

UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
TRIAL TEST I – FEBRUARY, 2023
COURSE: MATHEMATICAL ECONOMICS I
CLASS: MA IV TIME: 1 HOUR
ANSWER ALL QUESTIONS

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Q1. Assume that the consumers satisfaction depends on income and leisure. His utility function is given by $U = g(L, y)$ where L denotes leisure and y is the income. If the income of the consumer depends on the amount of work performed by him/her and is denoted by W , the wage rate by r and T is the total amount available time.

Show that $\frac{dU}{dW} = -g_1 + g_2 r$.

Q2. Define the following terms as applied in consumer behaviour:

- (i). budget line (ii). Indifference curve (iii). Marginal rate of substitution (MRS)

P. T. O

Q3. The utility derived by a consumer from consuming two goods X and Y is described by the function

$$U(X, Y) = X^2Y \text{ subject to the constraint } X + \frac{Y}{1+r} = I_1 + \frac{I_2}{1+r}.$$

- (a). write down the Lagrangian function.
 - (b). show that the quantity of good X that needs to be purchased to maximize his/her utility subject to the given constraint is $X = \frac{2I_1}{3} + \frac{2I_2}{3(1+r)}$
 - (c). show that the quantity of good Y that needs to be purchased to maximize his/her utility subject to the given constraint is $Y = \frac{(1+r)I_1}{3} + \frac{I_2}{3}$
 - (d). Determine the sufficiency condition for equilibrium.
- Q4. Give two reasons that bring about a shift in the price line and explain each of them briefly.

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TRIAL TEST II – APRIL, 2023 TIME: 1 HOUR
ANSWER ALL QUESTIONS

- ✓ Q1. Given the two factors Cobb-Douglas production function $Q = AL^\alpha K^{1-\alpha}$ where Q is the manufacturing output, L is the quantity of labour employed, K is the quantity of capital employed and A , and α are constants.
- Determine the marginal product of labour of Cobb-Douglas production function.
 - what conclusion can you draw from your result in (i)
 - show that, the average product of labour of Cobb-Douglas production function will depend on the ratio of the input factors used.

P. T. O

- ✓ Q2. Define the following terms as applied to the theory of the firm:
- Total product (TP)
 - Average Product
 - Marginal Product (MP)
 - Law of Diminishing Marginal Returns
- ✓ Q3. A firm has the following long run production function given by $X = aA^{0.5}B^{0.5}C^{0.25}$ where X is weekly output, a is a positive constant, A , B and C are the weekly inputs of the three factors used. The price of A is \$1.00, the price of B is \$9.00 and the price of C is \$8.00. Derive the following:
- The firm's long-run total cost function
 - The firm's long-run average cost function
 - The firm's long-run marginal cost function
- ✓ Q4. Find the Marginal Cost Functions for each of the following average cost functions:
- $AC = 1.5Q + 4 + \frac{46}{Q}$
 - $AC = \frac{160}{Q} + 5 - 3Q + 2Q^2$