THE CO-OPERATIVE UNIVERSITY
OF
KENYA
UNIVERSITY EXAMINATIONS 2019/2020
SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN STATISTICS WITH IT SECOND YEAR FIRST SEMESTER

BMAT 2111: CALCULUS 11

DATE:DECEMBER 2019 TIME: 2 HOURS

INSTRUCTIONS: Attempt Question One and any other Two Questions.

QUESTION ONE (30 MARKS)

(a) Evaluate the following integrals.

(i) $\int \frac{dx}{\sqrt{x^2+10x+30}}$ [3 marks]

(ii) $\int e^x sinxdx$ [4 marks]

(iii) $\int xlnxdx$ [3 marks]

(iv) $\int \frac{dx}{16+(x+2)^2}$ [3 marks]

(b) If the region in the first quadrant bounded by the curve $y = e^x$ and $x = 1$ is rotated about the x axis, what is the volume of the resulting solid? [5 marks]

(c) Show that the minimum value of $y = asec\theta - btan\theta$
is $\sqrt{a^2 - b^2}$ [4 marks]

(d) I invest ksh. 100,000 in a company for five years, with a guaranteed income of 8% per year, compounded semi-annually. How much will I have at the end of 5 years? If the interest were compounded continuously, how much would I have in 5 years [5 marks]

(e) Find the higher order derivatives $y'andy''$
$y = sin^2\theta$
$x = cos^3\theta$ [3 marks]

QUESTION TWO (20 MARKS)

1. Determine the partial fraction decomposition for the integral,

2. Use trapezoidal rule to estimate the following
   $\int_2^4 \sqrt{1+lnx^2}$ with $n = 8$ [8 marks]

3. Evaluate $\frac{dy}{dx}$ given
   $x^2 + y^3 = 10$. [5 marks]

QUESTION THREE (20 MARKS)

(a) A rectangular sheet of a metal measures 5 cm by 2 cm equal square sides of x cm are removed from each corner of the sheet and the edges are roll up to make an open box of volume vcm^3 show that $v = 40x - 26x^2 + 4x^3$ hence determine the maximum possible value of v and the corresponding value of x [5 marks]

(b) Evaluate the integral:

(i) $\int \frac{x+1}{x^2(x-1)}$. [5 marks]

(ii) $\int \frac{2x^3-4x-8}{x(x-1)(x^2+4)}$ [5 marks]

(iii) $\int sec^4 x tan^3 x dx$ [5 marks]

QUESTION FOUR (20 MARKS)

(a) . A tank contains 200 L of salt water with a concentration of 4 g/L. Salt water with a concentration of 3 g/L is being pumped into the tank at the rate of 8 L/min, and the tank is being emptied at the rate of 8 L/min. Assume the contents of the tank are being mixed thoroughly and continuously. Let S(t) be the amount of salt (measured in grams) in the tank at time t (measured in minutes).

(i) What is the amount of salt in the tank at time $t = 0$?. [1 marks].

(ii) What is the rate at which salt enters the tank? [2 marks]

(iii) What is the rate at which salt leaves the tank at time t? [2 marks]

(iv) What is $\frac{ds}{dt}$, the net rate of change of salt in the tank at time t? [1 mark]

(v) Write an initial value problem relating $S(t)$ and $\frac{ds}{dt}$. Solve the initial value problem. [4 marks]

(b) state and prove simpson's rule
hence solve
$\int_4^8 \sqrt{14lnx}dx$ $n = 8$ [10 marks]