



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
CERTIFICATE (UPGRADING MATHEMATICS)

AMA 1103: CALCULUS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2013
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A & B**

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

SECTION A (COMPULSORY)

Question One

- a) (i) Define differentiation (2 marks)
(ii) Define integration (2 marks)

b) Differentiation:

$$y = (x+1)(x-5)$$

- (i) (3 marks)

$$y = \frac{x^4 + 6x^2}{2x^2}$$

- (ii) (4 marks)

c) Integrate:

$$\int_{-2}^0 x^4 - 2x^3 + x^2 - x$$

- (i) (4 marks)

$$\int_0^{\pi/2} x + \cos^2 x \, dx$$

- (ii) (6 marks)

d) The velocity (v) of a moving projectile in terms of t is given by:

$$v = t^2 - 3t + 2 \text{ m/s}$$

If its distance from the origin after $t = 2$ (4 marks)

SECTION B (Answer any TWO questions from this section)

Question Two

- a) (i) Define normal and tangent to a curve (4 marks)

$$y = 3x^2 + 2x - 5$$

(ii) Find from first principles the derivative of: (7 marks)

b) Integrate:

$$\int \left(x + \frac{1}{\sqrt{x}} \right) \left(x + \frac{1}{x} \right) dx$$

- (i) (4 marks)

$$\int_0^{\pi/6} 2 \cos 2x + 3 \sin 4x$$

- (ii) (5 marks)

Question Three

a) Differentiate;

$$y = 5 \sin^2 x$$

(i)

(5 marks)

$$y = \sqrt{1+x^2}$$

(ii)

(4 marks)

b) A moving particle in a straight line describes the distance (s) and time (t) seconds as:

$$S = 6t - t^2$$

Find:

(i) Distance after $t = 2$

(2 marks)

(ii) velocity at $t = 2$

(3 marks)

(iii) Its acceleration at $t = 2$

(2 marks)

(iv) Its average velocity $t = 1$ and $t = 4$

(4 marks)

Question Four

a) Find and determine the turning points of the function:

$$y = 5 + 24x - 9x^2 - 2x^3$$

(12 marks)

b) Evaluate the area enclosed by the x-axis $x = 1$ and $x = 3$ and the graph

$$y = x^3 + 1$$

(3 marks)

c) If $y = (x^2 - 3x)^3$

$$\frac{dy}{dx}$$

Find when $x = 2$

(5 marks)

Question Five

a) Differentiate:

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

(i)

(5 marks)

$$y = \left(\frac{1}{x^2}\right)^{\frac{1}{3}}$$

(ii)

(3 marks)

b) Integrate:

(i) $\int \frac{8x - 3x}{x^3} dx$ (3 marks)

(ii) $\int_1^4 \frac{(x+3)(x-3)}{\sqrt{x}} dx$ (6 marks)

c) Find the equation of the normal to the curve:
 $y = x^3 - 9x^2 + 20x - 8$

(3 marks)