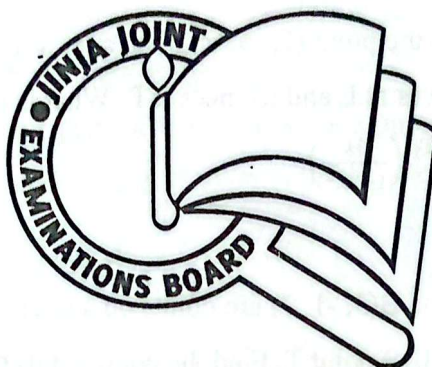


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PURE MATHEMATICS
AUGUST - 2025
3 HOURS



JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – AUGUST, 2025

PURE MATHEMATICS

Paper 1

3 HOURS

INSTRUCTIONS TO CANDIDATES

*Answer **all the eight** questions in section A and any **five** from section B.*

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

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

Begin each question on a fresh sheet of paper.

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

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Turn Over
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SECTION A: (40MARKS)*Attempt all questions in this section*

1. The sum of the first n -terms of the series $3 + 8 + 15 + \dots + (n^2 + 2n)$ is $\frac{125}{3}n$. Find the value of n . (5 marks)
2. Solve $\cot^2 2\theta + 3\operatorname{cosec}^2 2\theta = 7$ for $0^\circ \leq \theta \leq 180^\circ$. (5 marks)
3. A variable line through the point $(2, -5)$ cuts the axes at L and M , and the perpendiculars to the axes at L and M meet at P . What is the locus of P ? (5 marks)
4. Find $\frac{dy}{dx}$ if; $y = \tan^{-1}\left(\frac{6x}{1-2x^2}\right)$. (5 marks)
5. Find $\int \frac{2x}{\cos^2(x^2+3)} dx$. (5 marks)
6. Given that $A(2, 1, 5)$ and $B(3, -1, 7)$ are points on a straight line which meets the plane $4x + 3y - 2z + 17 = 0$ at point T . Find the coordinates of T . (5 marks)
7. Find the value of x if $\log_{x^2} 27 - \log_x 81 - \frac{1}{2} = 0$. (5 marks)
8. A wire of length 200m is to be cut into two pieces. One piece folded to form a circular ring and the other to form a rectangle whose length is twice its width. Show that for maximum total area, the circumference of the circle is approximately 82m. (5 marks)

SECTION B:*Answer any five questions*

9. (a.) Solve for x if, $4(25^x) + 7(5^x) - 2 = 0$. (5 marks)
- (b.) Express $3x^3 - 7x^2 + 5x - 11$ in the form $(x^2 - 3x - 4)Q(x) + Ax + B$, Where $Q(x)$ is a polynomial in x and A and B are constants. Determine the values of A and B and the expression $Q(x)$. (7 marks)
10. (a.) Prove that $\sin x - \sin(x + 60^\circ) + \sin(x + 120^\circ) = 0$. (4 marks)
- (b.) Solve $3 \cos \theta + 2 \sin \theta = 2.5$, for $-180^\circ \leq \theta \leq 180^\circ$. (4 marks)
- (c.) Certain roads in a city form a triangle and are of lengths 100m, 110m and 150m. Find the difference between the largest angle and the right angle. (4 marks)
11. (a.) Differentiate with respect to x .
 - (i.) $y = e^{4x} \cos 3x$.
 - (ii.) $y = \frac{(2-x)^2(1+x)}{(4+x)^3}$. (6 marks)

(b.) Given the parametric equations $x = 3 - 7 \cos \theta$ and $y = 6 + 5 \sin^3 \theta$. Find $\frac{d^2y}{dx^2}$ in terms of θ . (6 marks)

12. Given the points R(6, 1, 7), S(11, 0, 10), T(-14, 5, -5) and N(3, 45, -20);

(a.) Show that;

(i.) points R, S and T are collinear.

(ii.) STN is a right angle. (6 marks)

(b.) Find the cartesian equation of the plane containing points R, S and N. (6 marks)

13. (a.) Find (i.) $\int x \sec^2 x \, dx$.

(ii.) $\int \frac{x^3}{\sqrt{1-x^2}} \, dx$. (7 marks)

(b.) Evaluate $\int_3^5 \frac{2x^2+10}{(x-2)(x+1)^2} \, dx$ (5 marks)

14. (a.) Find the equation of a circle whose centre is (-3, 7) and touches the line $5x + 12y - 4 = 0$. (4 marks)

(b.) Show that the circles $x^2 + y^2 + 8x - 20y - 28 = 0$ and $x^2 + y^2 - 2x + 4y - 20 = 0$ are orthogonal. (8 marks)

15. (a.) Find the square root of the complex number $24 + 10i$. (5 marks)

(b.) If $\left| \frac{z-2i}{z+3} \right| = 2$, show that the locus of z is a circle. (5 marks)

(c.) If $Z = -2 + 5i$, find the argument of Z. (2 marks)

16. (a.) The curve has gradient of $2x - \frac{y}{x}$ and it passes through point (3, -1). Find the equation of the curve. (6 marks)

(b.) Solve the differential equation $x^2 \frac{dy}{dx} + y = x^2 e^{\frac{1}{x}}$, given that $y = 2$ when $x = 1$. (6 marks)