**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**SECOND YEAR FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

**SMA 2101: CALCULUS 1**

**DATE: NOVEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND**

**ANY OTHER TWO QUESTIONS**

**QUESTION ONE: 30 MARKS**

 a. Define the following terms:

 i. Range of a function. [2 marks]

 ii. Polynomial. [2 marks]

 iii. Composite function. [1 marks]

 b. Evaluate the following:-

 i. lim $x$ + $x$ - 3

 x 3 $x$ +3 $x$ 2- 9 [4 marks]

 ii. lim x + 2 [3 marks]

 $x$ -2 $x$ + $x$ -2

 c. Determine the equation of the normal line to the curve defined by

 the equation 2(y-$x$ )5 -$ x$y = 3 at the point (-1,1) [5 marks]

 d. Define continuity, hence determine whether the function f ($x)$ is

 continuous at $x$ = 1 where f ($x$) = $\sqrt{x-1}$ [5 marks]

 e. Determine the differential coefficient of $y$ = $x$ 2 cos2 $x$ [3 marks]

 f. Given that f($x)$= 5$ x$+ 1 and g($x)$= $x$2 . Express the composite

 function fog and gof in their simplest form possible and find

f (g (-2)) and g ( f (3) ) [5 marks]

**QUESTION TWO: 20 MARKS**

 a. Find the equation of both lines (normal and tangent) Through

(2, - 2) to the curve y = $x$2 + $x$ [6 marks]

 b. Find the derivative function of the following functions:-

 i. $x$2 + 2 $x$y + y2 = 3

ii. y = e coszx

iii y = 3sinx [10 marks]

 c. the total sales (in thousands) for a home video game + month after it

 was introduced is given by s(t) = 250t2

 t2 +100

 find S1(20) and interpret your results. [4 marks]

**QUESTION THREE: 20 MARKS**

a. Differentiate y = $x$ 2x with respect to $x$ [4 marks]

b. The rate of recovery of a patient after x milligrams of a certain drug

 is administered obeys the mathematical model

R = 4$x$3 - 10$ x$2 + 9$x$ + 50,

 3

 determine the value of $x$ that gives a maximum rate of recovery,

 hence state the maximum R. [10 marks]

c. Differentiate the following functions with respect to $ x$

 i. y = e2x (x 2/3 + 4 )  [3 marks]

 ii. y= cos (8$ x$2) [3 marks]

 $x$-1

**QUESTION FOUR: 20 MARKS**

 a. Find dy for the following, x=t2 and y=3t2 + 5 [3 marks]

 dx

 b. Calculate the values of a b that will make

 f(x) = x3 + ax2 + bx have

 i. A local maximum at x= -1 and a local minimum at

 x=3 [4 marks]

 ii. A local maximum at x =4 and a point of inflection at

 x=1 [3 marks]

 c. a body moves so that its distance (meters) from a fixed point

D at time in seconds is given by

 S= (t-1)2 (3t-2). Find,

 i. The time when the body passes through D. [3 marks]

 ii. The velocity and acceleration at each time. [4 marks]

 iii. Maximum velocity. [3marks]

**QUESTION FIVE: 20 MARKS**

 a. Find the equation of the normal to the curve y = 4x2 + 2x + 5

 at the point (0,2) [4 marks]

 b. find dy if y2 =x2 + sin xy [5 marks]

 dx

 c. water runs into a conical tank at the rate of 9m3/min. The tank stands

point down and has a height of 10m and a base radius of 15m. How fast is the water level rising when the water is 6m deep. [11 marks]