



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN SCIENCE & LABORATORY TECHNIQUES

AMA 2104: CALCULUS FOR SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions

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

This paper consist of **THREE** printed pages

QUESTION ONE (30 MARKS)

- a) (i) Make y , the subject of the following (3 marks)

$$r = \frac{ay^2}{y^2 + b}$$

- (ii) Expand $(3 + x)^6$ upto the term x^4 , hence evaluate $(3.003)^6$ correct to 3 decimal places (5 marks)

- (iii) A piece of wire is folded into a rectangle whose dimensions are such that its length is 4cm and longer than its width. The area of the rectangle so formed 21cm².

Determine:

- I. The dimension of the rectangle (3 marks)
II. The perimeter of the rectangle (2 marks)

- b) Using first principle, differentiate

$$y = x^{-2} + 2$$

- c) The table shows the distribution of masses of 100 first year medical students.

Mass kg	40 – 45	45 – 50	50 – 55	55 – 60	60 – 65	65 – 70
Frequency	9	12	22	28	19	10

Determine:-

- (i) The mean to the nearest kg. (5 marks)
(ii) The standard deviation (6 marks)

QUESTION TWO (20 MARKS)

- a) Differentiate with respect to x

$$y = e^x \cos x$$

- (i) (5 marks)

$$y = \frac{\ln x}{\sin x}$$

- (ii) (5 marks)

$$y = 2x^3 - 2x^2 - 10x - 8$$

- b) Given the function

Determine;

- (i) The turning points (6 marks)
(ii) The normal and tangent equations at (1, 0) (4 marks)

QUESTION THREE (20 MARKS)

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

a) Find for the given parametric equations

$$X = \frac{2t-1}{1-t}$$

$$y = t^2 + 1$$

(i)

$$x = \cos 2t$$

$$y = \sin t$$

(ii)

$$\int_2^4 \frac{x^2}{4} + x^2 + 1 dx$$

b) (i)

(4 marks)

(ii) Determine the area bounded by the curve

$$y = 3x^2 + 6x - 8,$$

the x – axis and the ordinates $x = 1$ and $x = 3$

QUESTION FOUR (20 MARKS)

$$Z = (2x - y)(x + 3y)$$

a) If

Determine:-

$$\frac{\partial z}{\partial x} \quad \frac{\partial z}{\partial y}$$

and

b) The distance S, metres, moved by a particle along a straight line after t, seconds in motion is given by

$$S = 8 + 10t^2 - 3t^3$$

Find:

i) The distance moved by the end of $t = 2$ (3 marks)

ii) The velocity of the particle at $t = 2$ (3 marks)

iii) The acceleration of the particle at $t = 2$ (3 marks)

iv) The value of t when the particle attains maximum velocity (3 marks)

c) Integrate

$$\int_{-4}^4 \frac{x^2 + 6x + 5}{x + 1} dx$$

(4 marks)

QUESTION FIVE (20 MARKS)

a) A bag contains 6 red balls and 4 green balls, one ball is drawn out of the bag at random and not replaced. Draw a tree diagram to represent the probability of the event for 3 consecutive draws.

Using the tree diagram,

Find the probability of drawing;

- i) Three red balls (2 marks)
ii) Two red balls (4 marks)
iii) Two green balls (4 marks)

$$y = \cos^{-1} x \quad \frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$$

- b) (i) Show that the derivative of $y = \cos^{-1} x$ is (5 marks)

$$x^2 + y^2 - 2x - 6y = 0$$

- (ii) If

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

Find $\frac{d^2y}{dx^2}$ at $x = 3$ and $y = 2$