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

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

(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) $\lim\limits_{x\to 4} \frac{16-x^2}{x-4}$ **[6 marks]**

(ii) $\lim\limits_{x\to\infty} \frac{10-7x^2-x^3}{3x^3-x^2+1}$ **[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.

[3 marks]

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

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

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

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

(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 $R'(x) = 30\, x^2 - 4x$. 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