

P425/1
Pure mathematics
Paper 1
July/August 2024
3 hours



**PROVINCIAL COUHEIA EXAMINATION AGENCY SECONDARY
MOCK EXAMINATIONS 2024**

Uganda Advanced certificate of Education

PURE MATHEMATICS

Paper 1

3 hours

INSTRUCTIONS TO CANDIDATES:

- Answer **all** questions in section **A** and only five questions from section **B**.
- All necessary calculations **MUST** be done on the same page as the rest of the answers.
- Any extra question(s) attempted in section **B** will not be marked.
- Begin each other question on a fresh sheet of paper.
- All working must be shown clearly.
- Silent, non-programmable, scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A (40 MARKS)

Answer all the questions in this section.

1. Solve the equation $Z^2 - 3(1 + i)z + 2(3 + i) = 0$ (05 marks)
2. Prove that $\frac{\sin\theta \cos 2\theta + \cos 3\theta \cos 6\theta}{\sin\theta \sin 2\theta + \sin 3\theta \sin 6\theta} = \cot 5\theta$ (05 marks)
3. Differentiate $\frac{x^2+2}{(x^2-3x+2)^{\frac{1}{2}}}$ with respect to x , expressing your answer in the simplest form. (05 marks)
4. If $(\frac{1}{2}, 2)$ is one extremity of a focal chord of the parabola $y^2 = 8x$, find the coordinates of the other extremity. (05 marks)
5. Find the polynomial function $P(x)$ of degree 3, with a leading coefficient 2 such that $P(0) = 1, P(1) = 0$ and $P(2) = 1$. (05 marks)
6. The area of an equilateral triangle increases at a rate of $20\text{cm}^2\text{s}^{-1}$, find the rate of increase in length of the side of the triangle when the side is 5cm. (05 marks)
7. Given the points $L(2, -1, 0), M(4, 7, 6)$ and $N(8, 5, -4)$, find the vector equation of the line which joins the midpoint of LM and MN . (05 marks)
8. Find the volume of the solid of revolution formed when the area enclosed by the curve $y = 5 + 4x - x^2$ and x -axis is rotated through 4 right angles about the line $y = 0$ (05 marks)

SECTION B (60 MARKS)

Answer any five questions from this section.

9. AB is a diameter of a circle in which $A(1, 3)$ and $B(7, -1)$
 - (a) Find the:
 - (i) centre C of the circle; (02 marks)
 - (ii) radius r of the circle; (02 marks)
 - (iii) equation of the circle. (02 marks)

- (b) The line $y + 5x = 8$ cuts the circle at A and again at a second point D. Calculate the coordinates of D. (03 marks)
- (c) Prove that the line $\overline{AB}$ is perpendicular to the line $\overline{CD}$. (03 marks)

10. (a) Given the parametric equations $x = 3 + 4\cos\alpha$; $y = 5 - 8\sin\alpha$.
Find $\frac{d^2y}{dx^2}$ (07 marks)
- (b) If $y = \frac{\cos x}{x^2}$, prove that: $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + (2 + x^2)y = 0$ (05 marks)

11. (a) Given that the second, fourth and ninth term of an Arithmetic Progression (AP) are consecutive terms of a Geometric Progression (GP), show that the common ratio of the GP is $r = 2.5$. (06 marks)

- (b) A piece of land of area $50,100m^2$ is divided in such a way that the areas of the plots are in Arithmetic Progression (AP). If the area of the smallest and the largest plots are $2m^2$ and $1000m^2$ respectively, find the:

- (i) number of plots in the piece of land;
(ii) total area of the first 13 plots to the nearest square metres. (06 marks)

12. (a) Given that $\sin A = \frac{\sqrt{3}}{2}$ and $\tan B = \frac{1}{\sqrt{3}}$, where A and B are acute angles, find the value of $\cos(A+B)$ (04 marks)

- (b) Three points A, B and C are in a straight line on a horizontal ground with B between A and C. A vertical pole at A is supported by two wires attached to its top and the points B and C. The wire at C makes an angle of 30° with the ground and the wire at B makes 50° with the ground. If $\overline{BC} = 4\text{cm}$, find the:

- (i) length of the two wires;
(ii) height of the pole. (08 marks)

13. Evaluate: (a) $\int_0^{\frac{\pi}{4}} \frac{\cos x}{(1 - \sin x) \sin x} dx$ (06 marks)

- (b) $\int_1^2 \frac{dx}{x^2 \sqrt{4 - x^2}}$ (06 marks)

14. (a) Find the vector parametric equations of the plane passing through the points $A(2,3,4)$, $B(-2,4,-3)$ and $C(1,0,3)$ and deduce its cartesian equation. (07 marks)
- (b) Determine the point of intersection of the plane in (a) above and the line $x + 1 = \frac{y+2}{5} = \frac{z-2}{2}$. (05 marks)
15. (a) Find the middle term in the expansion of $\left(3x^2 + \frac{1}{2x}\right)^{10}$. (04 marks)
- (b) Obtain the binomial expansion of $\sqrt{\left(\frac{1+x}{1-x}\right)}$ up to the term in x^2 . Hence by putting $x = \frac{1}{5}$, find $\sqrt{6}$ correct to 3 significant figures. (08 marks)
16. (a) Given that $\frac{dy}{dx} = e^{-2y}$ and $y = 0$ when $x = 5$, find the value of x when $y = 3$. (05 marks)
- (b) The population of a community is known to increase at a rate proportional to the number of people present at time t . If the population has doubled in 6 years, how long will it take to triple? (07 marks)

END