P425/1
PURE MATHEMATICS
Paper 1
Nov./Dec. 2025
3 hours

# UGANDA NATIONAL EXAMINATIONS BOARD

## Uganda Advanced Certificate of Education

PURE MATHEMATICS

**Paper 1**

3 hours

## INSTRUCTIONS TO CANDIDATES:

*This paper consists of* **two** *Sections;* **A** *and* **B**.

*Section* **A** *is* **compulsory**.

*Answer only* **five** *questions from Section* **B**.

*Any additional question(s) answered will* **not** *be marked.*

**All** *necessary working* **must** *be shown clearly.*

*Begin each answer on a fresh page.*

*Graph paper is provided.*

*Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*



**Turn Over**

## SECTION A (40 MARKS)

*Answer* **all** *the questions in this section.*

1. Solve the following simultaneous equations: (*05 marks*)

$$x + 3y + 2z = {}^{-}13$$
$$2x - 6y + 3z = 32$$
$$3x - 4y - z = 12$$

2. Prove that $\cos 3A = 4\cos^3 A - 3\cos A$. (*05 marks*)

3. The period $T$ of a simple pendulum of length, $l$, is given by $T = k\sqrt{\frac{l}{g}}$, where $k$ and $g$ are constants. If the length of the pendulum increases by 8 %, find the percentage increase in $T$. (*05 marks*)

4. A line passes through two points whose position vectors are $\mathbf{i} + 5\mathbf{j} - 3\mathbf{k}$ and $4\mathbf{i} + 3\mathbf{j} + \mathbf{k}$. Determine the Cartesian equation of the line. (*05 marks*)

5. Solve the differential equation: $e^x \frac{dy}{dx} = -x$ given that $y(0) = 2$. (*05 marks*)

6. Expand $f(x) = e^x \sin x$ using Maclaurin's theorem, up to the term in $x^2$. (*05 marks*)

7. A variable point $P(x, y)$ moves so that the ratio of its distances from two fixed points $Q(-2, 0)$ and $R(2,0)$ is $PQ: RP = 3:2$. Show that the locus of $P$ is a circle. (*05 marks*)

8. Solve the equation: $\log_5 a + 2\log_a 5 = 3$. (*05 marks*)

## SECTION B (60 MARKS)

*Answer* **five** *questions from this section.*

9. (a) Evaluate $\int_0^{\frac{\pi}{4}} \frac{2\cos^2 x + \sin^2 x}{1 + \cos^2 x}\,dx$ *(05 marks)*

(b) Find $\int x^2 \ln(1 - x^2)dx$. *(07 marks)*

10. (a) Find the Cartesian equation of the curve described by $|w - 3 + 6i| = 2|w|$ where $w$ is a complex number $x + iy$. *(05 marks)*

(b) Use De Moivre's theorem to simplify:

$$\frac{\cos 3\theta + i\sin\theta}{\cos 5\theta - i\sin 5\theta}$$

*(07 marks)*

11. (a) Differentiate the following with respect to $x$:

(i) $y = \ln(\frac{e^{3x}}{\cos 2x})$. *(03marks)*

(ii) $y = \sin^2(5x^2 + 4)$. *(03 marks)*

(b) A curve is defined by the parametric equations $x = 2t^3$ and $y = 4t^2 - t^4$. Find the equation of the tangent to the curve at the point (2, 3). *(06 marks)*

12. (a) Find the equation of a plane containing points $A(1, 2, 3)$, $B(3, 1, 9)$ and $C(-2, 1, 3)$. *(07 marks)*

(b) Determine the angle the plane in (a) makes with the line

$$\frac{x-2}{2} = \frac{y+1}{0} = \frac{z+3}{-1}$$

*(05 marks)*

13. The points $P(ap^2, 2ap)$ and $Q(aq^2, 2aq)$ lie on a parabola $y^2 = 4ax$. The tangents to the parabola at $P$ and $Q$ intersect at $R$. Find the coordinates of $R$. *(12 marks)*

14. (a) Given that $\alpha$ and $\beta$ are the roots of the equation $ax^2 + bx + c = 0$, show that $(\alpha^2 - 1)(\beta^2 - 1) = \left(\frac{c}{a} + 1\right)^2 - \frac{b^2}{a^2}$. *(06 marks)*

(b) Stella earned Shs1,000,000 from her employer in the first year. Her annual earnings kept increasing at a rate of 2%.

Find her:

(i) earnings in the second year.
(ii) earnings in the third year.
(iii) total earnings after eight years.

*(06 marks)*

**15.** (a) Without using mathematical tables or a calculator, show that,

$$\cos^{-1}\left(\frac{8}{17}\right) + \sin^{-1}\left(\frac{4}{5}\right) = \tan^{-1}\left(-\frac{77}{36}\right)$$ *(06 marks)*

(b) Solve the equation $2\cos x + \sec x = 3$ for $0^\circ \leq x \leq 90^\circ$. *(06 marks)*

**16.** (a) Sketch the region bounded by the curve $y = 2 + x - x^2$ and the $x$-axis.

*(06 marks)*

(b) The region in (a) is rotated about the $x$ – axis. Calculate the volume of the solid generated. *(06 marks)*