THE UNIVERSITY OF THE WEST INDIES
FIVE ISLANDS CAMPUS

Semester II

Examinations of APRIL/MAY 2023

Course Code: **ECON1004**

Course Title: **Mathematics for Social Sciences II**

Date of Assessment: **Wednesday May 3, 2023**

Time: **9:00 am**

Duration: **Two (2) Hours**

INSTRUCTIONS TO CANDIDATES:

This paper has __3__ pages and __6__ questions.

THIS ASSESSMENT IS WORTH ___60%___ OF YOUR FINAL GRADE.

1. **Answer ALL six (6) questions**
2. **Silent Non-programmable calculators may be used in this examination**
3. **All working must be clearly shown**
4. **No work is be submitted in pencil.**

PLEASE TURN OVER

Answer *ALL* questions

1. A firm's consumption function is given by C= $0.8Y + 5$ where Y is the firm's income.

   a) Compute the firm's marginal propensity to consume. **[2 marks]**

   b) Find the firm's marginal propensity to save and interpret it. **[4 marks]**

2. Given the function: $f(x, y) = x^2 + 2y^2 - xy + 14y$

   (i). Find the two first-order partial derivatives. **[4 marks]**

   (ii). Hence, compute the turning (critical/stationary) point(s). **[4 marks]**

   (iii). Then, determine or classify the nature of the turning points. **[4 marks]**

3. Brownie's Bakery sells hot raisin buns denoted by quantity Q at price P. Its demand function is: $P = 20 - Q^2$ and its supply function is: $P = 3Q + 2$.

   a) Find the equilibrium price and equilibrium quantity of hot raisin buns. **[4 marks]**

   b) Calculate the consumer's surplus for Brownie's Bakery. **[4 marks]**

   c) Compute the bakery's producer surplus on hot raisin buns. **[4 marks]**

4. Use the method of separating the variables to find the particular solution of the differential equations given initial conditions:
   $(1 + x^2)\frac{dy}{dx} + xy = 0$, given that $y = 2$ and $x = 0$ **[6 marks]**

5. The equilibrium prices P_1, P_2 and P_3 of three interdependent commodities satisfy the system of linear equations given by:

$$\begin{aligned} P_1 + 3P_2 + 3P_3 &= 32 \\ P_1 + 4P_2 + 3P_3 &= 37 \\ P_1 + 3P_2 + 4P_3 &= 35 \end{aligned}$$

   a) Express this system of linear equations in the form A x = b and determine |A|. **[3 marks]**

   b) Hence, use Cramer's rule to find the equilibrium prices P_1, P_2, P_3 of the three interdependent commodities. **[7 marks]**

PLEASE TURN OVER

6. Given the vectors $\boldsymbol{s} = (10,8,2)$ and $\boldsymbol{t} = (2, -4,4)$:

a) Find the length of vector $\boldsymbol{t}$. **[3 marks]**

b) Normalize the vector $\boldsymbol{t}$. **[3 marks]**

c) Determine whether vectors $\boldsymbol{s}$ and $\boldsymbol{t}$ are orthogonal. **[4 marks]**

d) Express the vector $\boldsymbol{c} = (5, 20)$ as a linear combination of $\boldsymbol{a} = (5, 7)$ and $\boldsymbol{b} = (1, 4)$. **[4 marks]**

END OF QUESTION PAPER