

UNIVERSITY OF SWAZILAND  
FACULTY OF SOCIAL SCIENCE  
DEPARTMENT OF ECONOMICS

SUPPLEMENTARY / RE-SIT EXAMINATION PAPER

JULY 2018

PAPER TITLE: MATHEMATICS FOR ECONOMICS

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)

A town has three main industries: a coal-mining operation, an electric power-generating plant, and a local railroad. To mine \$1 of coal, the mining operation must purchase \$0.25 of electricity to run its equipment and \$0.25 of transportation for its shipping needs. To produce \$1 of electricity, the generating plant requires \$0.65 of coal for fuel, \$0.05 of its own electricity to run auxiliary equipment, and \$0.05 of transportation. To provide \$1 of transportation, the railroad requires \$0.55 of coal for fuel and \$0.10 of electricity for its auxiliary equipment. In a certain week, the coal mining operation receives orders for \$50,000 of coal from outside the town and the generating plant receives orders for \$25,000 of electricity from outside. There is no outside demand for the local railroad. How much must each of the three industries produce in that week to exactly satisfy their own demand and the outside demand? [15]

B. What are the properties of the determinant? [10]

**Question 2**

(a) The Cobb-Douglas production function for a new product is given by  $N(X; Y) = 16X^{0.25}Y^{0.75}$  where  $x$  is the number of units of labour and  $y$  is the number of units of capital required to produce  $N(x;y)$  units of the product. Each unit of labour costs E50 and each unit of capital cost E100. If E500,000 has been budgeted for the production of this product, how should this amount be allocated between labour and capital in order to maximize production? What is the maximum number of units that can be produced? [15]

(b) The demand functions for two products are  $p = 12 - 2x$  and  $q = 20 - y$  where  $p$  and  $q$  are the respective prices for each product, and  $x$  and  $y$  are the respective amounts of each sold. Suppose the joint cost function of these products is  $C(X; Y) = X^2 + 2xy + 2y^2$  and the revenue function and the profit function. Determine the prices and amounts that will maximise profit. What is the maximum profit? [10]

**Question 3**

Consider the following equation which represents an economy

$$Y = C + I_o + G_o \quad Y_d = Y - T \quad C_o = 100 \quad I_o = 90 \quad b = 0.75$$

$$C = C_o + bY_d \quad T = T_o + tY \quad G_o = 330 \quad T_o = 330 \quad t = 0.20$$

- (a) What is the equilibrium level of income? [5]
- (b) What is the effect on the equilibrium level of income of a increase of 50 in government expenditures? [3]
- (c) What is the effect on the equilibrium level of income of a increase of 50 in government expenditures? [3]
- (d) If the proportional tax is increased by 10percent, what is the effect on the equilibrium level of income? [5]
- (e) If the government wants to alter the original marginal tax rate of 20 percent to achieve full employment = 1000, by how much should it change t? [9]

#### Question 4

Solve the following system of equation using

- (c) Gaussian elimination [10]
- (d) Gauss – Jordan method [15]

$$2x_1 + x_2 - x_3 = 5$$

$$3x_1 - 2x_2 + 2x_3 = -3$$

$$x_1 - 3x_2 - 3x_3 = -2$$

#### Question 5

- (a) With  $C = f(Y)$ , the marginal propensity to consume is given by  $f'(Y)$ . If the MPC = 0.8 and consumption is 40 when income is zero, find the consumption function. [5]
- (b) Given  $MC = 12e^{0.5Q}$  and  $FC = 36$ . Find the total cost. [7]
- (c) Given the demand function  $P = 45 - 0.5Q$ , find the consumer surplus when  $P_o = 32.5$  and  $Q_o = 25$ . [5]

(d) Under a monopoly, the quantity sold and market price are determined by the demand function  $P = 274 - Q^2$ , find the consumer surplus. [8]