THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UPGRADING MATHEMATICS

AMA 1103: CALCULUS

FINAL EXAMINATION

SERIES: AUGUST/SEPTEMBER 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) Given the function $y = x^2 + 3x + 2$, find;

(i) The gradient function the curve (1 mark)

(ii) The gradient of the curve at (1,2) (2 marks)

(iii) The equation of the tangent at (1,2) (4 marks)

(iv) The equation of the normal at (1,2) (4 marks)

(v) The turning point (3 marks)

b) (i) Integrate the function (5 marks)

$$\int_0^3 \frac{x^2 + 5x + 6}{x + 2}$$

c) Use product rule to differentiate

$$y = e^{x+1} \cos x$$

(4 marks)

d) Use substitution method to integrate (7 marks)

$$\int \frac{dx}{x^2 + 2x + 10}$$

Question Two (20 marks)

a) Using first principles differentiate $y = x^3$ (4 marks)

b) The speed of a body v m/s through the air at time t seconds is given by $v = 10(10t - t^2)$

Find

i) The value of t for the maximum velocity to be obtained (3 marks)

ii) The distance travelled by the body in the first 6 seconds from rest (4 marks)

iii) Its acceleration when $t = 6.5$ (3 marks)

iv) The velocity of the body when $t = 2$ (2 marks)

c) Find the derivative of the curve $y = \frac{2}{3}x^3 - \frac{1}{2}x^2 - x + 5$ at point where $x = 2$ (2 marks)

Question Three (20 marks)

a) Using chain rule differentiate

$$y = (2x+3)^{-4}$$

(i) (4 marks)

$$y = \cos^3 5x$$

(ii) (5 marks)

b) Use substitution method to integrate (5 marks)

$$\int \frac{dx}{1+x^2}$$

c) Find by integration the area bounded by the curve $y = 3x^2 + 4$, the x-axis and the lines $x=2$ and $x=5$ (6 marks)

Question Four (20 marks)

a) A rectangular sheet of metal measures 8cm by 5 cm. Equal squares up side x are removed from each corner and the edges are folded to make an open box of volume vcm3. Find the value of x for which the volume of the box is maximum and hence find this maximum volumes (12 marks)

b) Find the derivative of:

$$y = e^{2x^4}$$

(4 marks)

c) Integrate:

$$\int_{-1}^{3} (x-1)^2 \, dx$$

(4 marks)

Question Five (20 marks)

a) (i) Sketch the curve of $y = x^2$ (3 marks)

(iii) Find the area bounded by the curve $y = x^2$ and the lines $y = x, x = 1$ and $x = 2$ (10 marks)

b) Use product rule to differentiate:

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

(4 marks)

c) Integrate

$$\int_1^2 4x^3 dx$$

(3 marks)