

P425/1
PURE
MATHEMATICS
Paper 1
July / August, 2024
3 hours



MASAKA DIOCESAN EXAMINATIONS BOARD
JOINT MOCK EXAMINATIONS 2024
Uganda Advanced Certificate of Education
PURE MATHEMATICS
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INSTRUCTIONS TO CANDIDATES:

- Attempt **all** the **eight** (8) questions in section **A** and **not** more than **five** (5) from section **B**.
- **All** the necessary working **must** be shown clearly.
- A list of formulae and graph papers will be provided.
- Non programmable calculators may be used.

SECTION A

1. Find the square root of $23 - 4\sqrt{15}$. (5 marks)
2. Solve the equation. $5\sin^2 2x - 3 \sin 2x \cos 2x - 14 \cos^2 2x = 0$ for $0^\circ \leq x \leq 90^\circ$ (5 marks)
3. If $ax^2 + bx + c = 0$ and $x^2 + x + d = 0$ have a common root then show that $(c - ad)^2 = (b - a)(c - bd)$ (5 marks)
4. A hemispherical bowl of radius 13cm contains water up to height of 8cm. Find the volume of the water in the bowl. (5 marks)
5. If $y = (1 - x^2)^2 (1 - x^3)$ show that $\frac{dy}{dx} = -x(x + 1)(x - 1)^2(7x^2 + 7x + 4)$ (5 marks)
6. The lines $\frac{x-3}{a} = y - 4 = \frac{z-4}{-a}$ and $x - 8 = \frac{y-1}{3} = \frac{z-3}{3}$ intersect. Find the value of a and the point of intersection of the two lines.
7. Points $P(ap^2, 2ap)$ and $Q(aq^2, 2aq)$ lie on the parabolic $y^2 = 4ax$. Show the equation of the chord PQ is given by $Y(p+q) = 2x + 2apq$ (5 marks)
8. Solve the differential equation.
 $\left(\frac{dy}{dx}\right)^2 - \frac{1}{x} \frac{dy}{dx} + x \frac{dy}{dx} - 1 = 0$ (5 marks)

SECTION B (60 MARKS)

Attempt only **five** 5 questions.

9. a) Resolve $\frac{22-5x^3-5x^4}{(x-1)(x+2)}$ into partial fractions. (7 marks)
b) Hence evaluate $\int_3^6 \frac{22-5x^3-5x^4}{(x-1)(x+2)} dx$ to 4 significant figures. (5 marks)
10. a) Show that $\sin^2 A - \sin^2 B = \sin(A+B) \sin(A-B)$. (5 marks)
b) Show that $\tan 3\theta = \frac{3t-t^3}{1-3t^2}$ where $t = \tan \theta$. Hence solve the equation $t^3 - 3t^2 - 3t + 1 = 0$ (7 marks)
11. Given the curve $y = \frac{x^2+3}{x-1}$
 - a) Show that this curve cannot lie between two y -values. (5 marks)
 - b) Hence determine the turning points and their nature. (2 marks)

- c) State all the asymptotes and intercepts. (2 marks)
 d) Hence sketch the curve. (3 marks)

12. a) Find the ratio of the terms in x^7 to x^8 in the expansion of $\left(3x + \frac{2}{3}\right)^{17}$ (6 marks)

b) Using binomial expansion. Expand $(2 + x - 2x^2)^7$ up to x^4 . (6 marks)

13. a) Using Maclaurin's theorem expand $\ln(1 + \sin x)^2$ up to x^3 . (5 marks)
 b) Using Binomial expansion.

Expand $\sqrt{\frac{1+2x}{1-2x}}$ up to x^3 by putting $x = \frac{1}{7}$. Find the value of $\sqrt{5}$ to 3 significant figures. (7 marks)

14. The points A, B, C and D have position vectors $\begin{pmatrix} 4 \\ 2 \\ -1 \end{pmatrix}$, $\begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$, $\begin{pmatrix} -3 \\ 0 \\ 3 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ -4 \\ 1 \end{pmatrix}$. Respectively. The perpendicular from D to the plane containing A, B and C meets the plane at E. Find.

- The cartesian equation of the plane containing A, B and C. (5 marks)
- The position vector of point E. (4 marks)
- The vector equation of the straight line through D and E. (3 marks)

15. a) Identify the locus fully of the point P which represents the complex number $Z = x + iy$ on an Argand diagram. $1Z - i + 1z + i = 4$. (5 marks)

b) Use de Moivre's theorem to find the fifth roots of $-4 - 4i$. (7 marks)

16. Chocomel is used as a cough suppressant. After the drug is fully absorbed, the quantity of the drug in the body decreases at a rate proportional to the amount left in the body. The half life of Chocomel in the body is 3.8 hours and usual oral dose is 10mg.

- Write a differential equation for the quantity Q of the drug in the body at time t hours. (9 marks)
- How much of the dose is still in the body after 12 hours. (3 marks)

*** END ***