



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UPGRADING MATHEMATICS

AMA1003: CALCULUS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

$$y = x^2 + 4x + 3$$

- a) (i) Given the function find:
(i) The gradient function of the curve (1 marks)
(ii) The gradient of the curve at (1, 8) (1 marks)
(iii) The equation of the tangent at (1,8) (3 marks)
(iv) The equation of the line perpendicular to the point (1, 8) (3 marks)

$$\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 3x + 2}$$

- b) Find (5 marks)

- c) Use the first principles to differentiate:

$$y = x^2 - 2x + 3$$

(5 marks)

$$\int \frac{3}{x^2} dx$$

- d) Determine the integral of (4 marks)

$$y = 3x^2 \sin 4x$$

- e) Differentiate (4 marks)

$$y = 3 \ln 3x$$

- e) Find the derivative of (2 marks)

Question Two

- a) A particle moves in a straight line and its distance at any time from starting point is given by:

$$S = 45t + 11t^2 - t^3$$

Find:

- (i) Velocity at $t = 3$ (4 marks)
(ii) Acceleration at $t = 3$ (3 marks)
(iii) Its average velocity between $t = 1$ sec and $t = 3$ sec (4 marks)

$$y = 2xe^{3x} \quad \frac{d^2y}{dx^2} + \frac{6dy}{dx} + 9y = 0$$

- b) Given show that (10 marks)

Question Three

$$y = -2x^2 + 4x + 5$$

- a) Use the first principles to differentiate (8 marks)

$$y = \frac{x^2 + 1}{(x+1)^2}$$

b) Find the derivative of (6 marks)

$$y = 2e^{-3x} \cos 4x$$

c) Differentiate with respect to x (6 marks)

Question Four

$$\int \sqrt[4]{x} \, dx$$

a) Integrate (7 marks)

$$\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x^2 - 6x + 8}$$

b) Evaluate (5 marks)

$$y = \frac{2}{5}x^3 - \frac{4}{x^3} + 4\sqrt{x^5} + 7$$

c) Find the differential coefficient of (6 marks)

$$y = 7 \sin 2x - 3 \cos 4x$$

d) Find the derivative of (5 marks)

Question Five

$$f(x) = x^2 + 4$$

a) Find f(3) if (1 mark)

b) Find the equation of the line that passes through the point (5, 1) and whose slope is equal to $\frac{1}{2}$ (4 marks)

$$\int_{-2}^3 (x^2 + 3) dx$$

c) Integrate (4 marks)

$$\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = 0$$

$$y = xe^{2x}$$

d) Show that the differential equation is satisfied when (8 marks)