



MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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University Examinations 2022/2023

FIRST YEAR, SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN DATA SCIENCE

FIRST YEAR, SECOND FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

FIRST YEAR, SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

FIRST YEAR, SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

FIRST YEAR, SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN STATISTICS

SMA 3112: CALCULUS 1

DATE: AUGUST 2023

TIME: 2 HOURS

INSTRUCTIONS: Answer question one and any other two questions

QUESTION ONE (30 MARKS)

a) Given function $f(x) = 3x - 6$ find

(i) $f(2)$ (1 mark)

(ii) $f^{-1}(2)$ (2 marks)

b) Find the domain and range of the function $\frac{2}{\sqrt{x^2-4}}$ (5 marks)

c) Evaluate the limit

(i) $\lim_{x \rightarrow -2} \frac{3x^2+x-10}{x+2}$ (3 marks)



(ii) $\lim_{x \rightarrow \infty} \frac{4x^3 + 2x^2 - 4}{5x^3 - 3}$ (3 marks)

d) For what value of a and b is $f(x) = \begin{cases} -2, & x \leq -1 \\ ax - b & -1 \leq x \leq 1 \\ 3, & x \geq 1 \end{cases}$ (4 marks)

e) Find the derivative of the following functions

(i) $y = 6x^4 + 3x^3 - 4x$ (1 marks)

(ii) $y = x^5 e^{2x}$ (3 marks)

(iii) $y = \frac{(x^2 + 3x)}{\ln x}$ (3 marks)

f) Find the equation of the tangent and the normal to the curve $y = x^3 + 2x - 1$ at the point where (1,2) (5 marks)

QUESTION TWO (20 MARKS)

a) Evaluate the limits $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ (4 marks)

b) Find the derivative of the following functions using the first principle $y = x^2$ (5 marks)

c) A box of volume $32m^3$ having a square base and no top is to be constructed from material costing sh80 per square meter. Find the dimensions of such a box for which the cost of the material is least (11 marks)

QUESTION THREE (20 MARKS)

a) Differentiate $f(x) = e^{\tan x}$ with respect to x (5 marks)

b) Find $\frac{dy}{dx}$ given that $y = xy^3 + x^2y - 3x$ (5 marks)

c) Two sides of a triangle are 4 cm long. What should the angle between these sides be to make the area of the triangle as large as possible? (10 marks)

QUESTION FOUR (20 MARKS)

a) Evaluate the limits $\lim_{x \rightarrow 0} \left[\frac{\sqrt{2+x} - \sqrt{2}}{x} \right]$ (5 marks)

b) Find $\frac{d^2y}{dx^2}$ when $x = t^2$ and $y = t^3$ (6 marks)



- c) Find the stationary points of the curve below and classify them $y = 2x^3 - 15x^2 + 24x + 19$
(9 marks)

QUESTION FIVE (20 MARKS)

- a) Find the derivative of the following function $y = e^{4x-5}$ (4 marks)
- b) Differentiate $y = \sin^{-1}x$ (8 marks)
- c) Calculate the velocity and acceleration of a particle at $t = 1$ given that $S(t) = 3t^2 + 2t - 2$
and find the instant when the particle is at rest (8 marks)

