ERETA EDUCATION CONSULT LTD

JOINT MOCK EXAMINATIONS 2024

Uganda Advanced Certificate Of Education

PURE MATHEMATICS

PAPER 1

3HOURS

Instructions to Candidates:

- Attempt **all** the **eight** questions in section **A** and any **Five** from section **B**.
- All the working must be clearly shown.
- Mathematical tables with list of formulae and squared papers are provided.
- Silent, non-programmable calculator should be used.
- State the degree of accuracy at the end of each answer using **CAL** for calculates and **TAB** for tables.

Turn Over

SECTION A (40 marks)

1) Expand $(1 + x + x^2)^6$ as far as the term in x^2. **(05 marks)**

2) The line y=mx and the curve $y=x^2 - 2x$ intersect at the origin o and meet again at point A .If P is the midpoint of OA ,find the equation of the locus of P as m varies. **(05 marks)**

3) Given that x=2 is the repeated root of the equation $2x^3$+px^2+qx-4=0, find the values of p and q. **(05 marks)**

4) A line through the point A (1,-2, 3) parallel to the line $\frac{x}{3} = \frac{y+1}{-1}$ =z+1 meets the plane x+2y+2z=8 at Q, find the coordinates of Q**.** **(05 marks)**

5) Prove that $cos^4 A = \frac{1}{8}$(3+4COS2A+COS4A). **(05 marks)**

6) Solve the differential equation x(1-y)$\frac{dy}{dx}$ + y = 0, given that y=1 when x=e

(05 marks)

7) Find the volume generated when the area bounded by the curve y=1+2x-$x^2$and the line y=1 is rotated through 360^0 about the line y=1. **(05 marks)**

8) If y=e^xlnx, show that x$\frac{d^2y}{dx^2}$ = (2x-1)$\frac{dy}{dx}$ + $(1 - x)y$. **(05 marks)**

SECTION B (60 marks)

9) (a) Express$\frac{x^2+5x+10}{(x+1)(x^2-4)}$ in partial fractions **(07 marks)**

(b) Show that $\int_3^4 \frac{x^2+5x+10}{(x+1)(x^2-4)} dx = \ln(\frac{384}{125})$ **(05 marks)**

10) (a) The sum of the first seven terms of a G.P is 7and the sum of the next seven terms is 896.Find the common ratio of the progression. If the k^{th}term is the first term of the G.P which is greater than 1, find k. **(06 marks)**

(b) Jack operates an account with a certain bank which pays a compound interest of 13.5% per annum. He opened the account at the beginning of the year with sh.500, 000 and deposits the same amount at the beginning of every year. Calculate how much he will receive at the end of 9 years. After how long will the money have accumulated to sh.3, 320,000?   **(06 marks)**

11) (A) Express $\left(-1 - \sqrt{3}\ i\ \right)^{6}$ in the form x+iy   **(06 marks)**

   (b) Given that z (5+5i) =a (1+3i) +b (2-i) where a and b are real numbers and argz=$\frac{\pi}{2}$ and |z|=7, find the values of a and b.   **(06 marks)**

12) The points A and B have position vectors **a** and **b** with respect to the origin O. The points P, Q and R are defined such that 3OP=OA, 3OQ=2OB, 2PR=RQ and S is the point of intersection of AB and OR produced. Find the position vector of R in terms of **a** and **b**. If AS=KAB and OS=LOR, find the values of k and I. Hence write down the position vector of S.   **(12 marks)**

13) (a) Find the maximum and minimum values of the function $\frac{1}{3+sinx-2cosx}$, stating clearly the values of x.   **(06 marks)**

   (b) Prove that in any triangle ABC, cot $(\frac{A-C}{2})$ =$\frac{a+c}{a-c}$tan$\frac{B}{2}$.   **(06 marks)**

14)The differential equation $\frac{dp}{dt}$ = kp(c-p) shows the rate at which information flows in the student population c. P represents the number who have heard the information in t days and k is a constant

(a) Solve the differential equation.   **(06 marks)**

(b) A school has a population of 1000 students. Initially 20 students had heard the information. A day later 50 students had heard the information. How many students had not heard the information by the tenths day? **(06 marks)**

15) Sketch the curve y=$\frac{5x^2+8x+4}{x^2+x}$, by finding the turning points and clearly state the asymptotes. **(12 marks)**

16) Prove that the equation of the chord joining the points P (cp,$\frac{c}{p}$) and Q (cq,$\frac{c}{q}$) on rectangular hyperbola xy=c^2 is pqy+x = c(p+q). It is given that PQ subtends at right angle at the point R (cr,$\frac{c}{r}$) on the curve.

Prove that: (i) PQ is parallel to the normal at R to the curve

(ii) The midpoint of PQ lies on the straight line y+r^2x= 0   **(12 marks)**

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