



**PIONEER INTERNATIONAL UNIVERSITY**

**THE DEGREE OF BACHELOR OF EDUCATION**

**UNIT CODE: MATH 1111**

**UNIT TITLE: CALCULUS 1**

**END OF SEMESTER EXAMINATION**

**DATE: APRIL, 2022**

**Time: 2 HOURS**

**INSTRUCTIONS**

1. Answer question **ONE (1)** and any other **TWO (2)** questions
2. Show all your workings
3. Scientific Calculators and non-programmable calculators may be used

1. (a) Find the derivative of the following functions.

i.  $f(x) = \cot^4(\sin x^3)$  (4 marks)

ii.  $y = \ln(\sin x)$  (4 marks)

iii.  $y = 4^{3x^2}$  (4 marks)

(b) Calculate the derivative at the point (0, 0) of the function given by the equation  
 $x = y - 2 \sin y$  (4 marks)

(c) Using the appropriate method, find the limits for:

i.

$$\lim_{x \rightarrow 9} f(x) = \frac{x - 9}{\sqrt{x + 7} - 4}$$

(3 marks)

ii.

$$\lim_{x \rightarrow 2} f(x) = \frac{x^2 - 6x + 8}{x^2 - 4}$$

(4 marks)

(d) Integrate the following using substitution method:

$$\int x\sqrt{2x+1} dx$$

(7 marks)

2. Find  $f'(x)$  using implicit differentiation:

$$f(x) = x^2 + 2xy + 2y^2 = 1 \quad (5 \text{ marks})$$

$$\text{ii. } f(x) = x^2 + y^2 - 2x - 4y = 1 \quad (5 \text{ marks})$$

By stating the appropriate method, find the derivatives for the following functions:

$$\text{(a) } e^x \cos x$$

$$\text{ii. } f(x) = \sin^2 3x$$

$$\text{iii. } f(x) = \frac{7x+4}{x^2+5}$$

(10 marks)

3. Evaluate

(a) Given the the following function is continuous and differentiable in the given interval, determine the number(s)  $c$  which satisfies the conclusion of Mean Value Theorem for  $f(x) = 4x^3 - 8x^2 + 7x - 2$  on the interval  $[2,5]$  (8 marks)

(b) Given the function  $f(x) = 6x^2 + x - 6$  calculate the following values

$$\text{i. } f(0)$$

$$\text{ii. } f(2)$$

$$\text{iii. } f(-x)$$

$$\text{iv. } f(x+1)$$

$$\text{v. Given } g(m) = \sqrt{m-4}, \text{ solve } g(m) = 2 \quad (12 \text{ marks})$$

4. (a) Find the area below  $f(x) = -x^2 + 4x + 3$  and above  $g(x) = -x^3 + 7x^2 - 10x + 5$  over the interval  $1 \leq x \leq 2$

(8 marks)

(b) Find the stationary points, the maxima and minima for the function:  $y = 2x^3 - 3x^2 + 6$ : (12 marks)