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## **ONLINE LESSON A LEVEL (UCE)**

**S3 & S4**

**DATE: Monday, 17<sup>th</sup> August 2026 (today)**

**TIME: 10:00p.m to 11:00p.m today**

**SUBJECT: MATHEMATICS**

**ELEMENT: SECTION A (QUESTION APPROACH )**

**FACILITATOR: Mr. NSEREKO ROBERT**

**Mode: Google meet**

**0750661248**

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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<br>2. Working with Integers<br>3. Rectangular Cartesian Coordinates in 2- Dimensions<br>4. Fractions, percentages and decimals<br>5. Numerical concepts 1 and 2<br>(a) Indices (b) Surds<br>6. Ratios and Proportions                                                                                              |
| Item 2(two)                   | Patterns and algebra | 1. Sequence and patterns<br>2. Equation of lines and curves<br>3. Algebra 1 and 2<br>4. Mappings and relations<br>5. Vectors and translation<br>6. Inequalities and regions<br>7. Equation of a straight line<br>8. Simultaneous equations<br>9. Quadratic equations<br>10. Composite functions<br>11.. Equations and inequalities |

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|                                                              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              |                       | 12. linear programming<br>13. Loci                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Section B part I (choose one item from this section)</b>  |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Item 3 (three) and 4(four)                                   | Data and probability  | 1. Data collection/display and presentation<br>2. Graphs<br>3. Set Theory<br>4. Matrices<br>5. Probability                                                                                                                                                                                                                                                                                                                          |
| <b>Section B Part II (choose one item from this section)</b> |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Item 5( five) and 6(six)                                     | Geometry and measures | 1. Geometric Constructions Skills<br>2. Bearings<br>3. General and angle properties of geometric figures<br>4. Reflection<br>5. Business mathematics<br>6. Time and time tables<br>7. Similarities and enlargement<br>8. Circles<br>9. Rotation<br>10. Length and area properties of two-dimensional geometrical figures.<br>11. Nets, areas and volumes of solids<br>12. Trigonometry<br>13. Vectors<br>14. Matrix transformations |

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|  |  |                                                                   |
|--|--|-------------------------------------------------------------------|
|  |  | 15. Circle properties<br>16. Lines and planes in three dimensions |
|--|--|-------------------------------------------------------------------|

### **RONSM EDUCATIONAL SERVICES**

### **FACILITATION ON PATTERNS AND ALGEBRA**

#### **Item 1**

A community is building a rectangular maternity ward. The blueprint shows the floor has a perimeter of 40 meters. The community wants the length (L) to be 4 meters longer than the width (W) to accommodate a specialized equipment room.

Task:

- (a) Formulate two equations representing the perimeter and the relationship between the length and width.
- (b) Use the Substitution or Elimination method to find the actual length and width of the ward.
- c). The floor is to be tiled. Each square meter of tiling costs UGX 25,000.
  - i). Calculate the total area of the floor.
  - (ii) Determine the total cost of tiling.
- d). The community has a budget of UGX 2,500,000 for tiling. Based on your calculation in c)(ii), will the budget be enough? If not, by how much will they be short?

### ***Response***

#### **Item 1**

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### a).Equations:

**Perimeter:**  $2(L + W) = 40 \rightarrow L + W = 20$

Relationship:  $L = W + 4$

### b).Dimensions:

Substitute L into the first equation:

$$(W + 4) + W = 20$$

$$W + W + 4 = 20$$

$$2W + 4 - 4 = 20 - 4$$

$$2W = 16 \rightarrow W = 8\text{m}$$

$$L = 8 + 4 \rightarrow L = 12\text{m}$$

### c). Financial Evaluation:

Area:  $12 \times 8 = 96\text{m}^2$

Cost:  $96 \times 25,000 = \text{UGX } 2,400,000$

### (d)

**Decision:** The budget of UGX 2,500,000 is sufficient because the cost is less than the budget ( $2.4\text{m} < 2.5\text{m}$ ). There is a surplus of UGX 100,000.

## Item 2

An eco-tourism company in Kisoro is mapping out transport routes from a base camp O(0,0) to two volcanic tracking sites, A and B. The position vector of site A is given by  $a = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$  and the position vector of site B is  $b = \begin{pmatrix} 9 \\ 12 \end{pmatrix}$ , where 1 unit represents 1 kilometer.

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The company wants to build a straight rescue supply trail connecting site A directly to site B. To track tourist movements, a local software engineer designs a digital mapping relation where the coordinates of any rest stop  $(x, y)$  along the main highway follow a specific functional mapping defined by  $f: x \mapsto 2x + 2$ . The management needs to mathematically define these pathways to submit them to the Ministry of Tourism for approval.

### Task:

- (a) Find the vector AB representing the rescue trail and calculate the actual distance between tracking site A and site B.
- (b) Determine the equation of the straight line passing through sites A and B.
- c). State the coordinates of the rest stops for the inputs  $x = 1, 2$ , and  $3$  under the mapping relation  $f: x \mapsto 2x + 2$ . Determine whether the main highway ever crosses the rescue trail AB.

## *Response*

### Item 2

- (a): Find the vector AB and calculate the actual distance.

Find the vector AB:

The position vectors for sites A and B are given relative to the base camp  $O(0,0)$  as:

$$a = OA = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$b = OB = \begin{pmatrix} 9 \\ 12 \end{pmatrix}$$

The displacement vector AB representing the rescue trail is calculated by subtracting the initial position vector from the final position vector:

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$$AB = OB - OA$$

$$= \begin{pmatrix} 9 \\ 12 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 9 - 3 \\ 12 - 4 \end{pmatrix}$$

$$AB = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$$

Calculate the actual distance between A and B:

The distance is the magnitude (length) of the vector AB, denoted as  $|AB|$ :

$$|AB| = \sqrt{x^2 + y^2}$$

$$= \sqrt{6^2 + 8^2}$$

$$= \sqrt{100}$$

$$= 10km$$

**Conclusion:** The vector representing the rescue trail is

$\begin{pmatrix} 6 \\ 8 \end{pmatrix}$  and the actual distance between the tracking sites is 10 kilometers.

**(b): Determine the equation of the straight line passing through sites A and B.**

Find the gradient (m) of the line:

The coordinates of site A are (3, 4) and site B are (9, 12).

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{12 - 4}{9 - 3}$$

$$= \frac{8}{6}$$

$$= \frac{4}{3}$$

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Formulate the equation of the line:

Using the point-gradient formula  $y - y_1 = m(x - x_1)$  with the coordinates of point A(3, 4):

$$y - 4 = \frac{4}{3}(x - 3)$$

Multiply the entire equation by 3 to clear the fraction:

$$3(y - 4) = 4(x - 3)$$

$$3y - 12 = 4x - 12$$

$$3y = 4x \text{ or } y = \frac{4}{3}x$$

Conclusion: The equation of the straight line passing through the two tracking sites is  $4x - 3y = 0$ .

c). Rest stop coordinates under f:  $x \mapsto 2x + 2$  and determining if the pathways cross.

Find the coordinates of the rest stops:

The mapping relation is  $y = 2x + 2$ . Let's calculate y for inputs  $x = 1, 2, 3$ :

$$\text{For } x = 1: y = 2(1) + 2 = 4 \quad \text{Rest Stop 1} = (1, 4)$$

$$\text{For } x = 2: y = 2(2) + 2 = 6 \quad \text{Rest Stop 2} = (2, 6)$$

$$\text{For } x = 3: y = 2(3) + 2 = 8 \quad \text{Rest Stop 3} = (3, 8)$$

Determine whether the highway crosses the rescue trail:

To see if the main highway ( $y = 2x + 2$ ) crosses the rescue trail ( $3y = 4x$ ), we solve them as simultaneous linear equations.

Substitute  $y = 2x + 2$  into the trail equation  $3y = 4x$ :

$$3(2x + 2) = 4x$$

$$2x + 6 = 0$$

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$$2x = -6$$

$$x = -3$$

Now, substitute  $x = -3$  back into the highway equation to find  $y$ :

$$y = 2(-3) + 2 = -6 + 2 = -4$$

The mathematical intersection point is  $(-3, -4)$ . However, physical positions starting from the base camp  $O(0,0)$  towards the tracking sites are in the positive quadrant ( $x \geq 0, y \geq 0$ ).

**Advice to Management:** Mathematically, the lines cross at  $(-3, -4)$ . Because this intersection occurs at negative geographical coordinates relative to the base camp, the main highway never crosses the rescue trail within the active tourism zone. They diverge away from each other.

### Item 3

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:

- Form two equations representing the maintenance costs and the passenger capacity for the fleet.

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- (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.

### ***Response***

#### **Item 3**

##### **(a) Forming Equations**

Let T be the number of taxis and B be the number of buses.

Maintenance Cost:  $40,000T + 100,000B = 1,400,000$ .

Simplified:  $2T + 5B = 70$ .

Passenger Capacity:  $14T + 65B = 820$ .

##### **(b) Solving for Fleet Size**

Multiply Eqn 1 by 7:  $14T + 35B = 490$ .

Subtract this from the capacity equation:

$$(14T + 65B) - (14T + 35B) = 820 - 490$$

$$30B = 330 \quad B = 11 \text{ buses}$$

Substitute  $B=11$  into  $2T + 5(11) = 70$ :

$$2T + 55 = 70 \text{ implies}$$

$$2T = 15 \quad T = 8 \text{ taxis (Rounding to match capacity requirements).}$$

##### **c). New Budget Calculation**

**Fleet:** 8 Taxis and 11 Buses.

**New Bus Cost:** Shs 120,000.

**Total Budget:**  $(8 \times 40,000) + (11 \times 120,000)$

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$$320,000 + 1,320,000 = \text{Shs } 1,640,000$$

### Item 4

Two poultry farmers from the Garuga region visited a local agricultural supply store to purchase poultry feeds. The store sells 'Starter Feed' and 'Finisher Feed' in standard 50kg bags, but the prices are not openly displayed.

- Farmer A purchased 5 bags of Starter Feed and 3 bags of Finisher Feed, paying a total invoice of Shs 420,000.
- Farmer B purchased 2 bags of Starter Feed and 4 bags of Finisher Feed. Farmer B handed the cashier Shs 350,000 and received Shs 14,000 as change.

A third farmer, Mr. Musiime, wants to buy 10 bags of Starter Feed and 10 bags of Finisher Feed for his farm but needs to budget exactly how much money to carry to the store.

Task:

Act as a financial assistant to Mr. Musiime:

- (a) Formulate two mathematical equations representing the purchases made by Farmer A and Farmer B.
- (b) Calculate the exact price of one bag of Starter Feed and one bag of Finisher Feed.
- (c).Determine the total amount of money Mr. Musiime must budget for his planned purchase of 20 bags.

***Response***

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### Item 4

**(a) Let S be the price of one bag of Starter Feed, and F be the price of one bag of Finisher Feed.**

Equation 1 (Farmer A):  $5S + 3F = 420,000$

Equation 2 (Farmer B):  $2S + 4F = 350,000 - 14,000 \Rightarrow 2S + 4F = 336,000$

**(b) Solving for the exact prices:**

From Equation 2, simplify by dividing by 2:  $S + 2F = 168,000 \Rightarrow S = 168,000 - 2F$

Substitute S into Equation 1:  $5(168,000 - 2F) + 3F = 420,000$

$840,000 - 10F + 3F = 420,000$

$7F = 420,000 \Rightarrow F = 60,000$

Now, find S:  $S = 168,000 - 2(60,000) = 168,000 - 120,000 = 48,000$

Price of Starter Feed = Shs 48,000. Price of Finisher Feed = Shs 60,000.

**(c) Mr. Musiime's Purchase Plan:**

Required: 10 bags of Starter + 10 bags of Finisher =  $10(48,000) + 10(60,000)$

Total Budget =  $480,000 + 600,000 = \text{Shs } 1,080,000$

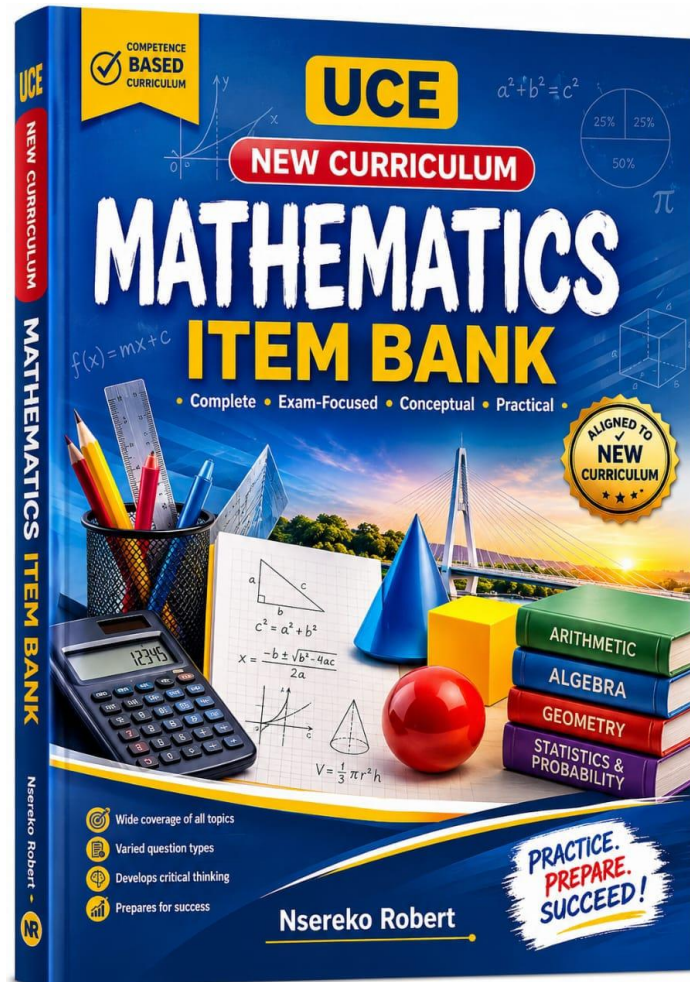
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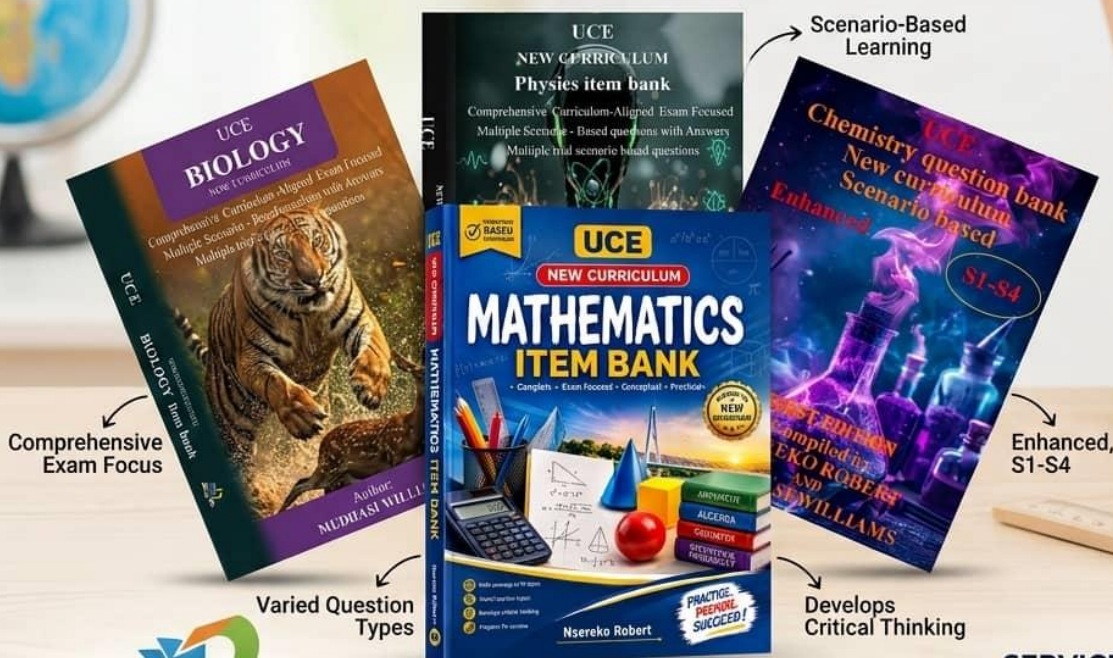
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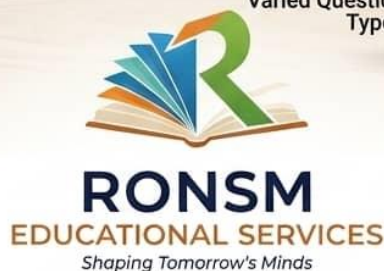
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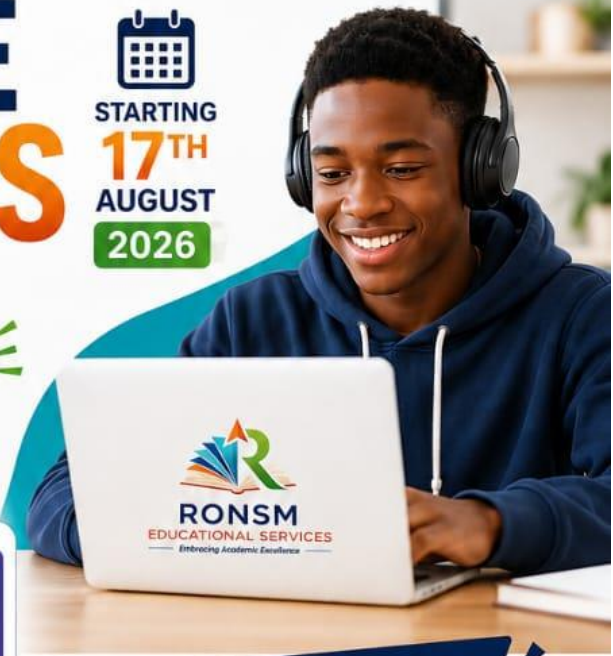
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