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

(i) $$y = e^x \cos x$$ (5 marks)

(ii) $$y = \frac{Inx}{\sin x}$$ (5 marks)

b) Given the function
$$y = 2x^3 - 2x^2 - 10x - 8$$
Determine;
(i)   The turning points   (6 marks)
(ii) The normal and tangent equations at (1, 0)   (4 marks)

QUESTION THREE (20 MARKS)

a) Find $\dfrac{dy}{dx}$ for the given parametric equations

(i)
$$X = \frac{2t-1}{1-t}$$
$$y = t^2 + 1$$

(ii)
$$x = \cos 2t$$
$$y = \sin t$$

b) (i) $$\int_2^4 \frac{x^2}{4} + x^2 + 1 \, dx$$ (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)

a) If
$$Z = (2x - y)(x + 3y)$$
Determine:-

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

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

(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)

b) (i) Show that the derivative of $y = \cos^{-1} x$ is $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{1-x^2}}$ (5 marks)

(ii) If $x^2 + y^2 - 2x - 6y = 0$

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