



MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE
DEGREE OF BACHELOR OF SCIENCE WITH INFORMATION
TECHNOLOGY

MAIN CAMPUS

MMA 107: MATHEMATICS II

Date: 13th June, 2017

Time: 8.30 - 11.30 am

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.



Question 1: Compulsory (30 marks)

a) Define the following terms

i). A function

ii). Domain of a function

iii). Range of a function

iv). Codomain of a function

(4mks)

b) Find the inverse of $f(x) = \frac{1}{x^2} - 1$

(3mks)

c) Differentiate the function $y = x^3 - 30x^2 + 6000$ from the first principle
(4mks)

d) Evaluate $A = \int_1^5 \left(\frac{x}{\sqrt{2x-1}} \right) dx$ using change of variables

(5mks)

e) i). Differentiate between odd function and an even function

ii). Show that $3x^2 - x^4$ is an even function

(5mks)

f) Use the $\epsilon - \delta$ definition of a limit to prove that

$$\lim_{x \rightarrow 2} (3x - 2) = 4$$

(6mks)

g). Evaluate $\frac{d}{dx} \tan x$

(3mks)

Question 2 (20 marks)

a) Find the turning points of the curve $y = 4x^3 - 15x^2 - 18x$ hence determine the maximum and minimum of y

(13mks)

b) Use implicit differentiation to find $\frac{dy}{dx}$ given that $y^3 + y^2 - 5y - x^2 = -4$

(4mks)

c). Evaluate the limits

$$\lim_{x \rightarrow 2} \frac{4(x^2 - 4)}{x - 2}$$

(3mks)

25
18
00
32

Question 3 (20 marks)

a) Let $f(x) = (x - 2)(8 - x)$ for $2 \leq x \leq 8$

i). Find $f(6)$ and $f(-1)$

ii). What is the domain of definition of $f(x)$

2(1)

iii). Find $(1 - 2t)$ and give the domain of the definition

iv). Find $f(f(3))$

Handwritten: $f(3) = (3-2)(8-3) = 1 \cdot 5 = 5$
 $f(f(3)) = f(5) = (5-2)(8-5) = 3 \cdot 3 = 9$ (10mks)

b) The distance x metres moved by a body in t seconds is given by

$$x = 3t^3 - \frac{11}{2}t^2 + 2t + 5.$$

Handwritten: $x = 3t^3 - \frac{11}{2}t^2 + 2t + 5$

i). its velocity after t seconds

ii). its velocity at the start and after 4 seconds

iii). the value of t when the body comes to rest

iv). the acceleration after t seconds

v). the acceleration after 2 seconds

vi). the value of t when the acceleration is $16m/s^2$ and

vii). the average velocity over the third second

(10mks)

Question 4 (20 marks)

a) Determine the area of the region bounded by $y = 2x^2 + 10$,
 $y = 4x + 16$, $x = -2$ and $x = 5$

(10mks)

b) Find $\frac{dy}{dx}$ for $y = (x^2 + 1)^3$

(4mks)

c). Find the equation of the tangent and the equation of the normal to the
 curve $y = x^3 + 2x + 1$ at a point $(1, 4)$

(6mks)

Question 5 (20 marks)

a) The rate at which the body cools is given by the equation $\frac{d\theta}{dt} = -k\theta$,
 where θ is the temperature of the body above its surroundings and k is
 constant. Solve the equation for θ given that at $t = 0$, $\theta = \theta_0$ (10mks)

b) Find the general solutions of the following differential equations

i). $2xy \frac{dy}{dx} = 1 + y^2$

ii). $\frac{dy}{dx} = 5x^2 + \cos 3x$ (5mks)

c). Find the particular solution of $\frac{dy}{dx} = 3e^{2x-3y}$ given that $y = 0$ when $x = 0$ (5mks)