MACHAKOS UNIVERSITY
University Examinations for 2020/2021 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF ECONOMICS AND FINANCE

BACHELOR OF ECONOMICS AND STATISTICS

BACHELOR OF ECONOMICS

BACHELOR OF ARTS

EES 100: MATHEMATICS FOR ECONOMISTS 1

DATE: 13/8/2021   TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

(i)   **Answer question one (Compulsory) and any other two questions**

(ii)   **Do not write on the question paper**

(iii) **Show your workings clearly**

QUESTION ONE (COMPULSORY) (30 MARKS)

a)   Explain the advantages of a Mathematical Approach in Economics   (5 marks)

b)   Consider the following sets:

$A = \{x \mid 0 \le x \le 12\}$ Where A is the Universal Set

$B = \{x \mid 2 \le x \le 8\}$

$C = \{5,8,9\}$

$D = \{0\}$

Find the following   (5 marks)

i) $B \cap A \cup D$

ii) $(D'^{)'} \cup D' \cap C' \cup C$

iii) $C' \cup C \cap A$

c)   The total cost function for a firm is given as:

$$C = 36X - 10X^2 + 2X^3$$

Find the level of output X that will minimize the average cost. Prove that it is the average cost minimizing output level   (6 marks)

d)   Given the following consumption function C = 70 + 0.85Y

i.   What is the Marginal propensity to consume   (1 mark)

ii.   Find the corresponding saving function.   (2 marks)

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      iii.   What is the corresponding marginal propensity to save and the level of induced savings when Y= 500   (3 marks)

e)   You are given the following supply and demand functions for a market;

$$Demand\ function: 0.04P^2 + 0.4P + 0.2Q = 20$$
$$\sup ply\ function: 0.15P^2 + 2P - 0.5Q = -50$$

      i.   Determine the price elasticity of demand at P = 10 and comment on your results   (3 marks)

      ii.   Determine the price elasticity of supply at P = 20 and comment on your results.   (3 marks)

f)   Explain the difference between endogenous and exogenous variables.   (2 marks)

QUESTION TWO (20 MARKS)

a)   Are the following numbers rational or irrational? Explain.   (6 marks)
      b. 7.321834321834321…
      c. 6.2173435921
      d. 2.1576531576531576…

b)   Find the equilibrium income, consumption and tax given the following national income model: (6 marks)
$$Y = C + I + G$$
$$C = 100 + 0.8Y^d$$
$$T = 10 + 0.1Y$$
$$I = 50$$
$$G = 30$$

c)   Solve the following quadratic equations: (4 marks)

$$x^2 - 4x + 4 = 0$$
$$x^2 - 5x = -6$$

d)   Evaluate the following   (4 marks)

(i) $(x^3 x^4 \div x^{-4})^{11}$

(ii) $\dfrac{(a^2)^4 d^9}{(a^5)(d^2)^3}$

QUESTION THREE (20 MARKS)

a)   Expand the following: (9 marks)
      i) $(a + b)^6$
      ii) $(x + y)^9$
      iii) $(a + b)^{10}$

b)   250 members of a certain society have voted to elect a new chairman. Each member may vote for either one or two candidates. The candidate elected is the one who

polls most votes. Three candidates x, y z stood for election and when the votes were counted, it was found that:
- 59 voted for y only, 37 voted for z only
- 12 voted for x and y, 14 voted for x and z
- 147 voted for either x or y or both x and y but not for z
- 102 voted for y or z or both but not for x

Required
i) Present the above information in a Venn diagram   (3 marks)
ii)   How many voters did not vote   (3 marks)
iii)   How many voters voted for x only   (3 marks)
iv)   Who won the elections? Why?   (2 marks)

QUESTION FOUR (20 MARKS)

a) Compute the following: (8 marks)
    i) $log_5 625$
    ii) $log_5(25)^{\frac{1}{2}}$
    iii) $\ln(e^5.e^{-2}.e^a)$
    iv) $log_{10}\{\frac{1000}{10^5}\}$

b) The total revenue and total cost functions of a firm are given by the following functions:

$$\text{Total revenue} = 14X - X^2$$
$$\text{Total cost} = X^3 - 2X$$

Determine the level of output X that will maximize: (12 marks)
    (i) The firm's total revenue (Test the second order condition)
    (ii) The Firm's profits (Test the second order condition)

QUESTION FIVE (20 MARKS)

a) Given the following Imports and Exports functions:

$M = 200 + 0.4Y$: Imports Function
$X = 600$:   Exports Function

Required:

(i) Identify the endogenous and exogenous variables?   (2 marks)
(ii) What is the income level that will ensure equilibrium in the balance of trade?
                                                    (3 marks)
(iii) Find the level of imports at this income level.   (1 mark)

b) Compute the derivatives of the following: (8 marks)
    i) $y = \frac{x^3 - 4x^4}{x^2 - 5}$
    ii) $y = (17 + x^2 + 3x^4)^8$

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iii) $y = (x^3 - 5)(4 - x^2)$

iv) $y = (3x_1^2 + x_2)(x_1 + x_2^2)$

c) Given the following market model, find the equilibrium prices and equilibrium quantities: (6 marks)

$$Qd_1 = 8 - 2P_1 + P_2$$
$$Qs_1 = -5 + 3P_1$$
$$Qd_1 = Qs_1$$
$$Qd_1 = 16 + P_1 - P_2$$
$$Qs_2 = -1 + 2P_2$$
$$Qd_2 = Qs_2$$