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

## UGANDA ADVANCED CERTIFICATE OF EDUCATION MOCK EXAMINATION

## **PURE MATHEMATICS**

## PAPER P425/1

## Time: 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.
- Clearly indicate the questions you have attempted and where necessary, begin a question on a fresh sheet of paper.
- 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. **DONOT**

Qn									
Marks									

## **SECTION A (40 MARKS)**

1. The points A, B and C have coordinates (0, 6), (1, 3) and (4, 6) respectively. Find the coordinates of the point D, the foot of the perpendicular from A to BC. (05 marks)

2. The *nth* term of an A.P is 
$$\frac{3n-1}{6}$$
, prove that the sum of *n* terms is  $\frac{n}{12}(3n+1)$ . (05 marks)

3. The volume of a sphere is increased by 3%. Find the percentage increase in the radius.

(05 Marks)

- 4. In a triangle OAB, OA = a and OB = b. Given that E divides OA in the ratio 6 : 1, D divides AB in the ratio 2 : 1 and point C is on OB produced such that OC : OB = 3 : 2, find the ratio ED : DC. (05 marks)
- 5. Find the area bounded between the curve  $y = x^2 8x$  and the x axis. (05 marks)

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- 6. Given that  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 2x + 6 = 0$ , find the quadratic equation  $\alpha \qquad \beta$

with roots 
$$\frac{\alpha}{1-\alpha^2}$$
 and  $\frac{\beta}{1-\beta^2}$ . (05 marks)

- 7. Prove that  $4\cos 3\theta \cos \theta + 1 = \frac{\sin 5\theta}{\sin \theta}$ . (05 marks)
- 8. By differentiating and eliminating the constants A and B of  $x = e^{-4t}(A + Bt)$ , find the final expression of the function (05 marks)

#### **SECTION B (60 MARKS)**

- 9a) The third term of an arithmetic progression is 3 and the seventh term exceeds three times the third term by 2. Find the:
- (i) common difference (ii) sum of the first 20 terms. (06 marks)
- b) Using the binomial theorem, expand  $\sqrt{\frac{1+x}{1-x}}$  as far as the term in  $x^2$ . Hence, find an approximate value of  $\sqrt{1.5}$ . (06 marks)
- 10. Sketch the curve  $y = \frac{2x^2 9x 18}{x^2 x 2}$  by clearly finding the turning points and the asymptotes. (12 marks)
- 11a) Find the magnitude and argument of the complex number  $w = \frac{2}{1-3i} + \frac{i}{(2-i)^2}$ . (06 marks)
- b) If k is a variable and z = 4k + 3(1-k)i, find:
- i) the locus of a point P(x, y) representing Z = x + yi. (03 marks)
- ii) the minimum value of |Z|. (03 marks)

12a) Evaluate: 
$$\int_0^{\frac{\pi}{2}} \sin 2x \cos x dx$$
 (05 Marks)

b) Determine the values of P, Q and R such that  $\frac{x^2 + 2x - 4}{x^2 + 2x - 3} = P + \frac{Q}{x + 3} + \frac{R}{x - 1}$ . Hence,

evaluate 
$$\int_{2}^{4} \frac{x^{2} + 2x - 4}{x^{2} + 2x - 3} dx$$
. (07 Marks)

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- 13a) The position vectors of points P and Q are  $2\mathbf{i} 3\mathbf{j} + 4\mathbf{k}$  and  $3\mathbf{i} 7\mathbf{j} + 12\mathbf{k}$  respectively. Determine;
  - i) the size of PQ. (03 marks)
  - ii) The Cartesian equation of PQ. (03 marks)
- b) Find the equation of the plane containing the points P and Q and the line  $\mathbf{r} = \mathbf{i} - 4\mathbf{j} + t(2\mathbf{i} + \mathbf{j} - 3\mathbf{k}).$  (06 marks)
- 14. Prove that the equation of the normal at the point  $P(at^2, 2at)$  on the

parabola  $y^2 = 4ax$  is  $tx + y = 2at + at^3$  and that it meets the parabola again at

$$Q(aT^2, 2aT)$$
 where  $T = -t - \frac{2}{t}$ . The tangents at P and Q meet at R. Prove that

if P is a variable point on the parabola, the locus of R is  $y^2(x+2a)+4a^3=0$ . (12 marks)

15a) Solve the equation: 
$$\cos^{-1} 2x - \cos^{-1} x = \frac{\pi}{3}$$
. (05 marks)

b) Find the maximum and minimum values of the function  $\frac{1}{3 + \sin x - 2\cos x}$  stating clearly the values of x. (06 marks)

16a) Solve the differential equation 
$$\frac{dy}{dx} + y = e^{-x} \cos \frac{1}{2}x$$
 given that  $y = -1$  when  $x = 0$ . (05 marks)

b) A kettle of hot water is cooling in a room where the room temperature is  $15^{\circ}C$ . The rate of cooling is proportional to the difference between the temperature of the water and the room temperature. Given that the water takes 10 minutes to cool from  $75^{\circ}C$  to  $45^{\circ}C$ , find the temperature of the water after 20 minutes. (07 marks)

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