



**THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE**

**(A Constituent College of JKUAT)**

(A Centre of Excellence)

# **Faculty of Engineering & Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**DIPLOMA IN TECHNOLOGY**

**DIPLOMA IN BUILDING & CIVIL ENGINEERING**

**DIPLOMA IN ARCHITECTURE**

CALCULUS I

**END OF SEMESTER EXAMINATION**

**SERIES: OCTOBER 2012**

**TIME: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table/Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions

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

**Question One (20 marks)**

$$y = \sqrt{x}$$

a) Working from the first principle, find the derivative of

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

b) Find given.

$$y = \frac{te^{3t}}{3\cos t}$$

i)

$$y = e^t \int \cos t$$

ii)

$$y = 5 \operatorname{cosec}(6\sqrt{t + 2t^2})$$

iii)

$$y = 2 \sin^4 t$$

iv)

**Question Two (20 marks)**

$$y = x^2 - x - 2,$$

a) A function is given as find:

i) The tangent at the point (1, -2)

ii) The normal at the point (1, -2)

**(7 marks)**

b) Find:

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

$$y = \sec ax$$

**(7 marks)**

c) A rectangular area is formed having a perimeter of 50cm. Determine the length and breadth of the rectangle. If it is to enclose the maximum possible area. **(6 marks)**

**Question Three (20 marks)**

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

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$$x = 3$$

a) Find and evaluate when

$$y = \frac{(x-2)^{3/2}}{(2x-1)(x+1)^2}$$

**(8 marks)**

b) Determine the turning point for the curve.

$$y = \frac{x^3}{3} - \frac{x^2}{x} - 6x + \frac{5}{3}$$

. Hence sketch the graph of the curve.

**(12 marks)**

**Question Four (20 marks)**

$$Z = 4x^2y^2 - 2x^3 + 7y^2;$$

a) Given find:

i)  $\frac{\partial^2 z}{\partial x^2}$  (iii)  $\frac{\partial^2 z}{\partial x \partial y}$

ii)  $\frac{\partial^2 z}{\partial y^2}$  (iv)  $\frac{\partial^2 z}{\partial y \partial x}$

**(6 marks)**

b) A car starts from rest and moves a distance, S meters in t seconds where:

$$S = \frac{1}{8}t^3 + \frac{1}{2t^2},$$

find at t = 5 seconds.

(i) The velocity

(ii) The acceleration

**(6 marks)**

c) Show the differential equation:

$$\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 41y = 0$$

$$y = 2e^{4x} \cos 5x$$

is satisfied when

**(8 marks)**

**Question Five (20 marks)**

$$\frac{d}{dx}(2x^3y^2)$$

a) Determine

**(6 marks)**

$$x = 4(\theta - \sin \theta), y = 4(1 - \cos \theta)$$

b) Given

Determine:

i)  $\frac{dy}{dx}$

ii)  $\frac{d^2y}{dx^2}$

**(9 marks)**

c) If  $f(x) = 2x^5 - 4x^3 + 3x - 5$ , find

i)  $f'(x)$

ii)  $f''(x)$

**(5 marks)**