

UNIVERSITY OF SWAZILAND  
FACULTY OF SOCIAL SCIENCE  
DEPARTMENT OF ECONOMICS

MAIN EXAMINATION PAPER

DECEMBER 2017

PAPER TITLE: MATHEMATICS FOR ECONOMICS I

CODE : ECO205/ ECON 208

INSTRUCTIONS

1. ANSWER ANY **FOUR** QUESTIONS
2. ALL QUESTIONS CARRY EQUAL MARKS [25]
3. THIS IS A TWO HOUR PAPER

DO NOT OPEN THIS PAPER UNTIL YOU HAVE BEEN  
INSTRUCTED TO DO SO

**Question 1**

- (a) Let the interrelationship between the production of two industries R and S and the final demand D in a given year be presented in the following data.

	R	S	D	Total
R	30	40	60	130
S	20	10	40	70

If the forecast external demand in two years is,

80
40

what should the total output X be?

[10]

- (b) The demand function for two products are

$$p = 12 - 2x \text{ and } q = 20 - y$$

Find the revenue function and the profit function. Determine the price and amounts that will maximise profit. What is the maximum profit?

[15]

**Question 2**

- (a) Maximize  $z = 26x - 3x^2 + 5xy - 6y^2 + 12y$  subject to  $3x + y = 170$  [10]

- (b) Maximize profits for a monopolistic firm producing two related goods, i.e.,  $P_1 = f(Q_1, Q_2)$  when the two goods are substitutes and the demand and total cost functions are

$$P_1 = 80 - 5Q_1 - 2Q_2, P_2 = 50 - Q_1 - 3Q_2, TC = 3Q_1^2 + Q_1Q_2 + 2Q_2^2$$

Use (a) Cramer's rule for the first-order condition and (b) the Hessian for the second-order condition.

[15]

**Question 3**

Minimize the cost of 434 units of production of a firm when  $Q = 10K^{0.7}L^{0.1}$  and  $P_K = 28, P_L = 10$ , by

- (a) Finding the critical values [10]

- (b) Using the bordered Hessian to test the second order conditions [15]

**Question 4**

- (a) The marginal cost is given by  $MC = 25 + 30Q - 9Q^2$ . Fixed cost = 55. Find the total cost, average cost and the variable cost functions. [12]

- (b) Given the demand function  $P = 42 - 5Q - Q^2$ . Assuming that the equilibrium price is 6 evaluate the consumers surplus. [8]

- (c) Given the supply function  $P = (Q + 3)^2$ , find the producer surplus PS at  $P_0 = 81$  and  $Q_0 = 6$  [5]

**Question 5**

(a) Given  $C = 2000 + 0.8Y_d$ , where  $Y_d = Y - T$  and  $T = 300 + 0.2Y$ , use the derivative to find the MPC [5]

(b) Given

$$Y = C + I_o + G_o + X_o - Z$$

$$T = T_o + tY$$

$$C = C_o + bY_d$$

$$Z = Z_o + zY_d$$

$$b = 0.9 \quad t = 0.2 \quad C_o = 125 \quad X_o = 150 \quad Z_o = 55 \quad I_o = 92.5$$
$$z = 0.15 \quad T_o = 150 \quad G_o = 600$$

- i. Calculate the equilibrium level of income [10]
- ii. Calculate the effect on the equilibrium level of income of an increase of 60 in autonomous exports [5]
- iii. Calculate the effect on the equilibrium level of income of an increase of 30 in autonomous imports. [5]