P425/1
PURE
MATHEMATICS
Paper 1
AUGUST 2022
3 HOURS

(MEPSA) RESOURCEFULL ASSESSMENT

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS set.2

PURE MATHEMATICS

Paper 1

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 necessary working* ***must*** *be shown clearly*
- *Begin each answer on a fresh sheet of paper*
- *Graph paper is provided*
- *Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

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SECTION A: (40 MARKS)

Answer **all** *questions in this section.*

1. Solve the simultaneous equations;

   $x + y = 4$

   $x^2 + y^2 - 3xy = 76$ *(05 marks)*

2. Solve the equation; $\sqrt{3}\ \sin\theta - \cos\theta + 2 = 0$ for $0 < 0 < 2\pi$. *(05 marks)*

3. Find the equations of the lines which pass through the point A(3, -2) and makes an angle θ with the line 2x - 3y – 4 = 0, where $\tan\theta = 2$. *(06 marks)*

4. Show that $\dfrac{(\sqrt{3} - i)^5}{\sqrt{3} + i} = -16$ *(05 marks)*

5. If y = A x^k, where A and K are non – zero constants , find the values of K such that; $x^2 \dfrac{d^2y}{dx^2} + 2x\dfrac{dy}{dx} - 2y = 0$ *(05 marks)*

6. Using the substitution x = e^t, evaluate the $\int_1^e \dfrac{3 - 1nx}{x^2}\, dx$. *(05 marks)*

7. Given that A and B are points whose position vectors are **a** = 2**i** + **k** and **b** = **i** - **j** + 3**k** respectively.
   Determine the position vector of the point that divides AB in the ratio -4 : 1 *(04 marks)*

8. Find the area bounded by the three curves y = x^2, y = $\frac{1}{4}x^2$ and y = $\frac{1}{x^2}$ in the first quadrant. *(05 marks)*

SECTION B: (60 MARKS)

Answer any **five** *questions from this section.* **All** *questions carry equal marks.*

9. (a) Find $\displaystyle\int \frac{1}{x^3\sqrt{x^2 - 4}}\, dx$ *(06 marks)*

   (b) Evaluate $\displaystyle\int_3^4 \frac{x^3}{x^2 - x - 2}\, dx$ *(06 marks)*

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10. (a) The eighth term of an arithmetic progression is twice the fourth term, and the sum of the eight terms is 30. Find the

(i) first four terms, *(06 marks)*
(ii) sum of the first 12 terms, of the progression *(02 marks)*

(b) Find the number of ways in which the letters of the word STATISTICS can be arranged in a straight line so that,

(i) the last two letters are both Ts. *(02 marks)*

(ii) all the three **Ss** must be together *(02 marks)*

11. (i) Given that the roots of the equation $ax^2 + bx + c = 0$ are α and β. Show that $a^2 = b^2 - 4ac$ if $\alpha - \beta = 1$. *(06 marks)*

(ii) Find a quadratic equation whose roots are $(\alpha + \alpha\beta)$ and $(\beta + \beta\alpha)$ in terms of a, b and c. *(06 marks)*

12. (a) Differentiate with respect to x,

(i) $2^{cos\, x^2}$ *(03 marks)*

(ii) $\log_e \left(\frac{(1+x)\, e^{-2x}}{1-x}\right)^{½}$ *(03 marks)*

(b) (i) Determine the equation of the normal to the curve $y=\frac{1}{x}$ at the point x = 2. *(03 marks)*

(ii) Find the coordinates if the other point where the normal meets the curve again

(03 marks)

13. (a) Given the points A (3, 1, 2) and B (2, -2, 4), find the sin e of the angle BOC.
Hence determine the area of triangle AOB. Where O is the origin.
(06 marks)

(b) Show that the line $\frac{x-2}{2} = \frac{2-y}{1} = \frac{3-z}{-3}$ is parallel to the plane $r.(4\mathbf{i} - \mathbf{j} - 3\mathbf{k}) = 4$.
Hence find the perpendicular distance between the line and the plane.
(06 marks)

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14.(a) $\sin(2\sin^{-1}x + \cos^{-1}x) = \sqrt{1 - x^2}$. *(05 marks)*

(b) Prove that $\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$, hence solve the equation

$\tan(x - 45^0) = 6\tan x$, where $-180^0 \leq x \leq 180^0$ *(07 marks)*

15. (a) Find the equation and radius of a circle passing through the points A (0,1), B (0, 4) and C (2 , 5). *(05 marks)*

(b) A circle passes through the point P(1, -4) and is tangent to the y-axis. If its radius is 5 units, find its equation *(07 marks)*

16. (a) Given that y = 0 when x = 0, solve the equation $\frac{dy}{dx} = 2y + 3$, Expressing *y* as a function of *x*. *(05 marks)*

(b) When a uniform rod is heated it expands in such a way that the rate of increase of its length, l, with respect to the temperature, θ^0 C, is proportional to the length. When the temperature is 0^0C the length of the rod is L. Given that the length of the rod has increased by 1% when the temperature is 20^0C, find the value of θ at which the length of the rod has increased by 5%. *(07 marks)*

END

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