EX0012

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

JUN 2024

MATHEMATICS FOR ECONOMISTS: EC106

EXAMINATION PAPER

DURATION: 3 HOURS

REQUIREMENTS

CALCULATOR

INSTRUCTIONS TO CANDIDATES

1. This paper carries four (4) questions
2. Answer **ALL** questions
3. All questions carry 25 marks
4. Show all your workings and write legibly

Question 1

1a i) Explain the difference between necessary condition and sufficient condition, giving simple examples. **(2 marks)**

ii) Differentiate Mathematical Economics and Econometrics, giving practical examples. **(3 marks)**

b) Find the domains of

i)$f(x) = \dfrac{1}{4-x}$ **(4 marks)**

ii)$g(x) = \sqrt{x-8}$ **(4 marks)**

iii)Show that the number 2 belongs to the range of the function from part (b) and give conclusion. **(4 marks)**

b) Solve the following equations

i)$\dfrac{7}{9} - \dfrac{x}{9} = 4$ **(2 marks)**

ii) $5(x-5)(x+2)$ **(2 marks)**

iii) $x(1+5) = -6$ **(2 marks)**

c) The price of a carton of apple juice and milk at Bindura University tuck shop is given by the formula $P = 1639 - 25X + 15$, where X is the number of cartons of apple juice sold. Find the price of a carton of apple juice when X = 23 and 16 **(2 marks)**

Question 2

a) Find the first-order derivatives of the following functions with respect to x and y:

i) $Z = 2x - 2y$ **(4 marks)**

ii) $Q = x^4 + 3x^2 y - 10 y^2$ **(4 marks)**

bi) A production function is given by the following function: $Q = 3014L^{0.2} K^{0.8}$ Find the marginal productivity of labor, MPL and the marginal productivity of capital, MPK. **(4 marks)**

ii) Find E_d given the demand function $Q = 250 - 3P$ **(5 marks)**

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c) Consider the following national income model:

$$Y = C + I_0 + G_0$$

$$C = a + bY \qquad a > 0, 0 < b < 1$$

where Y and C represent the endogenous variables national income and consumption expenditure respectively, and I_0 and G_0 stand for exogenously determined investment and government expenditure respectively.

i) What do the parameters a and b in the consumption function represent? **(2 marks)**

ii) Solve for the equilibrium values of income (Y^*) and consumption (C^*) using the substitution method. Be sure to specify any restrictions that are necessary for your solution values to hold **(3 marks)**

d) Solve the following and determine equilibrium price

$$Q_d = 24 - 2P, \; Q_s = -3 + 7P \text{ (2 marks)}$$

Question 3

a) Use the Cramer's Rule to solve the following equations:

$$4x + 2y + 4z = 2$$

$$3x + y + z = 2 \qquad \text{(5 marks)}$$

$$3x + y + 2z = 3$$

b) One of economic students records the weekly sales of personal computers (PCs) in three retail outlets at Bindura University of Science Education as shown by Table 1

	Basic	Extra	Latest
Shop A	150	320	180
Shop B	170	420	190

Shop C	201	63	58

The cost price of each model is: Basic $480, Extra $600, Latest $1020. The retail price of each model in each of the three shops is given in Table 2 below

	Basic	Extra	Latest
Shop A	560	750	1580
Shop B	520	690	1390
Shop C	590	720	1780

Use matrix multiplication to calculate

(i)   The total weekly cost of computers to each shop. **(7 marks)**

(ii) The total weekly revenue for each model for each shop. **(7 marks)**

(iii) The total weekly profit for each shop and identify which shop makes the greatest overall profit. **(6 marks)**

Question 4

a) Find the inverse of the following matrix.

$$\begin{vmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{vmatrix}$$ **(5 marks)**

b) The following Table shows input/output for the three sectors of the Zimbabwean economy

		Input to			
	Agric	Industry	Services	Other Demands	Total output
Outputs from Agric	150	125	100	100	600
Industry	210	250	140	300	900

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Services	170	0	30	100	300

If the final demands from each sector are changed to 500 from Agriculture, 550 from industry, 300 from services, calculate the total output from each sector **(20 marks)**

END