MEBU EXAMINATIONS CONSULT

UGANDA ADVANCED CERTIFICATE OF EDUCATION

END OF TERM 1 EXAMINATIONS 2024

PURE MATHEMATICS

PAPER 1

3 HOURS

INSTRUCTIONS.

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

✓ Any additional questions answered will not be marked.

✓ All working must be shown clearly.

✓ Begin each answered on a fresh sheet of paper.

✓ A graph paper is provided

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

SECTION A: (40 MARKS)

Attempt all questions in this section.

1. Solve the equation $\tan\theta - \cos\theta = 3$ for θ in the range $0^o \le \theta \le 360^o$. **(5 marks)**

2. Differentiate with respect to x; $\dfrac{x^2 - 1}{(x+2)^2}$. **(5 marks)**

3. Two vectors are such that $|a| = 3$, $|b| = 7$ and that $a \bullet b = 3$. Find the value of $|a+b|$ **(5 marks)**

4. Without using a calculator, find the exact value $\sqrt{\left(7 - 4\sqrt{3}\right)}$ **(5 marks)**

5. A variable point $P(x, y)$ moves such that the sum of the squares of its distances from the points $A(2,0)$ and $B(-2,0)$ is 9 units. Find the equation of the locus and describe it completely. **(5 marks)**

6. Evaluate $\displaystyle\int_{0}^{2}(x+2)^4(x-3)^2 dx$ **(5 marks)**

7. How many arrangements can be made from the letters of the word *OSMOSIS* if the letters
(i) Are taken one at a time. **(2 marks)**
(ii) *M* And *I* must be separate. **(3 marks)**

8. An inverted right circular cone of vertical angle 60° is being filled with water at a constant rate of 3π cm³/min. Find how long it takes to fill the cone if the height of the cone is 12cm. **(5 marks)**

SECTION B (60 MARKS)

Attempt only five questions in this section

9. (a) Solve the equations : $\dfrac{2x+y}{2} = \dfrac{y+2z}{6} = \dfrac{x+z}{3}$ **(6 marks)**

$$3x + 2y + 3z = 22$$

(b) When the polynomial is divided by $x-3$, the remainder is -6, and when divided by $x-1$ the remainder is 2. Find the remainder when the polynomial is divided by $x^2 - 4x + 3$.

(6 marks)

10. (a) If $z_1 = 2 + i$ and $z_2 = 3 + 2i$. Find the $\arg(z_2 - z_1)$ **(4 marks)**

(b) The complex number z lies on the complex plane and is such

that $|z - 6i| = 2|z - 3|$.

(i)   Find the equation of locus of the complex number.   **(4 marks)**

(ii)   Represent the locus on the complex plane.   **(2 marks)**

(iii) Calculate the greatest value of $|z|$.   **(2 marks)**

11   (a) On the same axes sketch the curves $f(x) = x^2 - 6x + 5$ and $y = \dfrac{1}{f(x)}$, clearly

indicating the asymptotes.   **(12 marks)**

12   A, B and C are vertices of a triangle., $Q(2,0)$ and $R(-1,-4)$ are midpoints of AB, BC and

AC respectively. Find the

(i)   Equation of the line AB.   **(4 marks)**

(ii)   Coordinates of the points A.   **(8 marks)**

13   (a) Evaluate $\displaystyle\int_0^{\frac{\pi}{3}} \tan x \sin^2 x\, dx$ **(5 marks)**

(b) Differentiate 2^x with respect to x, Hence $\displaystyle\int_0^2 2^x + e^x + x^2\, dx$ **(7 marks)**

14   The lines l_1 and l_2 given by the Cartesian equations

$\dfrac{x+4}{3} = \dfrac{y-2}{2} = \dfrac{z+3}{2}$ and $\dfrac{x-1}{2} = \dfrac{y-2}{p} = \dfrac{z+5}{4}$ intersect. Find the

(i)   Coordinates of the point of intersection.   **(5 marks)**

(ii)   Value of p.   **(3 marks)**

(iii) Angle between the two lines l_1 and l_2.   **(4 marks)**

15.   (a) Solve the equation: $\tan^{-1}\dfrac{x}{2}+\tan^{-1}\dfrac{x}{3}=\dfrac{\pi}{4}$ **(6 marks)**

(b) Express $\cos(\theta+60^{o})-\cos\theta$ in the form $R\sin(\theta+\alpha)$, Determine the greatest value of the expression $f(\theta)=1+\cos(\theta+60^{o})-\cos\theta$ Hence find the value of θ for which the maximum occurs in the range $0^{o}\leq\theta\leq360^{o}$.   **(6 marks)**

16. (a) Use maclaurin's theorem to expand e^{2x} in ascending   powers of x up to the term containing x^{3}.   **(6 marks)**

(b) Given that $t=x+\dfrac{1}{x}$, $y=t-\dfrac{1}{t}$. Find $\dfrac{dy}{dx}$ when $x=1$ **(6 marks)**

END