



**THE UNIVERSITY OF THE WEST INDIES
FIVE ISLANDS CAMPUS**

Semester II

Examinations of April/May 2023

Course Code:	ECON1003
Course Title:	Mathematics for Social Sciences I
Date of Assessment:	Wednesday May 3rd, 2023
Time:	9:00 am
Duration:	Two (2) Hours

INSTRUCTIONS TO CANDIDATES:

This paper has 4 pages and 5 questions.

YOU ARE REQUIRED TO ANSWER FIVE (5) QUESTIONS.

THIS ASSESSMENT IS WORTH 60 % OF YOUR FINAL GRADE.

ASSESSMENT DETAILS FROM INSTRUCTOR(S):

- This paper contains five questions
- Each question is worth 20 marks
- Students are required to answer all questions
- Show all working clearly for each question
- The total marks is one hundred (100) marks
- Non-programmable calculators are allowed

QUESTION 1 (Total: 20 Marks)

1. Suppose the projected sales of UWI Student Guild t-shirts for an academic year are given by $S = 100x + 4000$ where x is measured in months and $x = 0$ corresponds to the start of the academic year.

(a). Find the projected sales after the first semester if we consider a semester as 4 months **[2 marks]**

(b). To be a profitable venture, the sales must be greater than or equal to 4500

(i) Express the sales equation as an inequality given the above info **[3 marks]**

(ii) Find the value of x that will make the UWI Student Guild t-shirts a profitable venture **[3 marks]**

(c) Suppose that the revenue derived from the sale of q t-shirts is $R(q) = 500q$. If the total cost of producing q t-shirts is $C(q) = 100q + 6000$

(i) Find an expression for the Profit obtained from selling q t-shirts (*Recall* $P(q) = R(q) - C(q)$) **[2 marks]**

(ii) How many t-shirts must be produced and sold to generate exactly \$20,000 in profit?**[3 marks]**

(iii)How many t-shirts must be produced and sold to break even (Total Revenue = Total Cost)? **[3 marks]**

(iv)Find the marginal profit when the production and sales of the t-shirts break even **[2 marks]**

(v) Will the marginal profit be constant for any quantity of shirts sold? Provide a reason to support your answer. **[2 marks]**

QUESTION 2 (Total 20 Marks)

2. Suppose that Caribbean United Credit Union offers the following on the latest new membership promotion for recent UWI graduates:

Offer 1

A fixed shares deposit of \$ 10,000 *XCD* with an annual shares deposit of \$500 *XCD*

Offer 2

A fixed shares deposit of \$ 8000 *XCD* with an annual shares deposit of 5% of your existing shares.

(i) Show with supporting explanations that the first offer follows an arithmetic progression.**[7 marks]**

(ii) Show with supporting explanations that the first offer follows a geometric progression**[7 marks]**

(iii) Compare and contrast the two offers to determine which will have yield the higher savings in shares deposit in year five of membership [4 marks]

(iv) From a strategic financial perspective, which offer is ideally the better one in the long term? Provide supporting reasons for your response. [2 marks]

QUESTION 3 (Total 20 Marks)

3. A function $f(x)$ is defined as

$$\begin{cases} 5 + 3x & \text{if } x < 3 \\ 2x^2 - x - 1 & \text{if } x \geq 3 \end{cases}$$

(a) Determine whether $f(x)$ is continuous at $x = 3$ [9 marks]
(Hint: you will need to consider all three conditions for continuity)

(b) Evaluate the following limits

(i) $\lim_{x \rightarrow 4} \frac{16-x^2}{x-4}$ [6 marks]

(ii) $\lim_{x \rightarrow \infty} \frac{10-7x^2-x^3}{3x^3-x^2+1}$ [5 marks]

QUESTION 4 (Total 20 Marks)

4. **JUST 4 YOU Clothing Manufacturing Company**, the demand equation for a new denim sports jacket is given by

$p = 300 - 15x$ where x is the quantity and p is unit price. The cost function of this item is $C(x) = 1000 - 60x$.

Based on the above information, compute the following for the company

(a) The revenue function $R(x)$ ($R(x) = xp$, where p is unit price) [4 marks]

(b) The profit function $P(x)$ ($P(x) = R(x) - C(x)$) [4 marks]

(c) The marginal profit function [6 marks]

(d) The level of demand x which makes the marginal profit equal to zero [3 marks]

(e) Verify that the level of demand obtained from d) above produces maximum profit for the firm.

QUESTION 5 (Total 20 marks)

5. (a) Evaluate the following integral $\int 90x^5 + 4x^3 + 2x - 5 dx$

[4 marks]

Recall the laws of Integrals

$$\int c dx = cx, c \text{ is a constant}$$

$$\int x^n dx = \frac{x^{n+1}}{n+1}$$

For any indefinite integral $\int f(x) dx = F(x) + C, C$ is the constant of integration

(b) Suppose a group of Social Sciences students began creating and selling personalized hoodies to fellow students on campus. Suppose that the marginal revenue for producing x hoodies is given by $R'(x) = 30x^2 - 4x$. Find the total revenue earned when they produce 20 hoodies if the revenue earned from producing 1 hoodie is \$50 XCD (i.e. $R(1) = 50$)

[8 marks]

(c) Consider the system of linear equations

$$3x + 4y = 10$$

$$2x + 3y = 7$$

(i) Write the system of linear equations below in matrix form $AX = b$

[3 marks]

(ii) Hence using Cramer's method, show that the solution of the equations is

$$x = 2 \text{ and } y = 1$$

[5 marks]

END OF QUESTION PAPER