P425/1
PURE
MATHEMATICS
Paper 1
28th July 2025
2 Hours 30 Minutes

KAMPALA WAKISO GIANT SCHOOLS' ASSOCIATION (KWGSA)

National Joint Mock Examination 2025

Uganda Advanced Certificate of Education

PURE MATHEMATICS

Paper 1

2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES

Answer **all** *the questions in section* **A**

Choose **five** *questions from section* **B***.*

Mathematical tables with a list of formula and squared papers are provided.

Silent, simple non – programmable electronic calculators may be used.

SECTION A (40 MARKS)

Attempt **all** *questions*

1. If α and β are the roots of the equation $2x^2 - 7x + 1 = 0$, show that $\left(\sqrt{\frac{\alpha}{\beta}} - \sqrt{\frac{\beta}{\alpha}}\right)^2 = \frac{41}{2}$

(05 marks)

2. Differentiate with respect to ***x***. $\log_2\left(\frac{e^{x^2}}{Sin2x}\right)$ (05 marks)

3. Evaluate $\int \frac{3dx}{2x^2 - 7x + 6}$ (05 marks)

4. Use Ecron's reduction method to solve the equations;

2x + y = 3z + 7

4x – 15 = 2y – z

3x + 3y + 2z = 1 (05 marks)

5. Solve the equation $\log_9 x - \log_3(3 - 2x) = 0$ (05 marks)

6. Solve the equation $4Cosx + 3Cos\frac{x}{2} - 1 = 0$ for $0^0 \le \theta \le 360^0$ (05 marks)

7. Given vectors $OA = \begin{pmatrix} 8 \\ -6 \\ 10 \end{pmatrix}$ and $OB = \begin{pmatrix} 2 \\ 0 \\ 6 \end{pmatrix}$, find the coordinates of **T** which divides **AB** such that **AT : AB = 1 : 2** (05 marks)

8. A curve $x^2 + y^2 - 3xy + 5x - 6 = 0$ has a tangent at (1, 6). Find the equation of the tangent at this point. (05 marks)

SECTION B (60 MARKS)

Choose any **five** *questions from this section*

9. (a) Given points **P, Q** and **R** with position vectors $Q = 5i - 2j - 3k$, $R = 5i + 4j + 10k$ and $P = 4i - 8j - 13k$. Show that the points are vertices of a triangle. (05 marks)

(b) Two lines are given by parametric equation such that $L_1 = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix} + t\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$ and $L_2 = \begin{pmatrix} -3 \\ P \\ 7 \end{pmatrix} + S\begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$. Given that the lines intersect and a point **A**. Find the;

(i) values of ***t***, **S** and **P**

(ii) Coordinates of point **A**

(iii) Angle between $\mathbf{L_1}$ and $\mathbf{L_2}$ (07 marks)

10. In the diagram below, the curve $y = 10 - x^2$ meets the line $y = 2x - 5$ at points **A** and **B** and cuts the x – axis at **C** and **D**.

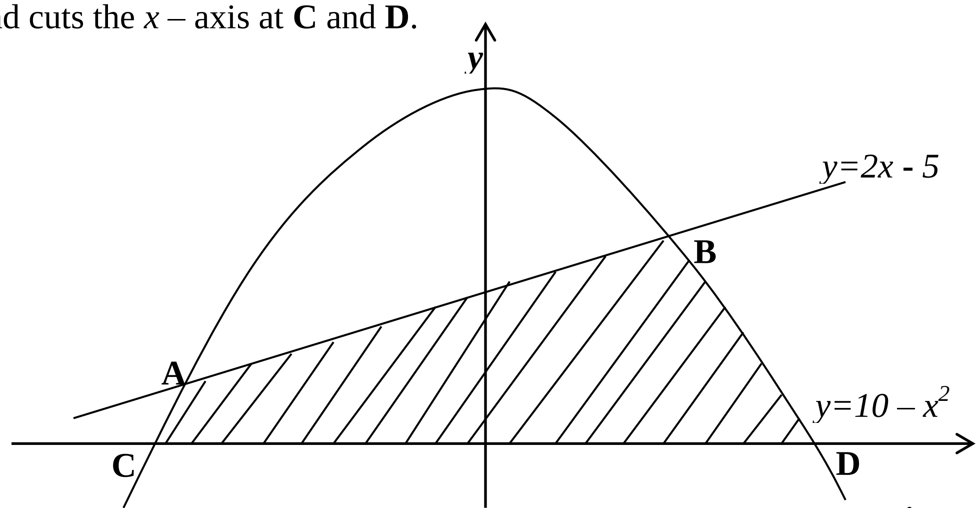

Fig. 1

Find the;

(a) Co-ordinates of **A, B, C** and **D**. (05 marks)

(b) area of the shaded region. Correct to one decimal place. (07 marks)

11. (a) Integrate $\dfrac{4x^2}{\left(1-x^6\right)^{\frac{1}{2}}}$ (04 marks)

(b) Evaluate $\displaystyle\int_1^3 \frac{x^2+1}{x^3+4x^2+3x}\,dx$ (08 marks)

12. (a) If $y = \dfrac{5x^2+3}{\sqrt{1-2x^2}}$, find $\dfrac{dy}{dx}$ (04 marks)

(b) A cylindrical tin without a lid is made of a sheet metal. If **S** is the area of the sheet used without waste, **V** is the volume of the tin and ***r*** is the radius of the cross section. Prove that $2V = Sr - \pi r^3$ and if **S** is given, prove that the volume of the sheet is maximum when the ratio of height to diameter is 1:2. (08 Marks)

13. (a) Show that angle $\left(\dfrac{Z+1}{Z-1}\right) = \dfrac{\pi}{4}$ represents a circle. Hence, state the radius and the coordinates of the centre. (06 marks)

(b) Given that the complex number **Z** and it's conjugate $\overline{Z}$ satisfies the equation $Z\overline{Z} - 2Z + 2\overline{Z} = 5 - 4i$ (06 marks)

14. (a) Prove that $\tan 3\theta = \dfrac{3t - t^3}{1 - 3t^2}$ where $t = \tan\theta$ and hence solve the equation $t^3 - 3t^2 - 3t + 1 = 0$ (06 marks)

(b) Solve the equation $5\tan\theta + Secx + 5 = 0$ for $0^0 \le \theta \le 360^0$ (06 marks)

15. (a) Solve the differential equation $\dfrac{dy}{dx} = e^{2x+y}$ (06 marks)

(b) Mbale city's population is growing in the way such that in tome ***t*** years, the rate at which the population increase is proportional to the size, ***N***, of the population at that time, ***t***. If the population increases from 100000 to 300000 in 10 years, What will the population be in the next 15 years. (06 marks)

16. (a) Find the equation of the tangent to a parabola $y^2 = \dfrac{x}{16}$ at a point $\left(t^2, \dfrac{t}{4}\right)$.

(07 marks)

(b) If the tangent to the parabola in (a) above at points $\left(p^2, \dfrac{p}{4}\right)$ and $Q\left(Q^2, \dfrac{Q}{4}\right)$ meet at a line $y = 2$;

(i) Show that P + Q = 16. (03 marks)

(ii) Deduce that the mid-point of PQ lie on the line $y = 2$. (02 marks)

END