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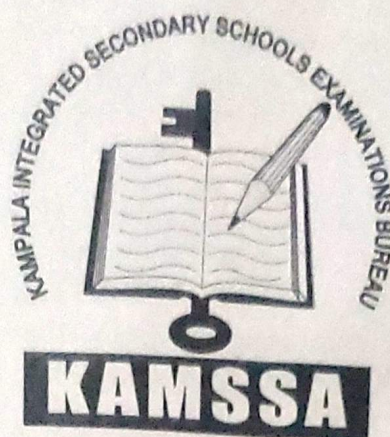
PRINCIPAL

MATHEMATICS

Paper 1

July - August 2026

3 hours



KAMSSA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

PRINCIPAL MATHEMATICS

Paper 1

3 hours

Instructions to candidates

- This examination paper consists of two sections; A and B.
- It has five examination items.
- Section A consists of one compulsory item.
- Section B has two parts, I and II each with two optional items.
- Respond to only two items from Section B, choosing one item from each of the parts, I and II.
- Respond to three items in all.
- Any additional item(s) responded to will not be scored.
- Begin each item on a fresh page.
- All necessary working must be shown clearly.
- Graph paper is provided.
- Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A
(Compulsory)

ITEM 1

A district survey team is designing a smart transport and communication layout for a new industrial park. The district survey office O is used as the reference point, with eastings and northings measured in kilometres. A service post P is located 3 km East and 2 km North of O , while another post Q is located 11 km East and 8 km North of O .

The team wants to know the distance between points P and Q and are still challenged.

An old drainage boundary follows the straight line $2x - 5y + 4 = 0$.

For emergency movement, the engineers want to construct a new access road through P perpendicular to this drainage boundary and determine where the two routes meet but they are finding it challenging.

Above the same industrial park, a drone signal platform is to pass through three aerial beacons $A(1, 1, 2)$, $B(2, 3, 5)$ and $C(-2, 2, 7)$ where the coordinates are measured in kilometers and a drone flight corridor passes through the points $R(3, 2, 3)$ and $S(1, 1, 4)$. The engineers need to determine where this flight corridor intersects the signal platform and whether the angle between the corridor and the platform is greater than 30° for stable signal transmission but they are still challenged.

On the ground design map, a landscaped security boundary is modeled by the ellipse whose parametric equations are $x = 1 + 5 \cos \theta$ and $y = -2 + 3 \sin \theta$. A straight inspection path is planned along the line $5y = 3x + 2$. The planners want to determine the patrol positions where this inspection path cuts the elliptical boundary before approving the route but they are still finding it difficult.

Task

(a) Help the district survey team to overcome the challenges being illustrated in the scenario.

SECTION B

Part I

Answer one item from this Part

ITEM 2

The formula of producing a certain brand of a product in a factory follows the polynomial $p(x) = ax^2 + 3x + b$. The formula was kept with unknowns a and b for security purposes.

However, to decrypt the value of a and b , it is true that $p(x)$ leaves a remainder of 16 when divided by $(x - 1)$ and a remainder of 46 when divided by $(x - 2)$. The factory manager needs to use the model but he is unable to determine the values of a and b .

The factory manufactures a product whose expiry time follows the equation

$3^{2x+1} + 3 = 10(3^x)$ where x is the number of years representing the expiry time. The factory manager wants to know the expiry time for the product in order to plan accordingly.

During the festive season, James, Peter and Mary visited the factory and purchased three kinds of products from the factory.

James bought 3kgs of kind A, 5kgs of kind B and 6kgs of kind C and paid UGX 405,000

Peter bought 53kgs of kind A, 30kg of kind B and 19kgs of kind C and paid UGX 3,495,000

Mary bought 9kgs of kind A, 12kgs of kind B and 5kgs of kind C and paid UGX 771,000.

The factory manager is interested in finding out the price at which each kind is being sold by his workers for proper accountability.

Task

Help the factory Manager to solve his challenges as illustrated in the scenario.

ITEM 3

One of your relatives owns a grain milling business. While reviewing the monthly sales records, he found that two quantities x and y , representing the number of flour sacks delivered to two different distribution centres, satisfy the conditions:

$$\log_{10} x - \log_{10} y = 1.0 \text{ and } \log_{10} x + \log_{10} y = \log_{10} 2.5$$

He wants to determine the exact number of sacks supplied to each Centre and requests for your help.

He also uses the expression $\frac{x+3}{x-1}$ to model the efficiency ratio of one of the milling machines. For the machine to operate safely, the ratio must remain greater than 2. He therefore needs to determine all possible values of x that satisfy this condition and he requests for your help.

During a maintenance inspection, the technician obtained the quadratic equation:

$3x^2 + 9x - 1 = 0$ whose roots are α and β . After modifying the machine settings, he was advised to use a new equation whose roots are α^3 and β^3 but he is finding it difficult.

In the accounts' office, one of the accountants is estimating the cost of fuel used by the milling generators using the expression $(2 - x)^6$. He requires the first three terms of its expansion in order to estimate the value of $(1.998)^6$ but he is unable to do it.

Task

Help your relative to overcome his challenges and give the necessary judgements were possible.

Part II

Answer one item from this Part

ITEM 4

A curved road path was constructed with the equation $y = 4x + x^2$. The road bounds a swamp to a straight river mathematically with an equation equal to the x -axis. Urban planners want to know the area of the swamp bounded by the curved path to the straight river.

Constructors want to use the coordinates of the maximum turning point as a Centre point of a circular junction that is going to be constructed at the top of the road.

While planning for the junction, constructors believe that a 2% error was made in measuring the radius of the circular junction. They want to know the percentage error that would affect the area of the whole circular junction.

Due to the poor sanitation in the city, Urban planners are planning to construct an open tank to be used for collecting water. The tank is to be constructed with a horizontal square base and four vertical rectangular sides. It is to have a Volume of 32cm^3 . Urban planners want to find out the **least** area of the sheet metal to be used.

Task

- Help the urban planners to come up with a simple sketch of swamp, total Area occupied by the swamp and the Centre point to be used.
- Help the urban planners to find the percentage error made in the area and the least area of the sheet metal to be used.

ITEM 5

James works in a company on a machine which produces a certain commodity continuously according to the model $f(t) = \frac{t^2}{(t-1)(t+2)}$, $3 \leq t \leq 5$ where t is the time in hours so that the management can be able to determine the mean production rate so as to improve efficiency and productivity if the mean production rate is greater than 0.5.

James has a container which contains a solution of salt in water. Initially the container contains **1000 litres** of water with 10kg of salt dissolved in it. The mixture is poured off at a rate of **20 litres per minute** and simultaneously pure water is added at a rate of **20 litres per minute**. All the time the container is stirred to keep the mixture uniform. James is interested in finding the mass of salt in the container after 5 minutes but he is finding it difficult.

Task

- (a) Help James to find out whether the Management will improve efficiency and productivity or not.
- (b) Help James to find the Mass of Salt remaining in the container after 5 minutes.

END