P425/1

MATHEMATICS

PAPER ONE

3 HOURS

UGANDA ADVANCED CERTIFICATE OF EDUCATION

S.6 INTERNAL MOCK 2016

3 HOURS

INSTRUCTIONS

Answer all questions in Section A and Not more than five in section B

All working must be shown clearly.

Silence, non-programmable calculators may be used.

SECTION A (40 MARKS)

1. Solve the equation $5\text{Sin}2x + 4 = 10\text{Sin}^2x$ for $-180 \le x \le 180^o$ (5mks)
2. The second and third terms of a geometrical progression are 24 and $12(d+1)$ respectively. Find d if the sum of the first three terms of the progression is 76. (5mks)
3. Points A and B have position vectors $2\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$ and $7\mathbf{i} - 2\mathbf{k}$ respectively. Find the coordinates of the point c which divides AB internally in the ratio 2 : 3 and point D which divided AB externally in the ratio 3 : 8. (5mks)
4. Given that $y = \frac{\sin x}{x}$, show that $x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + xy = 0$ (5mks)
5. Find the coordinates of the points of intersection of the curve with parametric equations $x = 2t^2 - 1$, $y = 3(t+1)$ and the line $3x - 4y = 3$. (5mks)
6. Find $\int \frac{\cos x}{4 + \sin^2 x}\, dx$ (5mks)

7. Solve the equation$\log_x 32 + \log_{1/x} 16 = 1$ (5mks)
8. A spherical water container of internal radius 10cm has water to a maximum depth of 18cm. Find the volume of the water in the container.
(5mks)

SECTION B (60 MARKS)

9. a) Use the binomial theorem to obtain the first four terms of the expansion of $(1 - 16x)^{1/4}$. by taking the first two terms, find$4\sqrt{39}$.
(6mks)

b) Use manclaurin's theorem to find the expansion of $e^x \sin x$ in ascending powers of x as far as the term x^3.
(6mks)

10. By splitting the numerator, find;
a) $\int \frac{2x-1}{4x^2+3}dx$ (6mks)
b) $\int \frac{\cos\theta - 2\sin\theta}{3\cos\theta + 4\sin\theta}d\theta$ (6mks)

11. a) If $0^o \le \theta \le 90^o$, $x > y > 0$ and $\cot\theta = \frac{x^2 - y^2}{2xy}$, find the value of $\sec\theta$ in the simplest form.
(6mks)

b) Solve $2\tan x \sin x + \sin x = \tan x + 1$ for $0^o \le x \le 360^o$
(6mks)

12. a) By using a linear combination, find the Cartesian equation of the plane which passes through the point (1, 2, 3) and which is parallel to the vectors $2\hat{i} + 4\hat{j} - 10\hat{k}$ and $6\hat{i} - 4\hat{j} + 2\hat{k}$. (6mks)

c) Find the equation of the line of intersection of the planes $4x + 3y + z = 10$ and $x + y + z = 6$. Find the angle between the planes above. (6mks)

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13. Sketch the curve $y = x^3 - 3x^2 + 2$ and find the area enclosed by the curve and the x-axis between $x = 0$ and $x = 4$. If this area is now rotated about the x-axis through 2π radians, determine the volume of the solid generated, correct to three significant figures.

(12mks)

14. a) Show that $z = 2 + 3i$ is a root of the equation $z^4 - 5z^3 + 18z^2 - 17z + 13 = 0$, hence find the other roots. (6mks)

b) If $Z = 1 + \text{Cos } 2\theta + i\sin 2\theta$, where $\left(\frac{-\pi}{2} < \theta < \frac{\pi}{2}\right)$ prove that $|Z| = 2$ and arg $(z) = \theta$. (6mks)

15. a) $P(ap^2, 2ap)$ is any point on the parabola $y^2 = 4ax$ and the chord from P passing through the focal point meets the parabola again at Q $(aq^2, 2aq)$ Show that the locus of the mid-point M of PQ is $y^2 = 2a(x-a)$.

(6mks)

(b)Find the equation of the normal at $R(aCos\theta, b\ Sin\theta)$ to the eclipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. If the normal at R to the eclipse meets the x-axis at N and the y-axis at S, find the area of triangle NOS where O is the centre of the eclipse. (6mks)

16. a) Find the particular solution of the equation. $\frac{dy}{dx} = x - \frac{2y}{x}$; given y (2) = 4. (5mks)

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 an expression for P in terms t.

ii) Predict the population of baboons by, first June, 2018. (7mks)

END

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