



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR  
FIRST YEAR FIRST SEMESTER**

**SCHOOL OF BUSINESS AND ECONOMICS  
MSC. ECONOMICS, MSC. AGRICULTURAL  
ECONOMICS**

**COURSE CODE: ECO 8103**

**COURSE TITLE: MATHEMATICS FOR  
ECONOMISTS**

**DATE: 30/1/2024**

**TIME: 1430-1630 HRS**

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**INSTRUCTIONS TO CANDIDATES**

1. Answer **QUESTION ONE AND ANY FOUR** questions

*This paper consists of **SIX** printed pages. Please turn over.*

### QUESTION ONE (20 MARKS)

a) Find  $Y^*$  and  $C^*$  from the following: (4 Marks)

$$Y = C + I_0 + G_0$$

$$C = 90 + 66Y^{\frac{1}{4}}$$

$$I_0 = 12$$

$$G_0 = 48$$

b) Given  $A = \begin{bmatrix} 0 & 4 \\ -1 & 3 \end{bmatrix}$ ,  $B = \begin{bmatrix} 3 & -8 \\ 0 & 1 \end{bmatrix}$ , and  $C = \begin{bmatrix} 1 & 0 & 9 \\ 6 & 1 & 1 \end{bmatrix}$ . Find  $A'$ ,  $B'$  and  $C'$ .

(6 Marks)

c) Use the matrices given in (b) above to verify that;

i.  $(A + B)' = A' + B'$  (3 Marks)

ii.  $(AC)' = C'A'$  (3 Marks)

d) Solve the integrals (4 Marks)

i)  $\int_3^{12} \frac{1}{64} x^4 dx$

ii)  $\int \frac{28}{x^8} dx$

### QUESTION TWO (20 MARKS)

a) Solve the following derivatives with respect to  $t$  and  $x$  respectively.

(6 marks)

i.  $y = e^{-5t}$

ii.  $y = 4e^{3t}$

iii.  $y = \ln\left(\frac{2x}{1+x}\right)$

b) What is the instantaneous rate of growth of  $y$  in each of the following?

(6 marks)

i.  $y = e^{0.07t}$

ii.  $y = 15e^{0.03t}$

c) Find the solution of the equation system using Cramer's Rule:

**(8 marks)**

$$77X_1 - X_2 - X_3 = 0$$

$$10.5X_1 - 2X_2 + X_3 = 8$$

$$6.8X_1 + 3X_2 - 2X_3 = 7$$

### QUESTION THREE (20 MARKS)

a) Consider a game where, for a fixed amount of money paid in advance, you can throw a die and collect KES 17000, if an odd number shows up, or KES 4000 if the number is even.

i. By use of diagrams explain the player's possible attitudes towards risk. **(4 marks)**

ii. Calculate the expected value of the payoff **(2 Marks)**

b) Smirnoff Distillers Ltd are in possession of a particular consignment of wine, which they can either sell at the present time ( $t=0$ ) at a sum of KES  $K$ , or else store for some length of time and sell at a higher value. The growing value ( $V$ ) of the wine takes the following function of time;

$$V = Ke^{\sqrt{t}}$$

Assuming that the interest rate on the continuous-compounding basis is  $r$ , where the present value of  $V$  can be expressed as;  $(A(t) = Ve^{-rt})$ .

i. Find the value of  $V$  at  $t=0$  **( 1 mark)**

ii. What is the optimum storage time for Smirnoff Distillers?

**(6 marks)**

- b) Assuming that  $r=0.675$ , then what is the number of years that KWAL Distillers will store the wine to maximize on V? **(5 Marks)**
- c) Discuss the **five** rules of logarithms **(5 marks)**

#### QUESTION FOUR (20 MARKS)

- a) Given the input matrix and the final demand vector; find the solution output levels. **(9 Marks)**

$$A = \begin{bmatrix} 0.006 & 0.25 & 0.34 \\ 0.33 & 0.40 & 0.12 \\ 0.19 & 0.38 & 0.9 \end{bmatrix} \quad d = \begin{bmatrix} 1800 \\ 2000 \\ 9000 \end{bmatrix}$$

- b) Find the rational roots, if any of the following function: **(3 marks)**

$$x^3 - 2x^2 + 3x - 2 = 0$$

- c) If the an individual's utility function takes the form:

$$U = U(x_1, x_2) = (x_1 + 2)^2(x_2 + 3)^3$$

Find the marginal utility functions for each of the two commodities.

**(3 marks)**

- d) Find the inverse of matrix A. **(5 marks)**

$$A = \begin{bmatrix} 4 & 0 & 1 \\ 19 & 1 & 3 \\ 7 & 1 & 0 \end{bmatrix}$$

#### QUESTION FIVE (20 MARKS)

- a) A farm faces the production function  $Q = 18K^{0.4}L^{0.6}$ . It can buy inputs K and L for KES 90 and KES 45 respectively. The firm's output is constrained at  $Q=99,000$ . Find the Least Cost Combination of K and L. **(4 Marks)**

b) Assume that the rate of investment is described by the function  $I(t) = 6t^{7/3}$  and that  $K(0) = 25$ :

- i. Find the time path of capital stock  $K$ . **(3 marks)**
- ii. Find the amount of capital accumulation during the time intervals  $(0,1)$  and  $(1,3)$  respectively. **(3 marks)**

c) Derive the equation of the straight line that has a slope of 0.5 and passes through the point  $(2, 3)$  **(1 mark)**

d) Use the method of substitution to solve the simultaneous equations

$$\begin{aligned} 6x + 4y &= 16 \\ 5x + y &= 12 \end{aligned} \quad \mathbf{(4\ Marks)}$$

e) Find the derivative of the following function **(5 Marks)**

$$y = f(x) = \left( \frac{x^2 - x - 3}{x^2 + 1} \right) (x^2 + x + 1)$$

### QUESTION SIX (20 MARKS)

a) Let the IS equation be:

$$Y = \frac{A}{1-b} - \frac{g}{1-b} i$$

Where  $(1-b)$  is the marginal propensity to save,  $g$  is the investment sensitivity to interest rates,  $A$  is an aggregate of exogenous variables.

Let the LM equation be:

$$Y = \frac{M_0}{k} + \frac{l}{k} i$$

Where  $k$  and  $l$  are income and interest sensitivity of money demand, respectively, and  $M_0$  is real money balances.

If  $b=0.8$ ,  $g=1000$ ,  $A=24$ ,  $k=0.75$ ,  $l=420$  and  $M_0=180$ .

- i. Write the IS-LM system in matrix form **(1 mark)**
- ii. Solve for  $Y$  and  $i$  by matrix inversion **(5 Marks)**

b) Discuss the assumptions and the solution of the Domar Growth Model  
**(9 marks)**

c) The demand and supply curves of commodity W in the market are defined by the following functions:

$$P=160-8Q_d$$

$$P=12Q_s$$

Where  $Q_d$  is the quantity demand.  $Q_s$  is the quantity supplied and  $P$  is the price. Determine the equilibrium price and quantity of W in the market.

**(5marks)**

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