**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATION 2017/2018**

**YEAR 1 SEMESTER 1 EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**

**IN ACTUARIAL, FINANCIAL ENGINEERING, BIOSTATISTICS, OPERATION RESEARCH,**

**STATISTICS**

**STA 2104: CALCULUS 1 FOR STATISTICS 1**

**DATE: JANUARY 2018 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTIONS ONE AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE: (30 marks)s**

1. Evaluate the following limits
2. Limx-3 x2+6x+9 (3 marks)

 x2- 9

1. Lim t-4 t2-16 (3 marks)

 2-$\sqrt{t}$

1. The total worldwide box office receipts for a long running blockbuster movies are approximated by the function T(x)=120x2/x2+4 where T(x) is measured in millions of dollars and x is measured in the number of months since the movie’s release. What will be the movie gross in the long run? (2 marks)
2. Let f(x)= x+2 if x≤1 find the value of k that will make f(x) be continuous on (-∞,∞) (3 marks)

 Kx2 if x>1

1. Use the first principle of differentiation to find $\frac{dy}{dx}$ given y(x)=x +$\frac{1}{x}$ (5 marks)
2. The sales (in millions of dollars) of a laser of disc recording a hit movie t, years from the date of release is given s(t)= 5t

 t2+1

1. Find the rate at which the sales are changing at time t. (2 marks)
2. How fast are sales changing at time the laser discs are released (t=0), two years from date of release (2 marks)
3. Find the rate of change of y(x) with respect to x given;
4. Y(x)= x+ (x+ x2)-3 -5  (3 marks)
5. xy=cos (x+y) (3 marks)
6. y=xx $e^{x}^{2}$ (3 marks)

**QUESTION TWO :( 20 marks)**

1. state Rolle’s Theorem ( mark)
2. Hence investigate whether f(x)=1+|x-1| in [0,3] satisfies Rolle’s theorem (3 marks)
3. Determine the value of m and n for which the function f(x) is continuous everywhere on the real number line given f(x)= -4x if x≤2

 mx-n if 2≤x<3 (6 marks)

 14 if x>3

1. The weekly demand for pulsar VCRs (video cassette recorders)is given by the demand equation p=-0.02x +300 (0≤x≤15000) where p denotes the wholesale unit price in dollars and x denotes the quantity demanded. The weekly total cost function associated with the manufacturing of these VCRs is p(x)=0.0000003x3-0.04x2+ 70000dollars.
2. Find the revenue function R(x) and the profit function P(x) (2 marks)
3. Find the marginal cost function C’ , the marginal revenue R’ and the marginal profit function P’. (3 marks)
4. Compute C’(3000), R’(3000) and P’(3000) and interpret your results (5 marks)s

**QUESTION THREE: (20 marks)**

1. Identify and classify the stationary points of y(x)=$\frac{1}{2}$ x4 -$ \frac{2}{3}$ x3- 2x2+ 3 [-2,3] (5 marks)
2. Find $\frac{dy}{dx}$ given
3. y=[4- u3][1+4u3]2 if u= -1 (4 marks)

 x2

1. $\sqrt{xy}$ -2(x2 -$ \sqrt[x]{y}$)=4x2y at (1,1) (3 marks)
2. $x=4$ -124t3 y=3t2  (4 marks)

 11+4t3

1. y=x2 cos-1 (2x) +ln (1+e2x) (4 marks)

**QUESTION THREE: (20 marks)**

1. Use linear approximation to estimate value of $\sqrt[3]{999}$ (3 marks)
2. Given the function f(x)=$\frac{1}{x-4}$ show that the interval [2,6] there exists no real number c such that f’(x)= f(6) – f(2) .State whether this contradicts the mean value theorem and give the reason for

 6 – 2

your answer. (4 marks)

1. Using the first principle of differentiation show that given f(x) =$\frac{u(x)}{v(x)}$ then f’(x)= u’(x)v(x)-v’(x)u(x)

 (V(x))2

Hence use your result to find g’(x) given g(x) = x +tan 3x (8 marks)

 X +sin 3x

1. A retailer has determined that the cost C for ordering and storing x units of a certain product is C(x)= 2x+ $\frac{300000}{x}$ 0≤x≤300 Find the order size that will minimize cost if the delivery truck can bring a maximum of 300 units per order. (4 marks)