



## MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture & Technology)

University Examinations

School of pure & Applied Sciences

End of Semester Examination

Certificate in Bridging Mathematics

### SMB 0103: CALCULUS

DATE: 9<sup>TH</sup> DECEMBER 2015

TIME: 2Hours

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**INSTRUCTIONS: Answer Question One and Any Other Two Questions**

#### QUESTION ONE (30 MARKS)

a) Find the derivative of  $y = 2x^3 + 3x^2$  from the first principles. (5mks)

b) Given that  $y = \sin^5 x$ , find  $\frac{dy}{dx}$  (6mks)

(c) The distance,  $x$  metres moved by a car in a time,  $t$  seconds is given

$x = 3t^3 - 2t^2 + 4t - 1$ . Determine the velocity and acceleration when

$t = 0$  and  $t = 1.5s$  (6mks)

d) Find the equation of the tangent to the curve described by the equation

$y = x^4 - 3x^2 + 2x$  at the point where  $x = 2$  (4mks)

e) Evaluate

$\int_0^2 (x^2 + 2x + 1) dx$  (4mks)

(f) Find the area bounded by the curve  $y = 4x^3 + 1$  between  $x = 2$  and  $x = 4$  using the trapezium rule with intervals of 0.5 of a unit. Also compute the same area using the method of direct integration. (5mks)

**QUESTION TWO (20 MARKS )**

(a) Evaluate the following

i)  $\int_1^5 (x + 4)^2 dx$  (4mks)

ii)  $\frac{dy}{dx}$  given that  $y = \frac{(x^2 + 8x)}{(x+1)}$  (4mks)

iii)  $\int (2 + x) dx$  (2mks)

(b) A rectangular block, with a square base of side  $x$  mm, has a total surface area of  $150 \text{ mm}^2$ . Show that the volume of the block is given by;

$$V = \frac{1}{2}(75x - x^3) \text{ mm}^3$$

and hence find the maximum volume of the block. (10mks)

**QUESTION THREE (20 MARKS)**

(a) Find the turning points of  $y = x^3 - 3x + 5$ . Distinguish between them. (10mks)

(b) An object moves along a straight line in such a way that its distance from a fixed-point O

on the line after  $t$  seconds is  $S$  meters, where  $S = \frac{1}{6}t^4$  find;

i) its velocity after 3 seconds and after 4 seconds (2mks)

ii) its average velocity during the 4<sup>th</sup> second (3mks)

iii) its acceleration after 2 seconds and after 4 seconds (2mks)

iv) its average acceleration from  $t = 0$  to  $t = 4$  (3mks)

**QUESTION FOUR (20 MARKS)**

(a) A farmer erects a fence along three sides of a rectangle in order to make a sheepfold, the

fourth side of the rectangle is provided by a hedge already in existence. Find the maximum area of enclosure thus made if the total length of the fence is to be 80m.

10mks

(b) Find  $\frac{dy}{dt}$  given that; (i)  $y = \frac{2}{(2t^3 - 5)^4}$  (6mks)

(ii)  $y = 5e^{2t+1}$  (4mks)