



**ALUPE UNIVERSITY  
COLLEGE**

*...Bastion of Knowledge...*

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## UNIVERSITY EXAMINATIONS

### 2019 /2020 ACADEMIC YEAR

...3rd.... YEAR ...1ST..... SEMESTER REGULAR EXAMINATION  
FOR THE DEGREE OF BACHELOR OF SCIENCE

### ECONOMICS

COURSE CODE: ECO 312

COURSE TITLE: MATHEMATICS FOR ECONOMIST

DATE: 11/12/2019

TIME: 8 am -12 pm

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**Main exam**

**INSTRUCTION TO CANDIDATES**

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### INSTRUCTIONS TO CANDIDATES

- Answer Question ONE and any other **TWO** questions
- Question ONE carries 30 marks
- Time allowed: 3 hours

### QUESTION ONE (30 MARKS)

- a) A firm faces the production function  $Q = 20K^{0.4}L^{0.6}$ . It can buy inputs K and L for sh. 400 and sh. 200 per unit respectively. Using the langragian multiplier determine the combination of K and L that should be used to maximize output if its input budget is constrained at sh. 6000. **(10 marks)**

- b) Given the consumers demand function as

$$P = 50 - 5Q$$

Determine the consumer's surplus at  $p=15$

**(6 marks)**

- c) Use the quadratic formula to solve  $16x^2 + 3x - 5 = 0$

**(6 marks)**

- d) Suppose the demand and Average cost functions for a firm is represented by

$$P = 20 - Q$$

$$AC = \frac{50}{Q} - 2 + Q$$

Obtain the profit function

**(8 marks)**

### QUESTION TWO (30 MARKS)

- a) Evaluate

i)  $\lim_{x \rightarrow \infty} \frac{1}{2x+7}$

**(4 marks)**

ii)  $\log_3 27 + \log_y y^5$

**(4 marks)**

- b) A company extracts minerals from ores. The number of kilograms that can be extracted from each ton of ore X and Y is given as follows.

	Ore X	Ore Y
Mineral A	36	6
Mineral B	3	12
Mineral C	20	10

The cost per ton is 20 shillings and 40 shillings for ore X and Y respectively

The company must produce at least 108, 36 and 100 kilograms of A, B and C respectively.

- i) Using the above information form the linear programming problem **(6 marks)**
- ii) Solve the above LPP using the graphical method **(6 marks)**

### QUESTION THREE (20 MARKS)

- a) Prove that the following demand function is unitary elastic **(5 marks)**  
$$p = \frac{1}{\alpha Q}$$
- b) For XYZ manufacturing company, the total fixed costs are sh. 1200 and the variable costs are sh. 2 per unit. The demand equation is given as

$$p = 100/\sqrt{q}$$

- i) At what level of output is profit maximized **(6 marks)**
- ii) What is the price at profit maximization **(4 marks)**
- c) Analyze the continuity of  $\frac{x^2 - 9}{x - 3}$   $0 \leq x \leq 3$  at  $x = 3$  **(5 marks)**

### QUESTIONFOUR (20 MARKS)

- a) Find the derivative of the function **(8 marks)**  
$$f(x) = \left( \frac{x^2 - x - 3}{x^2 + 1} \right) (x^2 + x + 1)$$
- b) The population of a town of 5000 grows at a rate of 3% per year.
  - i) Determine the equation that gives the population at n years from now. **(4 marks)**
  - ii) What will be the population in three years? **(2marks)**
  - c) Evaluate by means of integration by substitution:

$$\int_1^2 \frac{2 - 6x}{(2x - 3x^2)^3} dx \quad \textbf{(6 marks)}$$

**QUESTION FIVE (20 MARKS)**

a) i) Given a general quadratic equation  $ax^2+bx+c=0$  solve for x using the completion of squares method. **(6 marks)**

ii) Show how the solution in (i) above gives rise to the quadratic formula. **(6 marks)**

b) Suppose you have the following demand function

$$pq = 100$$

Let c be the total cost and the marginal cost is 0.01 at  $q=200$ .

Use chain rule to determine  $\frac{dc}{dp}$  at  $q=200$  **(8 marks)**

.....**END**.....