P425/1
PRINCIPAL
MATHEMATICS
Paper 1
JULY/AUG 2026
3 HOURS

PROVINCIAL EXAMINATIONS AGENCY (PEA)
COUHEIA MOCK EXAMINATIONS 2026
Uganda Advanced Certificate Of Education
PRINCIPAL MATHEMATICS
Paper 1
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

- *This examination paper has two sections **A** and **B**. It consists of **five** items.*
- *Section **A** has **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*
- **All** *responses* **must** *be written in the answer booklet(s) provided.*
- *A **graph Paper** is provided.*
- *Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A

*(Attempt **one** item)*

ITEM ONE

A farmers' association operates three mixed farms that supply food to a nearby trading Centre. To improve resource management, the association monitors the use of nitrogen fertilizer (x), organic compost (y) and irrigation water pumping hours (z). Data collected from three production cycles produced the following system of equations:

$$3x + 2y - z = 4$$

$$2x + y + 3z = 9$$

$$x + 3y - 2z = -1$$

The association's research team analyses the seasonal crop yield variability and further establishes that crop productivity is governed by the quadratic function: $3x^2 - 6x + 2 = 0$ where α and β are the roots of the above quadratic equation. To design a new automated nutrient dispenser, engineers proposed a mathematical model whose roots are:

$\left(2\alpha + \frac{1}{\beta}\right)$ **And** $\left(2\alpha + \frac{1}{\alpha}\right)$

Task;

a. Using either the matrix method or the elimination method, solve the system of equations and determine the values of x, y and z.

b. Without solving the quadratic yield equation, determine value of:

  i. $\alpha + \beta$

  ii. $\alpha\beta$

c. Hence, form the new calibrated quadratic function equation for the automated dispenser

SECTION B

Respond to only **two** items from this section choosing **one** item from each part.

PART I

ITEM TWO

Mr. Madiba is willing to put roof on his newly constructed house; he was told by his site engineer that the roof of his building should be in a triangular form ABC. He also told him the following statements The ties and struts are to be strong if;

$$\frac{\sin(A-B)}{\sin(A+B)} = \frac{a^2-b^2}{b^2}$$

The angle of inclination of ties to struts must be α defined by

$7\cos 2\alpha + 6\sin 2\alpha = 5$ where $0^0 \leq \alpha \leq 180^0$.

Length of sides a and b of the roof must make

$x^4 + 6x^3 + 13x^2 + ax + b$ a perfect square.

Task:

However, Mr. Madiba could not understand any of these statements since literally illiterate and he has approached you to help him through the following;

a. If the ties and struts are strong.
b. Angle of inclination of ties to struts.
c. Length of sides a and b of the roof.

ITEM THREE

Palm oil growing is one of the main farming activities performed in Kalangala district,

during the agricultural expo ceremony, the government of Uganda suggested land of $946400km^2$ along the shores of Lake Victoria. The land was supposed to be used in the partial fractions of

$$\frac{11x+12}{(2x+3)(x+2)(x-3)}.$$

However, the resident farmers were told to use the sum of the positive partial

fractions for growing palm oil and the fraction with the negative integral sign

will be used for construction of a house.

Task:

Mr. Kakeeto, the head the farmers' association in Kalangala district was actually unable to turn up to the occasion due to poor health issues and one of the farmers have approached you to help them in the following;

Express the fraction given above into simple fractions.

Taking $x = 5$ obtain the real fractions for growing palm oil and construction.

Determine the exact land in km^2maent for growing palm oil and construction.

Obtain the remaining land in km^2 and with a reason suggest any activity that can be done on it.

PART II

ITEM FOUR

The chairman from your hometown has requested your engineering group to design a local water supply and drainage channel network near village trading center. The cross-section profile of a natural hill ridge valley is modeled mathematically by the parabolic function curve $y = 6x - x^2$.

A straight pipeline must be constructed along the valley floor following a path modeled by the linear equation $y = x$

For drainage pipeline safety, you must first establish the exact geometric boundaries where the pipeline cuts through the hill ridge and then map out a cross-section safety exact measurement of the total surface area enclosed between the parabolic hill ridge and straight pipeline path to allocate the correct environmental compensation funds to the surrounding community is required by the local planning authority. .

Task:

As the leading hydraulic structural engineer on the project

a. Find out the coordinate points on the grid map where the drainage pipelines intersect the parabolic ridge
b. Sketch the enclosed cross-section profile of the valley safety zone showing the boundaries clearly.
c. Setup a structural definite integral expression and evaluate it to compute the exact regional area enclosed between the curve.

ITEM FIVE

On 7th of June 2026 your school is going to attend a seminar at Uganda Martyrs Namugongo and your class has been given the following set of questions to discuss during the seminar;

Using small changes in differential calculus, show that $627.5^{\frac{1}{4}} \approx 5\frac{1}{200}$

a. If; $x(t) = (t-2)^{\frac{3}{2}}$ and $y(t) = t^2$, prove that

$$\frac{d^2y}{dx^2} = \frac{4(t-4)}{9(t-2)^2}$$

b. If $y(t) = (\tan t)$ and $x(t) = in(1 + sint)$ show that

$$\frac{d^2y}{dx^2} = sec^3t(1 + sint)^2(1 + 2sint)$$

c. A curve $f(x)$ is given by parametric equations

i. $x(\theta) = 2cos\theta$ and $y(\theta) = \cos(\theta) - 2sin2\theta, 0 \leq \theta \leq 2\pi$

d. The point, p lies on $f(x)$ where; $\theta = \frac{\pi}{4}$

e. Find the coordinates of point p.

f. Show that the equation of the normal to $f(x)$ at point p is given by; $4x + 2y = 5\sqrt{2}$

END