CENTRAL UNIVERSITY

MAY 2019 RESIT EXAMINATION: 2018/2019

FACULTY OF ARTS AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

ECON 203 (3 CREDITS)

MATHEMATICS FOR ECONOMIST

LEVEL 200

MAY, 2019

2 HOURS

STUDENT ID No……………………………………………………………………………

INSTRUCTIONS

ANSWER ALL QUESTIONS IN SECTION A AND ANY FOUR (4) QUESTIONS IN SECTION B

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LECTURER: Daniel Offei

SECTION A

ANSWER ALL THE QUESTIONS (20 Marks)

1. Suppose that the demand for a product is given by the functional relationship $Q = 500 - 4P$. If a firm wants to sell 100 units, what price should it charge?
   A. Ghs 10
   B. Ghs 50
   C. Ghs 100
   D. Ghs 150

2. Suppose that we know that the quantity demanded of a good is a linear function of its selling price. Suppose that $(Q1, P1) = (95, 1)$ and $(Q2, P2) = (75, 5)$. The demand equation is:
   A. Q = 100 - 5P
   B. Q = 200 - 4P
   C. Q = -100 + 2P
   D. Q = 50 + 2.5P

3. The market demand and supply equations for a product are given by the equations $Q^D = 20 - 2P$ and $Q^S = -10 + 3P$, respectively. The equilibrium price and quantity are:
   A. $P^* = 4$ and $Q^* = 6$.
   B. $P^* = 5$ and $Q^* = 7$.
   C. $P^* = 6$ and $Q^* = 8$.
   D. $P^* = 7$ and $Q^* = 9$.

4. The derivative of a function:
   A. Is the slope of the function when the interval between adjacent values of the independent variable is infinitesimally small.
   B. Is constant for all values of the independent variable for nonlinear functions.
   C. Exists for all values of the independent variable for discontinuous functions.
   D. Only exists for inverse functions.
   E. None of the above.

5. The function $y = f(x) = 10 - 2x$ has a maximum value when x equals:
   A. 0.
   B. 5.
   C. 10.
   D. This function is linear. It has neither a maximum nor a minimum value.

6. The function $y = f(x) = 100 - 25x + 2.5x^2$ has a maximum value when x equals:
   A. 5.
   B. 25.
   C. 50.
   D. This function does not have a maximum value.

7. Suppose that the total revenue function of a firm is given by the expression $TR = 500Q - 5Q^2$. The value for Q which total revenue is optimized is:

A. *10*.
B. *50*.
C. *100*.
D. This function does not have a maximum value.

8. For a nonlinear functions to have a local maximum, then:

A. The first derivative is zero and the second derivative is zero.
B. The first derivative is zero and the second derivative is positive.
C. The first derivative is zero and the second derivative is negative.
D. The first derivative is positive and the second derivative is positive.
E. The first derivative is positive and the second derivative is negative.

9. Suppose that a firm's total profit function is p = $100x + 68y - 2xy - 5x^2 - 5y^2$. The profit maximizing combination of x and y is:

A. $x = 9$ and $y = 12$.
B. $x = 9$ and $y = 5$.
C. $x = 7$ and $y = 9$.
D. $x = 12$ and $y = 9$.

10. Suppose that a firm's total profit function is p = $100x + 68y - 2xy - 5x^2 - 5y^2$ as in question (9) above. The firm's maximum profit is:

A. Ghs 620.
B. Ghs 780.
C. Ghs 940.
D. Ghs 1,000.

SECTION B:

ANSWER ANY **FOUR (4)** QUESTIONS

Question 1

a). Assume a firm has a Total Cost function $TC = 10q$ and the total revenue function $TR = 200 + 14q$. Show that the profit-maximizing output ***cannot*** be determined for this firm.

(5 marks)

b). A monopolist's demand function is $P = 25 - 0.5Q$. The fixed cost of production is 7 and the variable cost is $Q + 1$ per unit. Show that Total Revenue $(TR) = 25Q - 0.5Q^2$ and Total Cost $(TC) = Q^2 + Q + 7$ and deduce the corresponding expressions for Marginal Revenue (MR) and Marginal Cost (MC). (15 marks)

Question 2

Given the production function $Q = K^2 + 2L^2$.

a) Indicate whether the function is homogeneous and find its degree of homogeneity. (6 marks)

b) Write down the expression for $\frac{\partial Q}{\partial K}$ and $\frac{\partial Q}{\partial L}$ *and* show that; (2 marks)

i. the Marginal Rate of Technical Substitution $(MRTS) = \frac{2L}{K}$ (4 marks)

ii. Euler's theorem holds for this function if the function is homogeneous. (8 marks)

Question 3

An individual utility function is given by

$$U = 1000x_1 + 450x_2 + 5x_1x_2 - 2x_1^2 - x_2^2$$

Where x_1 is the amount of leisure measured in hours per week and x_2 is earned income measured in Ghana Cedis (Ghs) per week.

a) Determine the level of Marginal Utility when $x_1 = 138$ and $x_2 = 500$ (6 marks)

b) Based on your answer in (a), estimate the change in Total Utility (U) if the individual works for an extra hour, which increases earned income by Ghs 15 per week. (6 marks)

c) Does the law of diminishing marginal utility holds for this function? (8 marks)

Question 4

Given

$$Z = 2y^3 - x^3 + 147x - 54y + 12$$

a) Find the critical points and test whether the function is at the relatiye maximum or minimum at those critical points. (18 marks)

b) Indicate the critical point(s) at which the function is at the saddle point. (Hint: at saddle point, $z_{xx} * z_{yy} < (z_{xy})^2$ whiles z_{xx} and z_{yy} have different signs) (2 marks)