

Nsereko Robert 0750661248 RONSM Educational services



# RONSM

## EDUCATIONAL SERVICES

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**PREMOCK AND MOCK PREPARATION SETS**

**O LEVEL (UCE)**

**SUBJECT: MATHEMATICS**

**SET: Set 1 of 10**

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**THE UCE NEW MATHEMATICS CURRICULUM PAPER  
SETTING**

<b>Section A (compulsory)</b>		
Item	Element of construct	Topics
Item one(1)	Numbers	1. Number bases 2. Working with Integers 3. Rectangular Cartesian Coordinates in 2- Dimensions 4. Fractions, percentages and decimals 5. Numerical concepts 1 and 2 (a) Indices (b) Surds 6. Ratios and Proportions
Item 2(two)	Patterns and algebra	1. Sequence and patterns 2. Equation of lines and curves 3. Algebra 1 and 2 4. Mappings and relations 5. Vectors and translation 6. Inequalities and regions 7. Equation of a straight line 8. Simultaneous equations 9. Quadratic equations 10. Composite functions 11.. Equations and inequalities 12. linear programming 13. Loci
<b>Section B part I (choose one item from this section)</b>		

Item 3 (three) and 4(four)	Data and probability	<ol style="list-style-type: none"> <li>1. Data collection/display and presentation</li> <li>2. Graphs</li> <li>3. Set Theory</li> <li>4. Matrices</li> <li>5. Probability</li> </ol>
<b>Section B Part II (choose one item from this section)</b>		
Item 5( five) and 6(six)	Geometry and measures	<ol style="list-style-type: none"> <li>1. Geometric Constructions Skills</li> <li>2. Bearings</li> <li>3. General and angle properties of geometric figures</li> <li>4. Reflection</li> <li>5. Business mathematics</li> <li>6. Time and time tables</li> <li>7. Similarities and enlargement</li> <li>8. Circles</li> <li>9. Rotation</li> <li>10. Length and area properties of two-dimensional geometrical figures.</li> <li>11. Nets, areas and volumes of solids</li> <li>12. Trigonometry</li> <li>13. Vectors</li> <li>14. Matrix transformations</li> <li>15. Circle properties</li> <li>16. Lines and planes in three dimensions</li> </ol>

**LEARNING AREA; ELEMENT OF CONSTRUCT ONE  
(NUMBERS)**

### **Item 1**

The school library floor, measuring 12 meters by 8 meters, is being renovated. The head teacher wants to use two types of tiles to create a specific pattern: Executive Granite Tiles for the center and Standard Ceramic Tiles for the border.

The design specifications are as follows:

A uniform border of 1 meter wide must be left all around the edge of the room for the Standard Tiles.

The inner rectangular area will be covered with Executive Granite Tiles.

Executive Tiles come in boxes covering 2 square meters each and cost Shs 85,000 per box.

Standard Tiles come in boxes covering 3 square meters each and cost Shs 45,000 per box.

A “Wastage Factor” of 10% of the total area must be added to the tile order to account for cutting and breakages.

### **The Tasks**

a).Spatial Analysis: Calculate the area of the floor that will be covered by the Executive Granite Tiles and the area to be covered by the Standard Ceramic Tiles.

b).Procurement: Determine the number of boxes needed for each type of tile, ensuring you include the 10% wastage (Note: Tiles are only sold in full boxes).

c).Financial Planning: Prepare a brief requisition for the school bursar showing the total cost of the tiles.

c).Critical Thinking: If the budget is strictly Shs 4,000,000, can the school afford this design? If not, suggest one mathematical adjustment (e.g., to the border width or tile choice) that would bring the project within budget.

### **Item 2**

Mr. Okello is a commercial farmer in Mubende who tracks his weekly business performance using a “Balance Sheet.” In the new curriculum, we represent gains as positive integers and losses or debts as negative integers.

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At the start of the month, Mr. Okello's farm account had a balance of Shs 500,000. During the first two weeks of the rainy season, the following events occurred:

Week 1: He sold 10 bags of maize at Shs 80,000 each, but had to pay a transport debt of Shs 150,000.

Week 2: A heavy storm destroyed part of the poultry house. Repairs cost him Shs 1,200,000. To cover this, he took a quick mobile loan of Shs 600,000.

Week 3 Projection: He expects to sell 50 trays of eggs at Shs 12,000 per tray.

### **The Tasks**

As a student consultant helping Mr. Okello understand his financial position:

(a): Using the set of Integers, write down a mathematical expression that represents the net change in Mr. Okello's wealth from Week 1 to the end of Week 2.

(b): Calculate Mr. Okello's actual bank balance at the end of Week 2. (Note: A loan is a temporary gain in cash but a negative value in net worth).

c): If the bank charges a service fee of Shs 25,000 for any account that drops below a balance of Shs 0, determine if Mr. Okello will be charged this fee.

(d): Will the expected sales in Week 3 be enough to bring his account balance back to a positive state (above Shs 0)? Show your logical reasoning.

### **Item 3**

A contractor at your architecture firm is mixing concrete for a foundation. To achieve the required strength, the "Standard Mix" must follow these proportions by volume:

$\frac{1}{6}$  of the mix is Cement.

$\frac{1}{3}$  of the mix is Sand.

The remainder of the mix is Gravel (Crushed Stones).

The contractor has a total volume of 1,200 Liters of dry materials. However, a site inspection reveals that 15% of the Sand provided is "contaminated" with clay and cannot be used.

**The Tasks**

- a).Composition: Calculate the exact volume (in Liters) of Cement, Sand, and Gravel required for a perfect 1,200L mix.
- b).Material Audit: If the contractor started with exactly 400 Liters of Sand, determine if they still have enough “clean” sand to complete the 1,200L mix after discarding the 15% contaminated portion.
- c).Adjustment: If they are short on clean sand, how many extra Liters must they buy to reach the required volume?
- d).Costing: If Cement costs Shs 800 per Liter, calculate the total cost of the Cement needed for this project.

**Item 4**

Mr. Kintu is a dedicated father of three: Aliga (the firstborn), Babirye (the second born), and Kato (the youngest). As they prepare for the new school term, he allocates a sum of money for their pocket money. He decides that Aliga will receive 40% of the total amount, Babirye will receive  $\frac{2}{9}$  of the total, and the remainder will go to Kato. After the distribution, Babirye notes that her share amounts to UGX 24,000.

Simultaneously, Mr. Kintu is designing a modern rectangular goat shed to fit into a specific corner of his backyard. The available corner has a maximum area of  $2.5\text{m}^2$ . The proposed dimensions for the shed are 128 cm in width and  $(256)^{\frac{3}{4}}\text{cm}$  in length.

**Tasks**

- a).Financial Analysis: Calculate the total amount of money Mr. Kintu distributed and determine exactly how much Aliga and Kato received.
- b).Structural Design: Simplify the length of the goat shed into the form  $a^n$  and calculate the total floor area of the shed in square centimeters.
- c).Feasibility Study: Determine if the proposed goat shed will fit within the allocated  $2.5\text{ m}^2$  corner. Justify your answer with calculations.

**LEARNING AREA; ELEMENT OF CONSTRUCT TWO  
(PATTERNS & ALGEBRA)**

**Item 5**

Mr. Mukasa runs a mixed farm with a poultry section and a piggery section. He employs several workers to manage the animals. According to the farm records, each worker in the poultry section manages 400 birds, while each worker in the piggery section manages 80 pigs. The farm has a total of 3,600 animals (birds and pigs combined).

Each poultry worker is paid Shs120,000 per month, and each piggery worker is paid Shs150,000 per month. Mr. Mukasa spends a total of Shs 1,290,000 on workers' wages every month. He needs help to determine the exact number of workers in each section using these records.

Additionally, the farm sells organic manure to local gardeners. The records for the last three months show the following sales at a constant wholesale price:

Month	Manure (Bags)	Amount Paid (Shs)
1	50	250,000
2	30	150,000
3	70	350,000

Mr. Mukasa expects to have 95 bags of manure available for sale next month and needs to know how much he will earn.

**Task**

Help Mr. Mukasa to:

(a) Determine the number of workers in the poultry section and the piggery section.

(b) (i) Form an equation to determine the amount of money paid for any number of manure bags and state the price per bag.

(ii) Calculate the total amount of money he is likely to receive from selling 95 bags next month.

**Item 6**

A youth group runs a small workshop making two types of school bags: Standard Bags and Premium Bags. Due to the limited number of sewing machines, the group can produce at most 20 bags in total per day. To meet their contracts, they must produce at least 5 Standard Bags every day.

The group also decided that they should produce more Premium Bags than Standard Bags because the Premium ones are currently in higher demand. A Standard Bag is sold for Shs 25,000 and a Premium Bag is sold for Shs40,000. To sustain their workshop and pay for materials, the group needs to earn more than Shs~400,000 from their daily sales.

**Task**

Help the youth group to:

- (a) Write mathematical statements (inequalities) representing the relationship between the number of Standard Bags ( $x$ ) and Premium Bags ( $y$ ).
- (b) Represent these relations on a Cartesian plane and shade the feasible region.
- c). Determine the number of each type of bag the group should produce to maximize their daily revenue.
- d).Find the minimum total number of bags they can produce in a day while still meeting their revenue goal of over Shs 400,000.

**Item 7**

A youth group in a village has been given a grant to start a greenhouse project. They plan to grow tomatoes and green peppers. The group decided that due to the size of the greenhouse, they can plant a maximum of 600 seedlings in total. They have a requirement to plant at least 150 tomato seedlings to meet a supply contract with a local hotel.

Furthermore, because green peppers require more care, the group decided that the number of tomato seedlings should be at least twice the number of green pepper seedlings. A tomato seedling costs Shs 800, while a green pepper seedling costs Shs 1,200. The group has a budget of Shs 600,000 available for buying seedlings and they intend to spend all of it or less.

Task:

(a) Write down the inequalities that represent the possible number of tomato seedlings ( $x$ ) and green pepper seedlings ( $y$ ) the group can plant.

(b) Represent these inequalities on a Cartesian plane and shade the feasible region.

c). Use your graph to determine the maximum number of seedlings they can buy within their Shs 600,000 budget.

### **Item 8**

A new transport company in Kampala is analyzing its operational costs for a fleet of taxis and buses. The company records show that each taxi requires Shs 40,000 for daily maintenance, while each bus requires Shs 100,000. The company has a total daily maintenance budget of Shs 1,400,000.

The manager's records indicate that each taxi carries 14 passengers per trip, and each bus carries 65 passengers per trip. On a specific morning, the company needs to transport 820 passengers using all available vehicles in one trip. The manager needs to know the exact number of taxis and buses in the fleet to plan for fuel and staffing.

Task:

(a) Form two equations representing the maintenance costs and the passenger capacity for the fleet.

(b) Solve the equations to determine the number of taxis and buses the company owns.

c). If the price of fuel increases and the maintenance cost for a bus rises to Shs 120,000, calculate the new total daily budget required to keep the same fleet running.

## **LEARNING AREA; ELEMENT OF CONSTRUCT THREE (DATA & PROBABILITY)**

### **Item 9**

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Nsereko owns a distribution company, RONSM Educational Services, that supplies science textbooks and mathematical sets to two schools, School A and School B.

School A ordered 500 Textbooks and 200 Math sets.

School B ordered 400 Textbooks and 300 Math sets.

The cost of a Textbook is UGX 25,000 and a Math set is UGX 10,000.

### **Tasks:**

(a) Represent the school orders in a  $2 \times 2$  matrix,  $Q$  (Quantity), and the unit prices in a  $2 \times 1$  matrix,  $P$  (Price).

(b) By calculating the matrix product  $QP$ , determine the total invoice amount for each school.

c) If RONSM offers a 10% discount to School B for paying in cash, calculate the final amount School B will pay.

### **Item 10**

On a bright Tuesday morning, Mr. Nsereko, a passionate Physics teacher, advised his Senior Four students to properly equip themselves for an upcoming practical seminar. He stressed that having the right tools—Scientific Calculators, Graph Pads, and Geometry Sets—would be vital for their success.

Taking the advice to heart, three friends—Ivan, Derrick, and Caleb—headed to the local stationers to stock up. Their purchases were as follows:

Ivan selected 2 Scientific Calculators, 6 Graph Pads, and 3 Geometry Sets.

Derrick picked up 3 Scientific Calculators, 4 Graph Pads, and 2 Geometry Sets.

Caleb bought 2 Scientific Calculators, 10 Graph Pads, and 4 Geometry Sets.

At the stationery shop, the unit prices were fixed at:

Scientific Calculator: Shs 25,000

Graph Pad: Shs 5,000

Geometry Set: Shs 4,500

### **Your Tasks**

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a) The Matrix Report:

Using your knowledge of matrix notation and multiplication, represent the students' purchases and the unit prices in matrix form. Calculate the individual total expenditure for Ivan, Derrick, and Caleb, and present the final "receipt" summary for Mr. Nsereko.

b) The Junior's Budget:

Sarah, a Senior Three student, wants to prepare for next term. She intends to buy 5 Scientific Calculators, 2 dozen Graph Pads, and 6 Geometry Sets. However, the shopkeeper has promised her a 15% discount on the standard price of every item. Calculate the total amount of money Sarah needs to save to make this purchase

### **Item 11**

It was 9:00 PM on a stormy evening when Uncle Moses' best man arrived unexpectedly with his young daughter. While the men settled in the dimly lit living room to finalize wedding arrangements, Aunt Sarah went to the kitchen to prepare tea.

Suddenly, a power blackout struck. Groping in the dark, Aunt Sarah reached into the cupboard, which she knew contained 8 large mugs and 6 small teacups. She needed to pick two containers at random to serve her guests. Because it was dark, she couldn't see what she was grabbing, and she didn't put the first one back before picking the second. Aunt Sarah has a specific rule: she will only serve the tea if she picks two different types of cups (one large and one small) to ensure the guest and the child have appropriate sizes.

Meanwhile, in the living room, the men were reviewing bids from three different logistics firms A, B, and C for the three upcoming wedding events: the Traditional Introduction, the Main Reception, and the Homecoming Party.

Supplier A (Introduction): Contracted for 10 crates of soda, 20 crates of beer, and 30 cartons of water. Prices: Soda @ Shs 20,000, Beer @ Shs 30,000, Water @ Shs 40,000.

Supplier B (Reception): Contracted for 15 crates of soda, 15 crates of beer, and 20 cartons of water. Prices: Soda @ Shs 25,000, Beer @ Shs 35,000, Water @ Shs 45,000.

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Supplier C (Homecoming): Contracted for 20 crates of soda, 10 crates of beer, and 15 cartons of water. Prices: Soda @ Shs 30,000, Beer @ Shs 40,000, Water @ Shs 50,000.

Uncle Moses' fellow teachers have made a generous offer: they will fully sponsor the most expensive of the three functions.

### **Your Tasks**

a).The Probability of Tea

i).Using a tree diagram or probability calculations, determine the likelihood that Aunt Sarah will actually serve the tea.

ii).The Big Question: Is it more likely that she will serve the tea (picks different cups) or that she won't (picks two of the same kind)? Justify your answer with the calculated probability.

b).The Sponsorship Identification

Help Uncle Moses determine which function his colleagues will be paying for.

i).Represent the quantities and the prices as matrices.

ii).Use matrix multiplication to find the total cost for each of the three ceremonies.

iii).Clearly identify the ceremony that carries the highest bill.

### **Item 12**

Three students—Musa, Sarah, and Okello—are participating in a physics club competition. To ensure fairness, they design a two-part selection process based on chance.

Part I: The Starter's Flip

To decide who begins, each player flips a fair coin three times in a row. A player only starts if they achieve a "Head" on every single toss.

**Task:**

a).Calculate the probability that Musa will be the one to start the game.

Part II: The Marble Selection

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A beaker contains 6 Red (R) and 4 Green (G) marbles. A player must draw three marbles one after the other without replacement.

The Winner: If all three marbles drawn are the same color, the player is crowned the champion.

The Disqualification: If the first two marbles are the same color but the third marble is different, the player is knocked out.

**Task:** Determine the probability of a player:

b).Winning the competition.

c).Being disqualified from the competition

## **GEOMETRY AND MEASURES**

### **Item 13**

Grace is a young entrepreneur in Gulu, Northern Uganda, launching a commercial bakery. She has secured \$10,000 in personal savings but requires an additional UGX 50,000,000 to procure high-capacity ovens and delivery vehicles. To bridge this gap, she is evaluating three distinct credit facilities.

The Financing Scenarios

Option 1: The Commercial Bank – Simple Interest Plan The bank offers a “Startup Growth Loan” of UGX 50,000,000 at a fixed annual simple interest rate of 20%. The total principal and interest are to be settled in a single lump sum at the end of a 2-year term.

Option 2: The Commercial Bank – Compound Interest Plan Alternatively, the bank offers a “Micro-Enterprise Bond” at an annual interest rate of 4%, compounded annually. The full amount is also due for repayment at the end of 2 years.

Option 3: The Equipment Supplier – Hire Purchase Agreement The supplier offers a direct financing deal. Instead of a bank loan, Grace would enter a Hire Purchase contract for the equipment. The terms are:

An immediate down payment of \$1,000.

Subsequent monthly installments of \$400 for a duration of 24 months.

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The supplier agrees to a fixed exchange rate of \$1 = UGX 3,800 for the entire duration of the contract to protect Grace from currency fluctuations.

### Your Tasks

a). Quantitative Analysis Calculate the total amount Grace will have repaid at the end of the 24-month period for each of the three options. Present your findings in a table and identify which option results in the lowest total expenditure for the business.

b). Cash Flow & Operational Impact Analyze the monthly cash flow implications for Grace under each scenario. Consider the following:

Which option places the heaviest immediate burden on her working capital?

Which option provides the most predictable monthly overhead?

How might the timing of the repayments (monthly vs. lump sum) affect her ability to buy raw materials like flour and yeast?

c). Strategic Recommendation Based on your calculations in Part A and your analysis in Part B, which financing route should Grace take? Provide a justified recommendation that balances long-term cost-savings with short-term operational survival in a remote economic environment

### Item 14

Your school is located in a dry area and wants to install a cylindrical water tank to harvest rainwater from the roof of the main hall. The school engineer provides the following data:

The available space for the tank base has a diameter of 4 meters.

To meet the school's needs during the dry season, the tank must hold at least 35,000 liters of water.

The height of the tank cannot exceed 3 meters due to the roof's gutter level.

**Hint:**  $1\text{m}^3 = 1,000$  liters and use  $\pi = 3.14$  or  $\frac{22}{7}$ .

**Task:**

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- (a) Calculate the maximum volume of water (in liters) that a tank with a 4m diameter and a 3m height can hold.
- (b) If the school decides to build a rectangular tank instead, with a base of 4m x 3m, what would be the minimum height required to reach the 35,000-liter capacity?
- c).Based on your calculations in (a), determine whether the cylindrical tank will be sufficient for the school's needs. If not, suggest one mathematical adjustment the engineer could make to the tank's dimensions.

### **Item 15**

A town council in Uganda is planning to gazette a new market area. The planning officer has mapped out the market's boundary on a Cartesian plane where each unit represents 10 meters. The four corners of the market are located at points A(2, 2), B(8, 2), C(8, 6), and D(2, 6).

The council has two urgent tasks:

They need to fence the entire market to prevent encroachment.

They plan to pave the entire floor with concrete. A contractor charges UGX 15,000 per square meter for paving.

Task:

- (a) Geometry & Mapping: Plot the points on a coordinate graph and identify the shape of the market. Calculate the actual perimeter of the market in meters.
- (b) Financial Integration: Determine the total area of the market in square meters. Use this to calculate the total cost the town council will pay the contractor for paving.
- c).Logical Reasoning: The council has a total budget of UGX 4,000,000 for both fencing and paving. If fencing material costs UGX 5,000 per meter, determine if the budget is sufficient for both activities. Show all your working.

### **Item 16**

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A farmers' cooperative in a semi-arid region of Uganda received a grant to install a solar-powered irrigation system. The system uses a large hemispherical underground water reservoir to store harvested rainwater.

The technician provides the following specifications:

The diameter of the hemispherical reservoir is 14 meters.

The water pump is designed to automatically turn off when the reservoir is 80% full to prevent overflow.

The cooperative intends to distribute the water into smaller cylindrical tanks for individual farmers. Each small tank has a radius of 1 meter and a height of 2 meters.

**Hint:** Use  $\pi = \frac{22}{7}$ .

Volume of a sphere =  $\frac{4}{3}r^3$ .

1 m<sup>3</sup> = 1,000 liters.

### Task:

(a) Volume Analysis: Calculate the maximum volume of the hemispherical reservoir in cubic meters (m<sup>3</sup>)

(b) Capacity Planning: Determine the amount of water (in liters) the reservoir holds when the pump automatically shuts off at 80% capacity.

c). Distribution Logic: How many of the farmers' small cylindrical tanks can be completely filled using the water from the reservoir when it is at the 80% shut-off level?

d).Evaluation: If the cooperative wants to serve 150 farmers with one full small tank each, determine if the current reservoir size is adequate. If not, suggest a mathematical adjustment to the reservoir's diameter.

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