



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
Kenya Institute of Highways & Building Technology

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBE 3101: MATHEMATICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Mathematical tables/ Calculator*

This paper consists of **FIVE** questions

Answer question **ONE** 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 1

- a) From the first principles, find the derivative of: $\frac{\cos 2x}{5x}$ (7 marks)

- b) Find $\frac{dy}{dx}$ given:

(i) $y = \frac{3-2x}{3+2x}$

(ii) $y = \sec \sqrt[3]{x}$

(iii) $y = \arctan x^2$

(9 marks)

- c) Find the equation of the tangent line to the graph of $f(x) = \sqrt{x^2 + 3}$, at the point (-1, 2). (4 marks)

SECTION B (Answer any TWO questions from this section)

Question 2

- a) Write the following $x + iy$ form:
 $3 + 2i + 2(1 - i)$

(i)

$e^{i\pi/4}$

(ii)

$e^2 - 3i$

(iii)

(9 marks)

- b) Express $z = 2.5 + 4.33j$ in the form $z = re^{j\theta}$. (5 marks)

- c) Express the following in polar form:

(i) $3 + 5j$

(ii) $-6 + 3j$

(6 marks)

Question 3

a) Use De Moivre's theorem to determine, $(1 + \sqrt{3}i)^6$. (6 marks)

b) In each part for the following, evaluate the limit;

$$\lim_{x \rightarrow \frac{\pi}{2}} \tan^{-1}(\sin x)$$

(i)

$$\lim_{x \rightarrow 0} \left[\frac{1}{x^2} - \frac{1}{x^4} \right]$$

(ii)

c) Let $z = 1 - i$. Find z^{10}

(6 marks)

(8 marks)

Question 4

a) Find $\frac{dy}{dx}$ when $t = 2$, given $x = t^2 + 2t, y = 2t^3 - 6t$

(6 marks)

b) Use logarithmic differentiation to find $\frac{dy}{dx}$ given;

$$y = x^5 \sin 2x \cos 4x$$

(i)

$$y = \frac{(3x+1) \cos 2x}{e^{2x}}$$

(ii)

$$\frac{dy}{dx} \quad y = \frac{e^{5x}(3x+1)}{\cos 2x}$$

c) Find $\frac{dy}{dx}$ given,

(10 marks)

(4 marks)

Question 5

a) Find the equation of the tangent to $y = x^3 - 2x^2 + 4$ at $(2, 4)$. (5 marks)

b) Given $z = (4x^3 - 2y)(3x + 5y)$, Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ (8 marks)

c) Find all the complex cube roots of $27i$ (5 marks)