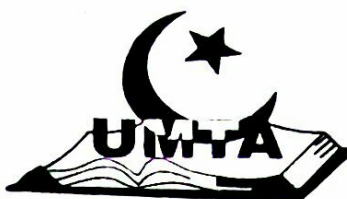


P425/1
Pure Mathematics
Paper 1
July - August, 2022
3 hours



UGANDA MUSLIM TEACHERS' ASSOCIATION
UMTA JOINT MOCK EXAMINATIONS 2022
UGANDA ADVANCED CERTIFICATE OF EDUCATION

Pure Mathematics

Paper 1

3 hours

INSTRUCTIONS TO CANDIDATES

- *Attempt all the eight questions in section A and five questions from section B.*
- *Any additional question(s) answered will not be marked*
- *All working must be shown clearly. Begin each question on a fresh sheet of paper.*
- *Silent, nonprogrammable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A

1. If $y = \tan^{-1}\left(\frac{ax-b}{bx+a}\right)$ show that $\frac{dy}{dx} = \frac{1}{1+x^2}$ (5 marks)
2. Evaluate $\int_1^4 \frac{x^2+x}{\sqrt{2x+1}} dx$ (5 marks)
3. $\frac{\sin x + \sin 3x + \sin 5x}{\cos x + \cos 3x + \cos 5x} = \tan 3x$ (5 marks)
4. Find the angle between $x - 3y + 5 = 0$ and $x + 2y - 1 = 0$ (5 marks)
5. Find the area enclosed by the curve $y = x - \frac{1}{x}$, the x-axis and line $x = 2$ (5 marks)
6. Solve the equation $\sqrt{(3x-x)} - \sqrt{(7+x)} = \sqrt{16+2x}$ (5 marks)
7. Calculate the number of different 7-arrangements which can be made with the letters of the word MAXIMUM. In how many of these do the 4 consonants all appear next to one another? (5 marks)
8. Find the length of the perpendicular distance from $A(4,3,5)$ to plane $6x-y+2z=14$ (5 marks)

SECTION B

9. (a) Find the foot of the perpendicular drawn from the point $(2, -1, 5)$ to the line $\frac{x-11}{10} = \frac{y+2}{-2} = \frac{z+5}{-11}$ (6 marks)
- (b) Find the angle between the plane $x-2y+z=20$ and line $\frac{2-x}{-3} = \frac{y+1}{4} = \frac{2-z}{-12}$ (6 marks)
10. (a) A conical vessel whose height is 10meters and the radius of the base 5m is being filled with water at a uniform rate of $1.5\text{m}^3\text{min}^{-1}$. Find the rate at which the level of the water in the vessel is rising when the depth is 4 meter. (6 marks)
- (b) Find the area enclosed between the curve $y = x(x-1)(x-2)$ from $x = 0$ to $x = 2$ (6 marks)

11. Partialise fully $f(x) = \frac{x^4 + x^3 - 6x^2 - 13x - 6}{x^3 - 7x - 6}$. Hence $\int f(x)dx$ from 4 to 5

(12 marks)

12. (a) Solve the differential equation

$$\frac{dy}{dx} + \frac{2xy}{x^2 + 1} - x = 0$$

(4 marks)

(b) A liquid cools in a room at a constant temperature of 22°C at a rate proportional to the excess temperature. Initially the temperature of the liquid was 100°C and 1 minute later it was 92.2°C . Find the temperature of the liquid after 5 minutes.

(8 marks)

13. (a) Solve the equation $2^{2x+8} - 32(2^x) + 1 = 0$

(5 marks)

(b) If $x = \log_a bc$, $y = \log_b ac$ and $z = \log_c ab$ Prove that $x + y + z = xyz - 2$

(8 marks)

14. (a) Expand $(1 - 3x)^{1/3}$ in ascending powers of x up to x^4 . By using $x = \frac{1}{8}$

evaluate $5^{1/3}$. Give your answer to two decimal places.

(6 marks)

(b) Determine the two ranges of real values of x which satisfy the inequality

$$\frac{x-2}{x-1} \leq \frac{x+2}{x+1}$$

(6 marks)

15. (a) Find the values of x that satisfy the equation

(6 marks)

$$10\sin^2 x + 10\sin x \cos x - \cos^2 x = 2 \quad \text{between } 0^\circ \text{ and } 360^\circ$$

(b) Show that $\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{3}{5}\right) = \tan^{-1}\left(\frac{27}{11}\right)$

(6 marks)

16. (a) Given that one root of the equation $Z^4 - 6Z^3 + 23Z^2 - 34Z + 26 = 0$ is $1+i$ find the others.

(6 marks)

(b) If Z is a general complex number on argand diagram. Show the region given by

$$|z + 1 - 4i| > |z - 2 - i|$$

(6 marks)

END