# KABARAK UNIVERSITY

## UNIVERSITY EXAMINATIONS

## 2008/2009 ACADEMIC YEAR

## FOR THE DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS AND MATHEMATICS

**COURSE CODE:** **ECON 121**

**COURSE TITLE:** **MATHEMATICS FOR ECONOMISTS I**

**STREAM:** **Y1S2**

**DAY:** **THURSDAY**

**TIME:** **8.30 – 10.30 A.M.**

**DATE:** **7/8/2008**

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**INSTRUCTIONS:**

1. Answer **QUESTION ONE** and any other **TWO** questions.

**PLEASE TURN OVER**

**QUESTION ONE**

(a) Given the sets:

$A = \{1,3,5,7\}$

$B = \{1,2,3,4,5,6,7,8,9,10\}$

$C = \{2,4,6,8\}$

**Find**:

(i) $A \cap B$ **(1mk)**

(ii) $A \cup C$ **(1mk)**

(iii) If in (a) above u (universal set) = $\left\{\frac{x}{x} \text{ is a positive integer}\right\}$

Find $A \cap A'$ **(3mks)**

(b) Solve the following inequalities:

(i) $-2x + 1 \leq x \leq 6 - x$ **(2mks)**

(ii) $|x - 4| > 6$ **(2mks)**

(c) The demand for the product of a firm varies with the price that the firm charges for the product. The firm estimates that annual total revenue (R) is a function of the price (P) specifically,

$R = f(p) = -50P^2 + 500p$

(i) Determine the price which should be charged in order to maximize total revenue? **(5mks)**

(ii) What is the maximum value of annual total revenue? **(5mks)**

(d) The total cost of producing q units of a certain product is described by the function.

$C = 100{,}000 + 1500q + 0.2q^2$

Where C is the total cost stated in shillings; Determine the number of units of q that should be produced in order to minimize the average cost per unit.

**(6mks)**

(e) (i) Without using tables show that:

$\frac{1}{2}\log\frac{25}{9} - \log\frac{15}{4} + \frac{2}{3}\log\frac{27}{8} = 0$ **(3mks)**

(ii) Show that $\log_a b = \frac{1}{\log_b a}$ **(3mks)**

## QUESTION TWO

A consumer's utility function is given by $U = q_1 q_2$ where $q_1$ and $q_2$ are the quantities of the two commodities consumed. If the price of $q_1$ is Shs.6 and that of $q_2$ is Shs.3 and the budget is Shs60,

(i) Write out a constrained utility maximization problem out of the information given.

(ii) What is the corresponding augmented objective function?

(iii) Find the levels of $q_1$ and $q_2$ that will satisfy the first order condition for maximum

(iii) Compute the optimum value of U

**(20mks)**

## QUESTION THREE

The demand and total cost function for a firm are given by;

$$P = 7 - \frac{2}{5}Q$$

$$TC = \frac{4}{7}Q^3 - \frac{3}{4}Q^2 + 7Q + 5$$

**Find:**

(i) The level of Q and P that will maximize profits.

(ii) The level of Q that will maximize TR

(iii) The level of Q that will minimize AVC

(iv) The level of Q that will minimize MC

(v) The minimum AVC and MC

**(20mks)**

## QUESTION FOUR

(a) Consider the following two commodity market model:

$$Q_{d1} = 8 - 2P_1 + P_2$$
$$Q_{s1} = -5 + 3P_1$$
$$Q_{d2} = 16 + P_1 - P_2$$
$$Q_{s2} = -1 + 2P_2$$

$Q_{d1} = Q_{s1}$
$Q_{d2} = Q_{s2}$

Determine by Cramer's rule:

(i) The value of equilibrium prices **(3mks)**

(ii) The value of equilibrium quantities **(3mks)**

(b) Consider the following national income model for a closed economy:

$Y = C + I_0 + G_0$
$C = c_0 + c_1 Y$

Where:

Y and C are endogenous variables, $I_0$ and $G_0$ are the exogenous variables and $C_0$ and $C_1$ are the parameters.

**Required:**

Determine by Cramer's rule the equilibrium $\overline{Y}$ and $\overline{C}$ **(5mks)**

(c) Solve the following equations by matrix inverse method

$x_1 + 2x_2 + 3x_3 = 3$
$2x_1 + 4x_2 + 5x_3 = 4$
$3x_1 + 5x_2 + 6x_3 = 8$

**(9mks)**

## QUESTION FIVE

(a) Find the critical value of z given

$Z = x + 2xy + y$
Subject to: $x + y - 4 = 0$ **(6mks)**

(b) Determine $\frac{dy}{dx}$ given that

$Y = (2x^3 + x^2 - 3x + 18)^5$ **(4mks)**

(c) Find the following:

(i) $\int -¼x^{-3}\,dx$ **(5mks)**

(ii) $\int (x^{¾} + \frac{3}{7}x^{-½} + x^5)dx$ **(5mks)**