P425/1

MATHEMATICS

PAPER 1(PURE MATHEMATICS)

MOCK 2024

AUGUST

TIME:3 HRS

MEBU EXAMINATIONS CONSULT

Uganda Advanced Certificate Of Education

MOCK EXAMINATIONS 2024

MATHEMATICS

PAPER 1 (PURE)

3 HOURS

INSTRUCTIONS TO CANDIDATES

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

Any additional question(s) answered will **NOT** be marked.

All working must be shown clearly.

Begin each answer 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)

Answer **ALL** questions in this section

1. Evaluate $\int_2^4 \frac{x^3-1}{x^2}dx$ (5 marks)
2. Solve the equation $5\cos\theta + 2\sin\theta = 3$ for $0^o \le \theta \le 360^o$ (5 marks)
3. The roots of a quadratic equation $x^2+8x+4=0$ are $\left(\alpha + \frac{1}{\beta}\right)$ and $\left(\beta + \frac{1}{\alpha}\right)$. Find the equation whose roots are α and β. (5 marks)
4. Find the acute angle between the lines $2x-y=6$ and $x=0$. (5 marks)
5. The sum of the first n terms of the progression is $S_n = n(n-2)$. Find the
   (i) Sum of the first twenty terms (2 marks)
   (ii) Twentieth term of the Progression. (3 marks)
6. Differentiate $\sqrt{(1+x^2)^3}$ with respect to x. (5 marks)
7. Prove that the points A, B and C whose position vectors are $2a$, $4b$ and $3a-2b$ respectively are collinear. (5marks)
8. The height of the cylinder increases by 2%, find the percentage change in the radius if the volume of the cylinder is to remain constant. (5 marks)

SECTION B (60 MARKS)

Answer only ***five*** questions from this section

9. (a) Use the substitution $y = x - \frac{1}{x}$ to express $x^2 + \frac{1}{x^2}$ in terms of y.

   Hence solve the equation $2x^4 - 3x^3 - 4x^2 + 3x + 2 = 0$ (6 marks)

   (b)Expand $(1-x)^{\frac{1}{3}}$ using binomial theorem in ascending powers of x up to and involving x^3, hence deduce the value of $\sqrt[3]{7}$ correct to three decimal places. (6 marks)

10 (a) Given that $z_1 = (4+5i)(7+2i)$ and that $z_2 = (4-5i)(7-2i)$. Write down the complex numbers z_1 and z_2 in the form $x+yi$. Hence express $18^2 + 43^2$ as a product of two prime factors. (5 marks)

(b) The point P representing a complex number z is such that

$$\arg(z+5-12i) = \frac{\pi}{4}$$

(i) Find the Cartesian equation of the locus of the point P. (4 marks)

(ii). Describe briefly the geometrical interpretation of the locus. (1 marks)

(iii) Compute the minimum value of $|z|$ (2 marks

11. For the curve $y = \frac{(x-2)^2}{x+2}$

i. Determine the nature turning points of the curve (7 marks)

ii. State the asymptotes of the curve. (3 marks)

iii. Sketch the curve. (2 marks)

12. The line $\boldsymbol{l}$ is drawn from A to B. B is the foot of the perpendicular drawn from the point A $(7,2,1)$ to the line $r = (1+\lambda)i + 2\lambda j + 3k$. Find the;

(a) Coordinates of the point B (8 marks)

(b) Cartesian equation of the line $\boldsymbol{l}$ (4 marks)

13 (a) Prove that $\frac{\cos 3\theta + \cos\theta}{\cos\theta + \sin\theta} = 1 + \cos 2\theta - \sin 2\theta$

Hence deduce $\frac{\cos 67\frac{1}{2}^o + \cos 22\frac{1}{2}^o}{\cos 22\frac{1}{2}^o + \sin 22\frac{1}{2}^o}$ (7marks)

(b) Solve the equation: $2\cos^2\theta + \sin\theta = 1$ for $-180^o \le \theta \le 180^o$ (5 marks)

14 (a) Evaluate $\int_0^{\frac{\pi}{4}} x\tan^2 x\,dx$ (6 marks)

(b) Differentiate $x^2 + e^{2x} + x^x$ with respect to x. (6 marks)

15(a). The points $P\left(\frac{p}{3}, \frac{9}{p}\right)$ and $Q\left(\frac{q}{3}, \frac{9}{q}\right)$ lie on a rectangular hyperbola. Determine the equation of the chord PQ and deduce the equation of the tangent at a point whose parameter is $'t'$. (6 marks)

(b). Given that the chord PQ is parallel to the line $6x + 2y = 3$, Show that the locus of M the midpoint of PQ is a straight line . (6 marks)

16. An Antelope runs from point A towards B, 100m apart at a rate proportional to the square root of the distance yet to be covered. If the speed of the Antelope at a point A is $20ms^{-1}$. Find the;

(i) Time it takes for the Antelope to reach point B. (7 marks)

(ii) Distance covered from point A by the Antelope in 8 seconds and the speed of the Antelope at this instant. (5 marks)

END