P425/1
Pure Mathematics
3 hours

EOT UACE EXAMINATIIONS 2024
Pure Mathematics Paper 1
Time: 3 Hours

INSTRUCTIONS:

- *Answer **all** the **eight** questions in Section **A** and only **five** questions in Section **B**. Each number in section B should state on fresh page*

SECTION A (40 MARKS)

Qn 1: Evaluate $\frac{dy}{dx}$ $at\ x = 2$, given that $y = In\left[\frac{1+x^2}{1-x^2}\right]^{\frac{1}{2}}$ [5marks]

Qn 2: Solve the inequality: $|x-2| > 3|2x+1|$. [5marks]

Qn 3: Differentiate $y = \boldsymbol{4x^2} + 6x$ from first principles. [5marks]

Qn 4: Solve the equation $\sqrt{6x+1} - \sqrt{2x-4} = 3$ [5marks]

Qn 5: Solve for x, $\sin(x + 30^0) = \cos x$, where $0 \le x \le 2\pi$. [5marks]

Qn 6: Show that $\tan(\alpha + \beta) = 1\,, if\ \ \tan\alpha = \frac{a}{(a+1)}\, and \tan\beta = \frac{1}{(2a+1)}$

[5marks]

Qn 7: Find the equation of the line which passes through the point (3, 2) and the point of intersection of the lines $3x - 4y - 6 = 0\ and\ 2x + 3y - 1 = 0$.

[5marks]

Qn 8: Express the function $f(x) = 1 - 6x - x^2$in form of $a - (x + b)^2$, hence state the value of x at which it occurs [5marks]

SECTION B (60 MARKS)

Question 9:

(a). Solve the simultaneous equations

$(x + 3)(y + 3) = 10\ and\ (x + 3)(x + y) = 2$ [05marks]

(b). Use a substitution $y = x + \frac{2}{x}$ to solve, $x^4 - 5x^3 + 10x^2 - 10x + 4 = 0$.

[07marks]

Question 10:

a) Express; $\sqrt{5}cosx + 2sinx$ in the form $Rcos(x - \alpha)$ where $R > 0$ and $0 < \alpha < 90^0$. Hence state the maximum value and minimum value of $\sqrt{5}cosx + 2sinx + 10$.

[06 marks]

b) Given that $acos^2\theta + bsin^2\theta = c$, prove that $tan^2\theta = \frac{c-a}{b-c}$,hence solve for θ,in the equation $6cos^2\theta + 2sin^2\theta = 5, where\ \theta\ is\ acute$. [06marks]

Question 11:

(a). In an AP, the thirteenth term is 27, and the seventh term is three times the second term. Find the first term, common difference and the sum of the first ten terms. [06marks]

(b). The first, second and third terms of geometric progression (G.P) are $2k + 6$, $2k\ and\ k + 2$ respectively, where k is a positive constant. Determine the;

i) value of k and the common ratio

ii) the sum to infinity of the progression [06marks]

Question 12:

(a). the polynomial $f(x) = ax^3 + 3x^2 + bx - 3$ is exacyly divisible by $(2x + 3)$ and leaves a remainder -3 when divided by $(x + 2)$. Find the values of$a\ and\ b$.

[05marks]

(b). The curve is given parametrically by the equations $x = \frac{t^2}{1+t^3}, y = \frac{t^3}{1+t^3}$, show that $\frac{dy}{dx} = \frac{3t}{2-t^3}$ and that $\frac{d^2y}{d^2x} = 48$ at a point $\left(\frac{1}{2}, \frac{1}{2}\right)$. [07marks]

Question 13:

(a). Differentiate the following with respect to x.

(i). $(2x + 1)^3 In\sqrt{(x - 3)}$

(ii). $\frac{2x^2-3x}{(x+4)^2}$ [06marks]

(b). Find the equation of the normal to the curve $xy^3 - 2x^2y^2 + x^4 - 1 = 0$ at the point $(1, 2)$ [06marks]

Question 14.

a) Given that in the equation ax^2 + bx + c = 0 are roots of the equation 3 times the other show that 3b^2 = 16ac. [04marks]

b) Find the values of β for which $10x^2 + 4x = 1 = 2\beta x(2 - x)$ has equal roots

[05marks]

c) Use synthetic approach to obtain the remainder when $(x + 4)$ divides the polynomial $2x^4 + 6x^3 - 7x^2 + 9x + 11$ [03marks]

END