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63/1 (SEM-2) CC4/ECOHC2046

2025

ECONOMICS

Paper : ECOHC2046

(Mathematical Methods for Economics – I)

Full Marks : 80

Pass Marks : 32

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Choose the correct answer of the following :
(any six) 1×6=6

(a) If $U = \{2, 4, 6, 8, 10, 12\}$ and
 $A = \{4, 6, 8\}$, then the complement
of $A(A^c)$ is

(i) $\{2, 4, 6\}$

(ii) $\{2, 4, 8\}$

(iii) $\{2, 4, 10\}$

(iv) $\{2, 10, 12\}$

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Contd.

(b) If ACB, BCA then two sets A and B are -

(i) Proper sub set

(ii) Equal set

(iii) Equivalent sets

(iv) Power set

(c) Every rational number is -

(i) Real number

(ii) Integar

(iii) Whole number

(iv) Natural number

(d) Which of the following is an irrational number ?

(i) $\sqrt{16}$

(ii) $\sqrt{12/13}$

(iii) $\sqrt{12}$

(iv) $\sqrt{100}$

(e) The limiting value of the function

$$\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$$

(i) 2

(ii) 0

(iii) 4

(iv) 1

(f) If $f(x) = x - \frac{1}{x}$, then $f(x) + f(1/x)$ is equal to

(i) 1

(ii) $2x$

(iii) $2/x$

(iv) 0

(g) If 'c' is any constant, then $\frac{dc}{dx}$

(i) c

(ii) x

(iii) -c

(iv) 0

(h) If $y = e^x$, then $\frac{d(e^x)}{dx}$

(i) e^{-x}

(ii) e^x

(iii) e

(iv) 0

(i) The value of $\int dx$ is

(i) $\log x + c$

(ii) $1/x + c$

(iii) $1/2x + c$

(iv) $x + c$

(j) The MPC of the consumption function

$$C(Y) = 50 + 0.4Y$$

(i) 50

(ii) 0

(iii) 0.4

(iv) $1/2$

2. Answer the following questions : **(any five)**

2×5=10

(a) Define null set with example.

(b) Fill in the blanks

(i) Every set is a _____ of itself.

(ii) The _____ set is a subset of every set.

(c) Define a rational function with example.

(d) Find the limit: $\lim_{x \rightarrow 3} \frac{x^2 + x - 6}{x + 3}$

(e) Find the derivative of the function

$$y = f(x) = \frac{1}{2}\sqrt{x}$$

(f) Find the elasticity of demand of the demand function

$$D = 24 - 4P, \text{ when } P = 3$$

where D and P represent demand and price.

(g) Find $\int(3x^2 - 2x + 2)dx$

3. Answer the following questions: **(any six)**
5×6=30

(a) Define with example: 2+3=5

(i) Singleton set

(ii) Equal sets and Equivalent set

(b) Evaluate the limit function

$$\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x^2 - x - 2}$$

(c) Find out the equilibrium price and quantity of the following market model.

$$Q_d = 15 - 2P$$

$$Q_s = -5 + 2P$$

$$Q_s = Q_c$$

(d) Write product rule of differentiation.

If $y = (x^2 + 10)(x + 1)$, find the value of

$$\frac{dy}{dx} \quad 2+3=5$$

(e) If $y = \frac{1 + \sqrt{x}}{1 - \sqrt{x}}$, find the value of $\frac{dy}{dx}$.

(f) Derive the relationship between MC and AC using the product rule of differentiation.

(g) Find the second order derivative of the functions 2+3=5

(i) $f(x) = 15x^3 - 6x^2 + 30x + 20$

(ii) $f(x) = 30 + e^x + x^2$

(h) Integrate the following: 2+3=5

(i) $\int(2ax + 10\sqrt{x} + e^x)dx$

(ii) $\int \frac{2x + 3}{x^2 + 3x} dx$

- (i) The total cost function of a firm is given by 2+3=5

$$C(Q) = 0.005Q^3 - 0.02Q^2 + 30Q + 3000$$

find -

- (i) average cost (AC) when $Q = 10$
(ii) marginal cost (MC) when $Q = 10$

- (j) State the conditions of an unconstrained maxima and minima with single explanatory variable.

4. Answer the following questions: **(any two)**

10×2=20

- (a) The total cost function of a firm is given below:

$$C = Q^3 - 7Q^2 + 2Q + 16$$

Find out the level of output at which average variable cost (AVC) is minimum and also show that $MC = AVC$ at that level of output. 5+5=10

- (b) (i) Define consumer's surplus. For a demand function $Qd = a - bp$, find the marginal revenue function.

- (ii) If the consumer's demand function is given by

$$Q = f(P) = 50 - 2P$$

find the consumer's surplus when market price $P = 20$.

2+3+5=10

- (c) (i) State and prove the quotient rule of differentiation.

- (ii) If $y = \frac{2x+5}{x^2-3}$, find $\frac{dy}{dx}$

1+4+5=10

- (d) Find the following integral: 5+5=10

(i) $\int (4x^3 + 1/x + e^x) dx$

(ii) $\int x.e^x dx$

5. Answer the following questions : **(any one)**

14×1=14

- (a) (i) Define point elasticity of demand. If $TR = PQ$, where P and Q are price and quantity respectively, then show that

$$ed = \frac{AR}{AR - MR}$$

- (ii) The marginal revenue function is given by $MR = 50 - 4Q$, find the point elasticity of demand when $Q = 10$.

2+7+5=14

- (b) A monopolist average revenue (AR) and total cost (TC) functions are given by

$$AR = 16 - 2Q$$

$$TC = 20 + 4Q - Q^2$$

Find

- (i) Profit maximizing output
(ii) Equilibrium price
(iii) Point elasticity of demand at equilibrium level of price.

8+3+3=14

- (c) Define Cobweb market model. Given the demand and supply functions for Cobweb market model.

$$Q_{dt} = 18 - 3P_t$$

$$Q_{st} = -3 + 4P_{t-1}$$

Find intertemporal equilibrium price and also determine whether you will get stable equilibrium. 2+12=14