

P425/1  
**PURE MATHEMATICS**  
PAPER 1  
3 HOURS

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**POST MOCK SET 9 2020**

**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. Solve the inequality  $\frac{1+x}{4+x} \geq \frac{5-2x}{x}$  (5marks)
2. Evaluate  $\int_3^4 \frac{1}{x^2-3x+2} dx$  (5marks)
3. Solve the equation  $2\tan\theta + \sin 2\theta \sec\theta = 1 + \sec\theta$  for  $0 \leq \theta \leq 2\pi$ . (5marks)
4. The line  $5x - 2y + 8 = 0$  is a tangent to the circle with centre at  $(-2, 3)$ . Find the equation of the circle. (5marks)
5. Expand  $(25 - 2x)^{\frac{1}{2}}$  in ascending powers of  $x$  up to the term in  $x^3$ . Hence by taking  $x=1$ , obtain the value of  $\sqrt{23}$  correct to four significant figures. (5marks)
6. If  $y = e^{2x} \sin 2x$ , show that  $\frac{d^2y}{dx^2} = 8(2e^{2x} \cos^2 x - 1)$ . (5marks)
7. The position vectors of the points P and Q are  $3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$  and  $2\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$  respectively. Find the acute angle between PQ and the line;  
 $1 - x = \frac{y-3}{2} = \frac{4-x}{2}$  (5marks)
8. Solve the differential equation,  $\left(\frac{dy}{dx}\right)^3 = e^{(x-3y)}$ . Given that  $y(6) = 0$ . (5marks)

**SECTION B (60MARKS)**  
**Attempt ONLY 5 questions in this section.**

9. a) Show that;  $\log_{16}(xy) = \frac{1}{2}\log_4 x + \frac{1}{2}\log_4 y$ . Hence or otherwise, solve the simultaneous equations.  

$$\log_{16}(xy) = \frac{7}{2}$$

$$\log_4 x / \log_4 y = -8$$
 (7marks)
- b) Solve the equation  $2^{(2+2x)} + 3 \cdot 2^x - 1 = 0$ . (5marks)
10. a) Find  $x$ , if  $\sin^{-1}x + \cos^{-1}\left(\frac{x}{2}\right) = \frac{5\pi}{6}$ . (5marks)
- b) Express  $5\sin\theta + 12\cos\theta$  in the form  $r \sin(\theta + a)$ , giving the value of  $r$  and  $a$ , hence find  $5\sin\theta + 12\cos\theta = 7$ . (7marks)
11. a) Differentiate with respect to  $x$ .  
 i)  $x^{\log_{10} x}$   
 ii)  $\tan^{-1}\left(\frac{1-x}{1+x}\right)$ , simplify your answers (8marks)
- b) if  $y = e^{4x}\cos 3x$ , show that  $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 25y = 0$ . (4marks)
12. a) Show that the line  $\frac{x-2}{2} = \frac{y-2}{-1} = \frac{z-3}{3}$  and the plane  $\underline{r} \cdot \begin{pmatrix} 4 \\ -1 \\ -3 \end{pmatrix} = 4$  are parallel and find the perpendicular distance of the line from the plane. (6marks)
- b) Find the equation of the plane passing through the origin and parallel to the lines'  
 $\frac{x+2}{3} = \frac{y-1}{4} = \frac{z+1}{5}$  and  $\frac{x-3}{4} = \frac{y-2}{-5} = \frac{z+1}{1}$ . (6marks)
13. a) Solve the differential equation  
 $x^2 \frac{dy}{dx} = y(y+x)$ ; Given that  $y(4) = 6$ . (4marks)
- b) A certain game park was found to have 100 lions. Given that the lions die at a rate proportional to the number of lions present and the initial death rate is 5 lions per year.  
 i) Form a differential equation and solve it.  
 ii) How many lions will be in the park after six years? (8marks)

14. a) Given that  $Z = \cos \phi + i \sin \phi$ , where  $\phi \neq \pi$ ,  
show that  $\frac{2}{1+Z} = 1 - i \tan\left(\frac{1}{2}\phi\right)$ . (6marks)
- b) The polynomial  $P(z) = z^4 - 3z^3 + 7z^2 + 21z - 26$  has  $2 + 3i$  as one of the roots. Find the other three roots of the equation  $P(z) = 0$ . (6marks)
15. a) Work out  $\int \frac{dx}{e^x - 1}$ . (5marks)
- b) The area bounded by the curve  $y = x(x - 4)$ , and the x-axis is rotated about the x-axis through a  $\frac{1}{2}$ -turn. Find the volume of the solid generated. (7marks)
16. a) find an equation of the circle that passes through the points.  
 $A(-1,4), B(2,5)$  and  $C(0,1)$ . (5marks)
- b) The line  $x + y = c$  is a tangent to the circle  $x^2 + y^2 - 4y + 2 = 0$ . Find the coordinates of the points of contact of the tangent for each value of  $C$ . (7marks)

**END**