

P425/1

**PURE MATHEMATICS**

PAPER 1

3 HOURS

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**PURE MATHEMATICS**

Paper 1

3 hours

**INSTRUCTIONS TO CANDIDATES:**

- Attempt **ALL** the **EIGHT** questions in section A and any **FIVE** from section B.
- All working must be clearly shown.
- Mathematical tables with list of formulae and squared paper are provided.
- Silent, non-programmable calculators should be used.
- State the degree of accuracy at the end of each answer using **CAL** for calculator and **TAB** for tables.
- Clearly indicate the questions you have attempted in a grid on your answer scripts.

Question		Mark
Section A		
Section B		
<b>Total</b>		

## SECTION A: (40 MARKS)

Attempt **ALL** questions in this section

1. Without using tables or calculator, solve  $5^{\log_{25} x} = 3^{\log_{27} 2x}$  (05 marks)
2. Given that  $ye^x = \sin x + \cos x$ , show that  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = 0$ . (05 marks)
3. Solve the equation  $\cos(\theta + 60^\circ) = 1 + \cos \theta$  for  $-180^\circ < \theta < 360^\circ$ . (05 marks)
4. Find the acute angle between the line  $\mathbf{r} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 0 \\ 4 \end{pmatrix}$  and the plane  $4x - 7y - 4z = 20$ . (05 marks)
5. Find the volume of the solid of revolution formed by rotating the area enclosed by the curve  $y = 4x - x^2$  and the line  $y = 2x$  through one revolution about the  $x$ -axis. (05 marks)
6. A line  $2x - y + 3 = 0$  is a tangent to the circle whose centre is  $(-4, 5)$ . Determine the equation of the circle. (05 marks)
7. The roots of the equation  $x^2 + px + (p + 9) = 0$  differ by 3. Find the possible values of  $p$ . (05 marks)
8. Given that  $\int_0^a (3x^2 - 4x - 1)dx = 6$ . Find the value of  $a$ . (05 marks)

## SECTION B: (60 MARKS)

Attempt **FIVE** questions in this section

9. (a) Find and sketch the locus  $\text{Arg}(iz + 1) = \frac{\pi}{4}$  on the argand diagram. (04 marks)  
(b) Given that  $z_1 = 6\left(\cos \frac{5\pi}{12} + i \sin \frac{5\pi}{12}\right)$  and  $z_2 = 3\left(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4}\right)$ . Find  $\frac{z_1}{z_2}$  in the form  $a + bi$ . (04 marks)  
(c) Solve the equation:  $z^3 - i - 1 = 0$ . (04 marks)
10. (a) Prove that in any triangle **ABC**, then  $\frac{a+c}{a-c} \tan \frac{B}{2} = \cot \left(\frac{A-C}{2}\right)$ , where **A**, **B** and **C** are angles of a triangle. (06 marks)

- (b) Solve the equation:  $\sin x - \sin 4x = \sin 2x - \sin 3x$  for  $0^\circ < \theta < 360^\circ$ .  
(06 marks)
11. Expand  $\sqrt{\frac{1+5x}{1-5x}}$  as far as the term in  $x^3$ . Raking the first three terms of the expansion and putting  $x = \frac{1}{9}$ , evaluate  $\sqrt{14}$  correct to 4 significant figures.  
(12 marks)
12. (a) A container in the shape of a hollow cone of semi vertical angle  $30^\circ$  is held with its vertex pointing down wards. Water is poured into the cone at a rate of  $5\text{cm}^3\text{s}^{-1}$ . Find the rate at which the depth of the water is increasing when the depth is  $10\text{cm}$ .  
(06 marks)
- (b) Given that  $y = a(1 - \cos\theta)$  and  $y = a(\theta - \sin\theta)$ .  
Show that  $\frac{d^2y}{dx^2} = -\frac{1}{4}\text{cosec}^4\frac{\theta}{2}$ .  
(06 marks)
13. (a) A point P moves such that its distance from the points  $A(-2, 0)$  and  $B(8, 6)$  are in the ratio  $AP:PB = 3:2$ . Find the locus of the P and describe it fully.  
(07 marks)
- (b) Find the perpendicular distance of the line  $3x = 4(y + 1)$  and the point  $(1, 1)$ .  
(05 marks)
14. (a) Integrate and find the value of  $\int_0^{\frac{\pi}{2}} \left( \frac{1+\sqrt{x}}{\sqrt{x}} + \cot x \right) dx$ .  
(06 marks)
- (b) Find the area enclosed by the curve  $y = x(x - 4)$  and  $x$ -axis.  
(06 marks)
15. Line P is given by  $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z-5}{3}$  and line R is given by  $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$  Find:  
(a) The point of intersection of P and R  
(b) Angle between P and R.  
(12 marks)
16. A curve is such that  $\frac{dy}{dx} = 6x + \frac{k}{x^2}$  and passess through a point  $P(1, 9)$ . The gradient of the curve at P is 2. Find the  
(a) Value of k.  
(b) Equation of the curve.  
(12 marks)

END

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