Total No. of Printed Pages—8

1 SEM TDC ECOH (CBCS) C 2

2022

(Nov/Dec)

ECONOMICS

(Core)

Paper : C–2

(Mathematical Methods for Economics—I)

Full Marks : 80
Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option : 1×8=8

(a) If $A = \{0, 2, 4, 6, 8\}$ and $B = \{2, 6, 4, 0, 8\}$, then

(i) $A = B$ *(ii)* $A \neq B$

(iii) $A \geq B$ *(iv)* $A \leq B$

(b) The symbol used to denote null set is

(i) ϕ *(ii)* ψ

(iii) ω *(iv)* χ

(c) If $n = 2$, the below polynomial function $f(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \cdots + a_n x^n$ will be known as

(i) constant function

(ii) linear function

(iii) quadratic function

(iv) cubic function

(d) $\frac{d}{dx}(10 + 5x^2)2x^3 =$

(i) $60x^2 + 50x^4$

(ii) $60x^3 + 50x^4$

(iii) $60x^2 + 50x^3$

(iv) $20x^3 + 10x^5$

(e) The correct relationship among average revenue (AR), marginal revenue (MR) and elasticity of demand is

(i) $e_d = \frac{AR}{AR - MR}$

(ii) $e_d = \frac{MR}{AR - MR}$

(iii) $e_d = \frac{AR}{MR - AR}$

(iv) $e_d = \frac{MR}{MR - AR}$

(f) $\int e^x dx =$

(i) e^x (ii) $e^x + c$

(iii) $\log e + c$ (iv) $x + c$

(g) $\int_1^5 3x^2 dx =$

(i) 134 (ii) 124

(iii) 114 (iv) 104

(h) A function is said to be continuous at a point $x = a$, if

(i) $\lim_{x \to a} f(x)$ exist

(ii) $\lim_{x \to a} f(x)$ exist and $\lim_{x \to a} f(x) = f(a)$

(iii) $\lim_{x \to a} f(x) = f(a)$

(iv) None of the above

2. Answer any *four* of the following : 4×4=16

(a) If $A = \{3, 7, 5, 9\}$ and $B = \{1, 3, 6, 7\}$, then find the union and intersection of sets A and B.

(b) From the given total cost (TC) function, find the average cost (AC), average variable cost (AVC), average fixed cost (AFC) and marginal cost (MC) :

$$TC = \frac{1}{3}Q^3 + 7Q^2 + 13Q + 237$$

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(c) The total revenue (R) of a firm per day is a function of its daily sells (Q) :

$$R = 20 + 5Q$$

The firm sells maximum 50 units of output per day. What are domain and range of the revenue function?

(d) Check whether the following function

$$y = \frac{x^2 - 4x + 4}{(x - 2)}$$

is continuous at point $x = 2$.

(e) Calculate the elasticity of supply of the following function when price (P) = 10 :

$$S = -100 + 2P$$

3. (a) (i) Given $A = \{4, 5\}$, $B = \{3, 6, 7\}$ and $C = \{2, 3\}$. Verify the associative law of set operations. 4

(ii) Among 120 college students, 75 students like to play cricket and 65 students like to play football. If each student likes to play at least one of the two games, how many students would like to play both cricket and football? 4

(iii) Define variables, constants and parameters with example. 3

Or

(b) (i) In case of ordered pair $(a, b) \neq (b, a)$ unless $a = b$. Explain. 3

(Continued)

(ii) If

$A = \{a, b, c, d, x, y\}$ and $B = \{b, d, x, y\}$

then find $A - B$ and $B - A$. 4

(iii) Define the following with examples : 4

(1) Equivalent set

(2) Disjoint set

(3) Universal set

(4) Finite set

4. (a) (i) Draw the graph of the following function : 3

$$y = |x| + 2$$

(ii) Write short notes on constant function and logarithmic function. 4

(iii) Find the sum of squares of first 9 natural numbers. 4

Or

(b) (i) Illustrate the concept of limit of a function. Evaluate the limit of the function

$$\lim_{x \to 7} \frac{x^2 - 16}{x + 4}$$ 3+4=7

(ii) What do you understand by sequences and series? Give examples. 4

5. *(a)* *(i)* Find the derivative of the following function using product rule of differentiation : 3

$$y = (9x^2 - 2)(3x + 1)$$

(ii) Consider the demand function $q = 500 - 10p$. Compute the price elasticity of demand when $p = 30$. 4

(iii) Given the total cost (C) function of a firm as follows

$$C = 10000 + 100Q - 10Q^2 + \frac{1}{3}Q^3$$

Find the level of output at which marginal cost is equal to average variable cost. 4

Or

(b) *(i)* A consumer has a following utility function

$$U = f(Q) = aQ^b, \text{ where } a > 0;\ b < 1$$

Show that the utility function display diminishing marginal utility. 4

(ii) Given the consumption function $C = C(Y) = 100 + 0 \cdot 6Y$, where Y is income. Find the marginal propensity to consume (mpc) and marginal propensity to save (mps). 3

(iii) A firm has the following total revenue (TR) and total cost (TC) functions :

$TR = 1200Q - 2Q^2$

$TC = Q^3 - 61 \cdot 25Q^2 + 1528 \cdot 5Q + 2000$

Calculate the profit maximizing output and the maximum profit. 4

6. (a) (i) Evaluate : 3

$$\int 8e^{2x+3}\, dx$$

(ii) Derive the total cost function from the given marginal cost function :

$$MC = 2x^2 - 3\sqrt{x} + 4$$

when the total fixed cost is 200. 4

(iii) Find out the point elasticity of demand from the following marginal revenue function :

$MR = 20 - 0 \cdot 2Q$, when $Q = 5$ 4

Or

(b) (i) Find the consumption function when $MPC = 0 \cdot 5 \frac{1}{\sqrt{Y}}$ with aggregate consumption 100 when income is zero. 3

(ii) Determine the increase in the total revenue from the following marginal revenue function when sale increases from 8 to 12 : 4

$MR = 30 - 4Q$

(iii) Find the consumer surplus from the following demand function when market price (P) is 12 : 4

$$Q = \sqrt{(60 - 2P)}$$

7. (a) (i) Explain the role of differential equation in economic applications. 4

(ii) Examine the following market model for stability : 8

$$Q_d = 14 - 3P$$
$$Q_s = -10 + 2P$$
$$\frac{dP}{dt} = 4(Q_d - Q_s)$$

Or

(b) (i) Solve the differential equation 4

$$\frac{dy}{dx} + 8y = 4 \quad \text{when } y(0) = 2$$

(ii) In reference to the following differential equation, explain a standard first-order linear differential equation with constant coefficient and constant term :

$$\frac{dy}{dx} + u(x)\,y = v(x)$$

What is a homogeneous linear differential equation? Give example. 8

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