

BINDURA UNIVERSITY OF SCIENCE EDUCATION
FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

AGM 203

Department of Agricultural Economics, Education and Extension
BSc Agricultural Science (Honours) Part II Examination
Mathematics for Agricultural Economics

3 HOURS (100 Marks)

INSTRUCTIONS

NOV 2023

Answer any FOUR questions. Each question carries 25 marks.

1. (a) Given the demand schedule $p=120-3q$, derive a function for the Marginal Revenue and find the output at which Total Revenue is at maximum [5 marks]

- (b) A monopoly faces the demand schedule $p=460-2q$ and the cost function

$$TC=20+0.5q^2$$

- i. How much should it sell to maximize profit? [5 marks]
- ii. Calculate the maximum profit. [5 marks]

- (c) In a basic Keynesian macroeconomic model it is assumed that $Y=C+I$

where $I=250$ and $C=0.75Y$.

- i. Calculate the equilibrium level of Y . [5 marks]
- ii. What increase in I would be needed to cause Y to increase to 1200. [5 marks]

2. (a) In a two industry economy it is known that industry I uses 10 cents of its own product and 60 cents of commodity II to produce a dollar's worth of commodity I; industry II uses none of its own product but uses 50 cents of commodity I in producing a dollar's worth of commodity II: and the open sector demands \$1000 billion of commodity I and \$2000 billion of commodity II. Calculate the solution output levels. **[15 marks]**

(b) If the consumption function is given by;

$$C = 0.01Y^2 + 0.2Y + 50$$

Calculate Marginal Propensity to Consume (MPC) and Marginal Propensity to Save (MPS) when $Y = 30$ **[10 marks]**

3. (a) Given the supply and demand functions:

$$P = Q_S^2 + 14Q_S + 22$$

$$P = -Q_D^2 - 10Q_D + 150$$

Determine the equilibrium price and quantity. **[10 marks]**

(b) Given the supply and demand functions:

$$P = \frac{1}{2}Q_S + 25$$

$$P = -2Q_D + 50$$

Determine the effect on the market equilibrium if the government decides to impose a fixed tax of \$5 on each good **[15 marks]**

4. An individual has the utility function $U = 4X^{0.5}Y^{0.5}$ and can buy good X at \$2 a unit and good Y at \$8 a unit. If their budget is \$100, find the combination of X and Y that they should purchase to maximise utility and check that second-order conditions are met using the bordered Hessian matrix. [25 marks]
5. a) Given the function $y=5x^2-4x$ and $y=6x^4-3x-4$
- Find the derivative dy/dx of the two functions. [7 marks]
 - Find $f'(2)$ and $f'(3)$ of the two functions. [8 marks]
- b) Given the production function $Q=96K^{0.3}L^{0.7}$. Find MPP_K and MPP_L . [10 marks]
6. A small manufacturer produces two kinds of good, A and B, for which demand exceeds capacity. The production costs for A and B are \$6 and \$3, respectively, each, and the corresponding selling prices are \$7 and \$4. In addition, the transport costs are 20 cents and 30 cents for each good of type A and B, respectively. The conditions of a bank loan limit the manufacturer to maximum weekly production costs of \$2700 and maximum weekly transport costs of \$120. How should the manufacturer arrange production to maximize profit

[25 marks]

End of Paper