

P425/1
PURE
MATHEMATICS
PAPER 1
July/August, 2019
3 hours

MOCK EXAMINATIONS 2019
Uganda Advanced Certificate of Education
Pure Mathematics Paper 1
Time: 3 Hours

NAME: _____ **COMBINATION:** _____

INSTRUCTIONS TO CANDIDATES:

- Answer **all** the **eight** questions in section A and only **five** questions in section B.
- Indicate the five questions attempted in section B in the table aside.
- Additional question(s) answered will **not** be marked.
- **All** working **must** be shown clearly.
- Graph paper is provided.
- Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

Question		Mark
Section A		
Section B		
Total		

Section A (40 Marks)

Answer **ALL** questions from this section. All questions carry equal marks.

Qn 1: Solve the equation $5 \sin 2x + 4 = 10 \sin^2 x$ for $-\pi \leq x \leq \pi$. [5]

Qn 2: The second and third terms of a geometric progression are 24 and $12(\alpha + 1)$ respectively. Find α if the sum of the first three terms of the progression is 76. [5]

Qn 3: The perpendicular bisector of the line joining the points (3, 2) and (5, 6) meets the x-axis at A and the y-axis at B, prove that the distance $AB = 6\sqrt{5}$. [5]

Qn 4: Given that $y = \frac{\sin x}{x}$, show that $x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + xy = 0$. [5]

Qn 5: Show that the lines L_1 , vector equation $\vec{r} = \begin{pmatrix} 2 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ and L_2 , vector equation $\vec{r} = \begin{pmatrix} 3 \\ -3 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ are perpendicular and find the position vector of their point of intersection. [5]

Qn 6: Find $\int \frac{\cos x}{4 + \sin^2 x} dx$. [5]

Qn 7: Solve the equation $\log_x 32 - \log_{256} x = 1$. [5]

Qn 8: A spherical water container of internal radius 10 cm has water to a maximum depth of 18 cm. Find the volume of the water in the container. [5]

Section B (60 Marks)

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

Question 9:

- (a). Differentiate:
- (i). $\log_{10} \left(\frac{e^x}{\cos 3x} \right),$
 - (ii). $\sin^2(4x^2 + 5).$
- (b). A curve is defined by the parametric equation $x = 2t^2, y = 4t - t^4$. Find the equation of the tangent to the curve at the point (2, 3). [12]

Question 10:

- (a). Given that $\frac{a}{b} = \frac{c}{d} = k$, show that $k = \frac{a+c}{b+d}$. Hence, solve the simultaneous equations

$$\frac{x + 4z}{4} = \frac{y + z}{6} = \frac{3x + y}{5}$$

$$4x + 2y + 5z = 30.$$

- (b). Solve the equation $e^{2x} - 4e^x + 3 = 0$. [12]

Question 11:

- (a). Given that \vec{r} and \vec{s} are inclined at 60° ; \vec{t} is perpendicular to $\vec{r} + \vec{s}$ and $|\vec{r}| = 8, |\vec{s}| = 5, |\vec{t}| = 10$, find $|\vec{r} + \vec{s} + \vec{t}|$ and $|\vec{r} - \vec{s}|$.
- (b). The equation of a plane P is $\vec{r} \cdot \begin{pmatrix} 2 \\ 6 \\ 9 \end{pmatrix} = 33$ where \vec{r} is the position vector of a point on P . Find:
- (i). the perpendicular distance from the origin to the plane.
 - (ii). the equation of a line L which passes through the point $A(5, -1, 2)$ and perpendicular to P .
 - (iii). the coordinates of the points of intersection of P and L . [12]

Question 12:

- (a). Find $\int x \sec^2 x \, dx,$
- (b). Evaluate $\int_2^3 \frac{3+3x}{x^3-1} \, dx.$ [12]

Question 13:

(a). In the equation $ax^2 + bx + c = 0$, one of the root is the square of the other. Without solving the equation, prove that

$$c(a - b)^3 = a(c - b)^3$$

(b). (i). If α and β are the roots of the quadratic equation $ax^2 + bx + c = 0$, obtain the equation whose roots are $\frac{1}{\alpha^3}$ and $\frac{1}{\beta^3}$.

(ii). If in the equation in (b)(i) above, $\alpha\beta^2 = 1$, prove that $a^3 + c^3 + abc = 0$. [12]

Question 14:

- (a). Find the equation of the line through the intersection of the lines $3x - 4y + 6 = 0$ and $5x + y + 13 = 0$ which
- (i). passes through the point $(2, 4)$,
 - (ii). makes an angle of 60° with the x -axis.
- (b). A circle touches the y -axis at a distance $+4$ from the origin and cuts off an intercept 6 from the x -axis. Find the equation of the circle. [12]

Question 15:

- (a). Given that $\cot^2 \theta + 3 \operatorname{cosec}^2 \theta = 7$, show that $\tan \theta = \pm 1$.
- (b). (i). Express the function $y = 4 \cos x - 6 \sin x$ in the form $R \cos(x + \alpha)$ where R is a constant and $0 \leq \alpha \leq 2\pi$. Hence find the coordinates of the minimum point of y .
- (ii). State the values of x at which the curve cuts the y -axis. [12]

Question 16:

- (a). Find the particular solution of the equation $\frac{dy}{dx} = x - \frac{2y}{x}$ given $y(2) = 4$. [5]
- (b). The rate of increase of the population, P , of baboons in Busitema forest reserve is proportional to the number present in the forest at any time, t years. On first June 2010, there were 300 baboons in the forest and a year later, they were found to be 380.
- (i). Form a differential equation involving P and t where t is time. [1]
 - (ii). Predict the population of baboons by first June 2018. [6]

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