Students Name: ....

School Name.. Index Number ....

P425/1
PURE MATHS
PAPER 1
3HOURS
JULY/AUGUST 2025

HES MOCK EXAMINATIONS 2025

UGANDA ADVANCED CERTIFICATE OF EDUCATION

PURE MATHS
PAPER 1
3 HOURS

INSTRUCTIONS

Attempt all questions in section A and any 5 in section B

SECTION A

1. Given that $f'(x) = \lim_{h \to 0} \left(\frac{f(x+h)-f(x)}{h}\right)$ is the limit definition of the derivative of a function $f(x)$, use it to find the derivative of a function $f(x) = 5x^2 + 3x$ (5 marks)

2. Find the square root of $5 + 2\sqrt{6}$ (5 marks)

3. Given that $\underline{w}$ and $\underline{v}$ are inclined at 60^0 to each other and $\underline{u}$ perpendicular to $\underline{w} + \underline{v}$. If $|\underline{w}| = 8$, $|\underline{v}| = 5$ and $|\underline{u}| = 10$. Find $|\underline{w} + \underline{v} + \underline{u}|$ (5 marks)

4. Find the distance between the foci, the eccentricity and length of the latus rectum to the ellipse $3x^2 + 4y^2 = 12$. (5 marks)

5. Show that $sin2x - sin2xcos2x + sin2xcos22x + \cdots$ is a geometric sequence and prove that $S_\infty = tan\, x$ (5 marks)

6. Determine the values of X and Y which satisfy the equation $x^2 + 4xy + y^2 = 13$ and $2x^2 + 3xy = 8$ (5 marks)

7. Use Maclaurin's theorem to find the series expansion of $tan^{-1}(x)$ up to the term in x^3. (5 marks)

8. The area of the segment cut off by $y = 5$ from $y = x^2 + 1$ is rotated through a half turnabout $y = 5$. Find the volume of the solid generated (5 marks)

SECTION B

9. a) Given that $A(2,13,-5)$, $B(3,\beta,-3)$ and $C(6,-7,\alpha)$ are collinear, find the values of the contacts α and β. (5 marks)

   b) The equation $\frac{(x-3)}{2} = \frac{(y-5)}{1} = \frac{(7-Z)}{4}$ and $\frac{(x+1)}{3} = \frac{(4+y)}{1} = \frac{(2-Z)}{2}$ represent two pipes P_1 and P_2 respectively in a chemical plant where length is measured in metres. A bypass is to be installed connecting P_1 and P_2. Find the length of the shortest pipe that may be fitted. (7 marks)

10. a) Given that $W = x + iy$ where x and y are real. Show that the locus of a point $P(x, y)$ is a circle of $\frac{(W+1)}{(W+2)}$ is purely real. Hence deduce the centre and radius of the locus of P (6 marks)

b) Find the cube root of $12i - 5$ (6 marks)

11. a) Show that $tan4\theta = \frac{4t\,(1-t^2)}{t^4 - 6t^2 + 1}$, where $t = tan\theta$ (6 marks)

b) Solve the equation $sinx + sin5x = sin2x + sin4x$ for $0 < x < \frac{\pi}{2}$

(6marks)

12. a) Show that the circles with equations $x^2 + y^2 + 4x - 2y - 11 = 0$ and $x^2 + y^2 - 4x - 8y + 11 = 0$ are orthogonal and find the length of the common chord (6 marks)

b) Find the equation of a circle which passes through the point of intersection of the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 2x - 4y + 4 = 0$ for which $x + 2y = 0$ is a tangent. (6 marks)

13. a) Given that $\binom{20}{r} = \binom{20}{r-4}$ find the value of r. (6 marks)

b) A polynomial is given by $f(x) = x^3 + Bx^2 + x - 6$. The ratio of the remainder when $f(x)$ is divided by $(x + 1)$ to the remainder when divided by $(x - 2)$ $is\ -1{:}\,5$. Find the value of B. (6 marks)

14. Given that $y = \frac{x^2 - x - 6}{x - 1}$. Show that y can take on all real values for real values of x and hence sketch the curve. (12 marks)

END

13.