of the second year.
3. How much more money does she need to add after 2 years to buy the smartphone?

ITEM 41

A hardware store in Masaka sells iron sheets in bundles. A bundle contains 20 iron sheets and costs Shs 680,000. A customer wants to buy 45 iron sheets for his new house. He also needs 15 kg of nails costing Shs 4,500 per kg.

Task

1. How many bundles must the customer buy to get at least 45 iron sheets, and how many extra sheets will he have?
2. Calculate the total cost of the iron sheets he buys.
3. Find the total bill for the iron sheets and the nails.

ITEM 42

Odinga, a farmer in Soroti, operates a small fish farm. He has a pond with 400 fish. He estimates that the average weight of each fish is 1.5 kg. The market price for fresh fish is Shs 8,000 per kg. He sells his fish to a local trader who offers him a price that is 15% lower than the market price.

Task

1. What is the total estimated weight of all the fish in the pond?
2. Calculate the price per kg the trader is offering Odongo.
3. Determine the total amount Odinga will receive from the trader if he sells all his fish.

ITEM 43

A small bakery in Mityana produces 1,200 loaves of bread each day. Each loaf requires 0.4 kg of flour. A 50 kg bag of flour costs Shs 110,000. The bakery also incurs daily overhead costs of Shs 150,000 for labor, power, and transport.

Task

1. How many kilograms of flour are needed per day?
2. How many 50 kg bags of flour are needed daily, and what is their total cost?
3. Calculate the bakery's total daily cost (flour + overhead) and find the cost of producing one loaf of bread.

ITEM 44

A family in Mbarara has a water tank that can hold 5,000 litres. They use 200 litres of water per day for household chores. During a dry spell, they decide to ration their water to 150 litres per day to make it last longer.

Task

1. Under normal usage, for how many days would a full tank last?
2. Under the rationing plan, for how many days will the tank last?
3. By rationing, how many more days of water do they gain from a full tank?

ITEM 45

Kintu operates a taxi on the Kampala-Jinja route. He bought the taxi for Shs 35,000,000. He estimates its value will depreciate by 18% each year, using the reducing balance method.

Task

1. Calculate the value of the taxi after one year.
2. Find the value of the taxi after two years.
3. How much total value has the taxi lost over the two years?

ITEM 46

A school canteen in Gulu buys 5 crates of soda. Each crate contains 24 bottles and costs Shs 28,000. The canteen sells each bottle of soda at Shs 1,800. By the end of the week, they sold all the soda except for 8 bottles.

Task

1. Calculate the total cost of the 5 crates of soda.
2. How many bottles of soda were sold?
3. Find the total revenue from the sold bottles and the profit made.

ITEM 47

Nakato is a vendor at a craft market in Kampala. She buys 30 handcrafted necklaces from a local artist at Shs 12,000 each. She sells 2/3 of them at a price that gives her a 40% profit on the cost price. She sells the remaining necklaces at a 20% discount on her initial selling price.

Task

1. Find the total cost of all the necklaces.
2. Determine the initial selling price of one necklace to achieve a 40% profit.
3. Calculate the total revenue from all the necklaces (first batch and second batch combined).

ITEM 48

Two friends, Ali and Babu, decide to start a small business selling mobile money services. Ali contributes Shs 800,000 and Babu contributes Shs 600,000. After one year, their business makes a total profit of Shs 490,000. They agree to share the profit in proportion to their capital contributions.

Task

1. What is the total capital invested in the business?
2. Express the ratio of Ali's contribution to Babu's contribution in its simplest form.
3. Calculate how much profit each partner receives.

ITEM 49

A shop in Lira sells a bag of rice for Shs 110,000, making a profit of 10%. The shopkeeper wants to increase his profit to 25%.

Task

1. What is the cost price of the bag of rice?
2. What should be the new selling price of the bag of rice to achieve a 25% profit?
3. If he offers a discount of 5% on this new selling price, what would be the new profit percentage?

ITEM 50

A school in Kabale wants to take its 180 students on a trip to a national park. They hire a bus that can carry 60 passengers at a cost of Shs 750,000. The entry fee to the park is Shs 15,000 per student. They also budget Shs 5,000 per student for a packed lunch.

Task

1. How many buses will they need to hire to carry all the students?
2. Calculate the total cost of hiring the buses.
3. Find the total cost for park entry fees and lunches for all the students.
4. What is the total cost of the trip for the school?

ITEM 51

Mukisa invests Shs 2,500,000 in a savings account that offers compound interest of 4% per annum, compounded annually. He invests another Shs 2,000,000 in a different account that offers simple interest of 6% per annum. He wants to compare the two investments after 3 years.

Task

1. Calculate the total amount in the compound interest account after 3 years.
2. Calculate the total amount in the simple interest account after 3 years.
3. Which investment yields more money after 3 years and by how much?

ITEM 52

A restaurant in Arua buys 20 kg of beef at Shs 12,000 per kg and 15 kg of chicken at Shs 15,000 per kg. They use all the meat to make stew. The cost of other ingredients (tomatoes, onions, oil, etc.) for the stew is Shs 85,000. They plan to sell the stew in plates, with each plate containing 0.3 kg of meat.

Task

1. What is the total cost of the beef and chicken?
2. What is the total cost of making all the stew (meat + other ingredients)?
3. How many plates of stew can they prepare from the total meat?
4. If they want a 50% profit on the total cost of the stew, what should be the selling price per plate?

ITEM 53

A furniture maker in Jinja buys wood to make tables and chairs. He has a budget of Shs 2,000,000 for wood. A table requires wood costing Shs 150,000, and a chair requires wood costing Shs 50,000. He has orders for at least 10 tables and 15 chairs.

Task

1. Write down inequalities to represent the number of tables (t) and chairs (c) he can make, considering his budget and the minimum orders.
2. If he makes exactly 10 tables, what is the maximum number of chairs he can make within his budget?
3. What is the total cost of wood if he makes 12 tables and 18 chairs? Is this within his budget?

ITEM 54

A family in Mityana receives a water bill. They used 25,000 litres of water in a month. The water company charges Shs 500 for the first 5,000 litres and Shs 150 for every 1,000 litres (or part thereof) thereafter. There is also a fixed service charge of Shs 3,500 per month.

Task

1. How many additional 1,000-litre blocks were used after the first 5,000 litres?
2. Calculate the total consumption charge for the water used.
3. Find the total amount of the water bill for the month, including the service charge.

ITEM 55

Okot is a second-hand clothes dealer in Gulu. He bought a bale of clothes containing 50 pieces for Shs 600,000. He sold 20 of them at Shs 18,000 each, 15 at Shs 15,000 each, and the rest at a clearance price of Shs 10,000 each.

Task

1. Calculate the revenue from each batch of clothes.
2. Find his total revenue from all the clothes.
3. Determine his overall profit or loss from the bale.

ITEM 56

A construction company in Kampala is building a wall. The wall requires 2,500 bricks. The company already has 800 bricks. They need to buy more bricks in batches. A batch contains 500 bricks and costs Shs 450,000.

Task

1. How many more bricks does the company need to buy?
2. How many batches must they buy to get at least this number of bricks?

3. What is the total cost of the new bricks?
4. If the cost of cement and labor is Shs 1,200,000, find the total cost of building the wall.

ITEM 57

Nambi wants to send money to her mother in the village using a mobile money service. The service charges a fee of 1.5% of the amount being sent. She wants her mother to receive exactly Shs 250,000.

Task

1. If the amount Nambi sends is x, write an equation showing that after the 1.5% fee is deducted, her mother gets Shs 250,000.
2. Solve for x to find the amount Nambi must send.
3. What is the total fee charged for this transaction?

ITEM 58

A school in Fort Portal wants to fence its rectangular playground. The playground is 120 m long and 80 m wide. They plan to put up a fence with 5 strands of barbed wire. The fence posts are placed 5 m apart. A roll of barbed wire contains 500 m and costs Shs 250,000.

Task

1. Calculate the perimeter of the playground.
2. What is the total length of barbed wire needed for all 5 strands?
3. How many rolls of barbed wire are needed, and what is their total cost?

ITEM 59

A taxi driver in Mbale operates on a route where he pays a daily stage fee of Shs 5,000. His taxi consumes fuel worth Shs 40,000 per day. He makes 4 round trips, and each passenger pays Shs 2,000 per trip. He carries an average of 12 passengers per trip.

Task

1. Calculate the total number of passengers he carries in a day.
2. Find his total daily revenue from passengers.
3. Determine his net daily profit after deducting the stage fee and fuel costs.

ITEM 60

A dairy farmer in Mbarara has 15 cows. Each cow produces an average of 12 litres of milk per day. He sells the milk to a cooling plant at Shs 800 per litre. He spends Shs 40,000 per day on feeding the cows.

Task

1. Calculate the total litres of milk produced per day.
2. Find the farmer's total daily revenue from milk sales.
3. Determine his daily profit after subtracting the cost of feeding the cows.
4. What is his total profit for the month of April (30 days)?

ITEM 61

A group of 5 women in a village near Lira form a savings group. Each woman saves Shs 5,000 per week. They keep the money in a box. After 12 weeks, they decide to lend the total savings to a member at a simple interest rate of 5% per month for 3 months.

Task

1. What is the total amount saved by the group after 12 weeks?
2. Calculate the simple interest earned from the loan after 3 months.
3. If they share the total interest earned equally, how much does each woman receive?

ITEM 62

A small hardware shop in Jinja sells a bag of cement for Shs 32,000. This price gives the shop a profit of 28%. The manufacturer then increases the price of cement to the shop by 10%.

Task

1. Calculate the original cost price of the bag of cement for the shop.
2. What is the new cost price for the shop after the manufacturer's increase?
3. If the shop wants to maintain the same profit percentage of 28%, what should be the new selling price?
4. If the shop instead wants to maintain the same profit amount (in shillings) as before, what should be the new selling price?

ITEM 63

A school in Kabale received a donation of textbooks to be shared among three classes: Senior 1, Senior 2, and Senior 3. The books are to be shared in the ratio 3:4:5 respectively. Senior 3 receives 60 more books than Senior 1.

Task

1. If Senior 1 gets 3x books, express the number of books for Senior 2 and Senior 3 in terms of x.
2. Form an equation to represent that Senior 3 gets 60 more books than Senior 1, and solve for x.
3. Find the total number of books donated to the school.

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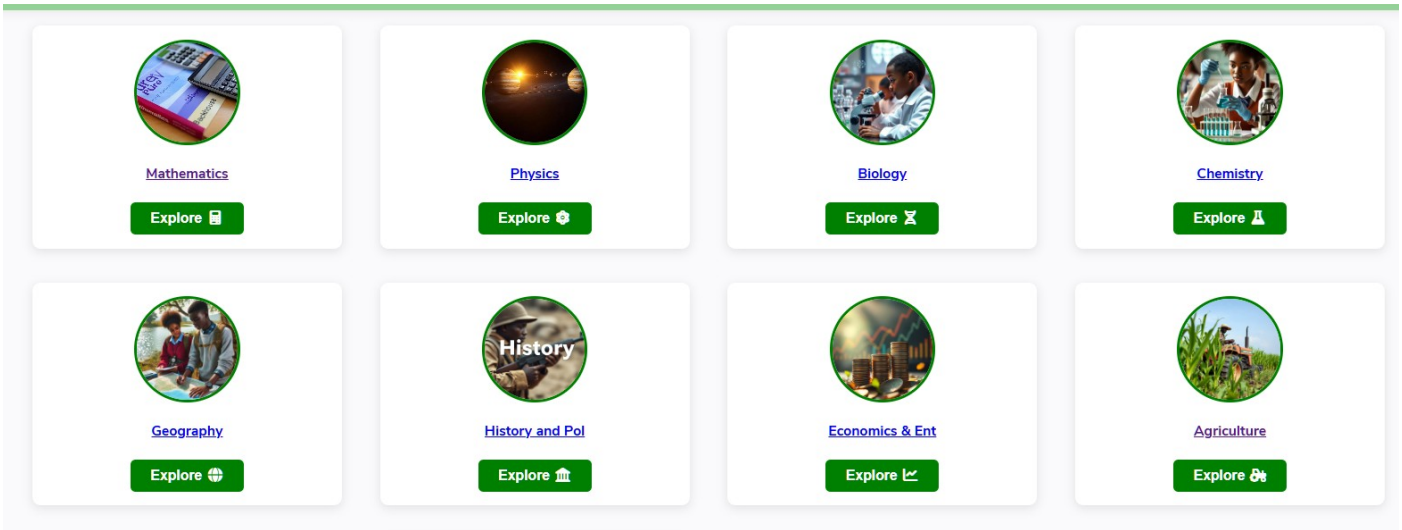
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