CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS

AGEC 854: MATHEMATICS FOR ECONOMIST

STREAMS: MSC AGEC **TIME: 3 HOURS**

DAY/DATE: WEDNESDAY 18/12/2024 **11.30 A.M – 2.30 P.M**

INSTRUCTIONS:

(i) Answer **ALL** questions in **Section A** and any other **TWO** questions.
(ii) Do not write on the question paper

SECTION A

QUESTION ONE

a. $\int x\sqrt{x+4}\,dx$ **(2 Marks)**

b. $\int x^5 e^{x^3}\,dx$ **(2 Marks)**

c. $\int \frac{2t^3+1}{(t^4+2t)^3}\,dt$ **(2 Marks)**

d. $if\ g(x) = x^2 f(x)$ find $g'(3)$ **(2 Marks)**

e. If $f(x) = \frac{3x+2}{x^2+x}$ find $f'(x)$ **(2 Marks)**

QUESTION TWO

Using Kuhn-Tuckers conditions to solve the following maximization problem

$Max\ U = xy^2$

Subject to
$x + y \leq 80$

$2x + y \leq 100$

$x, y \geq 0$ **(10 Marks)**

QUESTION THREE

A survey of farmers shows that:

- 40 farmers grow wheat,
- 30 farmers grow corn,
- 15 farmers grow both wheat and corn.

a. Use a Venn diagram to illustrate this information and calculate how many farmers grow only wheat, only corn, and neither crop. **(5 Marks)**

b. Suppose these crops are subject to subsidies. Explain how the Venn diagram can be utilized to inform policy decisions regarding the allocation of subsidies to farmers to cultivate wheat, corn, or both. **(5 Marks)**

SECTION B

QUESTION FOUR

An economy has three sectors: Agriculture, Industry, and Services. Their interdependencies are represented by the input-output matrix

$$A = 0.1\ 0.2\ 0.1\ 0.3\ 0.1\ 0.2\ 0.1\ 0.2\ 0.1$$

Given that the final demand for Agriculture is 50, Industry is 60, and Services is 70, calculate the total output for each sector. Discuss the economic implications of the interdependencies between these sectors. **(15 Marks)**

QUESTION FIVE

A farm's production function for crops x1 and x2 is given by:

$$Q(x_1, x_2) = x_1^{0.5} x_2^{0.5}$$

The farmer faces the following budget constraint:$p_1x_1 + p_2x_2 = M$, where $p_1 = 4, p_2 = 2$, and M=100.

(a) Write down the Lagrangian for this problem and derive the first-order conditions. (**5 Marks**)

(b) Solve for the optimal levels of x_1 and x_2. (**10 Marks**)

QUESTION SIX

A man always eats lunch at one of two restaurants, A and B. He never eats at A twice in a row. However, if he eats at B, he is three times as likely to eat at B next time as at A. Initially, he is equally likely to eat at either restaurant.

a. What is the probability that he eats at A on the third day after the initial one?

b. What proportion of his lunches does he eat at A? **(15 Marks)**
