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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2016/2017 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 11th August, 2016.
Time: 8.30am – 10.30am

KMA 104 - CALCULUS I

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) i) Define a function and give two relations; one that is a function and one that is not a function.

(2 Marks)

ii) Determine the range of; $f(x) = \frac{2x}{x^2-4}$ and $f(x) = 2^x$

(2 Marks)

b) Evaluate the following limit;

$$\lim_{x\to 3} \frac{x-3}{x^2-9}$$

(3 Marks)

c) Determine the slope of the following functions;

i) $f(x) = (4x^2-2)^3(3x-2x^3)^5$

(3 Marks)

ii) $f(x) = \left(\frac{4x^2+x}{1+2x^2}\right)^5$

(4 Marks)

iii) $g(x) = \tan(x^2-4x)\cos(x^2-4x) + sec(x^2-4x)$

(4 Marks)

d) Given that $2xy^3 + x^2 = \sin(x+y)$find;

i) $\frac{dy}{dx}$

(4 Marks)

ii) $\frac{d^2y}{dx^2}$ at $\left(\frac{\pi}{2}, \frac{\pi}{4}\right)$.

(4 Marks)

e) Find the area between $y = 4x + 6$ and $y = 2x^2 - 4x + 12$

(4 Marks)

QUESTION TWO (20 MARKS)

a) Find the derivative of the following function;

$$f(x) = \frac{3x^2 + 5}{x^3 - 10}$$

(4 Marks)

b) For what values of x does $y = (x - 5)^3(x - 1)^2$ have a horizontal tangent.

(5 Marks)

c) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ given that; $y = \frac{\ln x - 4x}{x^2}$

(6 Marks)

d) A body initially at rest is projected in a straight line. If its displacement is $s(t) = 12t - 5t^2$

i) Find the velocity of the body after 2 seconds.

(2 Marks)

ii) The total time taken for the body to come down.

(3 Marks)

QUESTION THREE (20 MARKS)

a) Evaluate the following; $\int_0^1 2x(x^2 - 1)^3 dx$

(4 Marks)

b) Differentiate the following;

i) $f(x) = \frac{1}{(3 - 12x - 4x^2)e^{3x - x^2}}$

(4 Marks)

ii) $\sec(x + 1)^2 \tan(x - 1)^2$

(5 Marks)

c) Evaluate the limit;

$$\lim_{x \to 0} \frac{4x^2 - 2\sin 2x}{x}$$

(4 Marks)

d) Determine if $f(x) = \frac{x^2 - 1}{x + 1}$ is continuous at $x = -1$.

(3 Marks)

QUESTION FOUR (20 MARKS)

a) State the Rolle's Theorem.

(3 Marks)

b) Verify Rolle's Theorem for $f(t) = 2t - t^2 - t^3$ on $[-2, 1]$.

(6 Marks)

c) Differentiate; $\frac{5}{2x-3}$
From the first principal.

(5 Marks)

d) Find the inverse of the function;

$$f(x) = \frac{2x-5}{x+3}$$

(3 Marks)

e) Use chain rule to determine the derivative of $y = 8\cot(4x-\pi)$

(3 Marks)

QUESTION FIVE (20 MARKS)

a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ given that;

$$x(r) = r^2 - r \text{ and } y(r) = \frac{2}{3}r^3 + \frac{1}{2}r^2 - r.$$

(6 Marks)

b) Find the slope of; $2x + 2y = (x+y+1)^2$ at (1,0).

(4 Marks)

c) Discuss the continuity of; $f(x) = \begin{cases} 4x+1 & for\ x \leq 0 \\ 1-2x & for\ x > 0 \end{cases}$ at $x = 0$.

(5 Marks)

d) Find $f'(0)$ and $f'\left(\frac{\pi}{8}\right)$ given that $f(x) = \cos 2x + \sec 2x$

(5 Marks)