4 SEM TDC ECO M 1

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(May)

ECONOMICS

(Major)

Course : 401

(Mathematics for Economics)

Full Marks : 80
Pass Marks : 32

Time : 3 hours

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

1. Choose the correct answer :   1×8=8

(a) Given $S = \{1, 2, 7, 8\}$ and $T = \{2, 4, 6, 8\}$.
$S \cap T$ is

   (i) $\{1, 2, 4, 6, 7, 8\}$

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

   (iii) $\{1, 4, 6, 7\}$

   (iv) None of the above

(b) $y = \alpha_0 + \alpha_1 x + \alpha_2 x^2$ is a form of

   (i) constant function

   (ii) polynomial function

   (iii) exponential function

   (iv) logarithmic function

(c) $\begin{vmatrix} 3 & 2 \\ 1 & 5 \end{vmatrix} = ?$

   (i) 13

   (ii) −13

   (iii) 16

   (iv) −16

(d) $(A + B)' = ?$

   (i) $A' + B'$

   (ii) $A' + B$

   (iii) $A + B'$

   (iv) $A + B$

(e) Which of the following is a symmetric matrix?

(i) $\begin{bmatrix} 2 & 2 & 2 \\ 1 & 2 & 2 \\ 2 & 3 & 2 \end{bmatrix}$

(ii) $\begin{bmatrix} 4 & 0 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 4 \end{bmatrix}$

(iii) $\begin{bmatrix} 2 & 0 & 3 \\ 0 & 4 & 3 \\ 0 & 0 & 3 \end{bmatrix}$

(iv) $\begin{bmatrix} 3 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 4 & 2 \end{bmatrix}$

(f) Given $y = \dfrac{5}{2x^2}$. $\dfrac{dy}{dx}$ is

(i) $-\dfrac{x^3}{5}$

(ii) $\dfrac{x^3}{5}$

(iii) $\dfrac{5}{x^3}$

(iv) $-\dfrac{5}{x^3}$

(g) The elasticity of substitution of Cobb-Douglas production function is

  (i) 0

  (ii) 1

  (iii) more than 1

  (iv) less than 1

(h) $\int \dfrac{1}{x^5} \, dx = ?$

  (i) $\dfrac{1}{4x^4} + c$

  (ii) $-\dfrac{1}{4x^4} + c$

  (iii) $4x^4 + c$

  (iv) None of the above

2. Write short notes on (any *four*) :   4×4=16

(a) Rank of matrix

(b) Properties of determinant

(c) Mathematical derivation of the relationship between AC and MC

(d) Mathematical derivation of the relationship between AR and MR

(e) Consumer's surplus

(f) First-order difference equation

3. *(a)* *(i)* Given the universal set

$$S = \{a, b, c, 1, 2, 3\}$$

Find the complement of

$$S_1 = \{a, 1, 2\}$$ 2

(ii) Show the operations of sets with the help of Venn diagram. 6

(iii) Find the limit of the function

$$y = 10 - 6x + x^2 \text{ as } x \to 2$$ 3

Or

(b) *(i)* What is ordered pair? How is it related to function? 5

(ii) Prepare a brief note on different forms of functions and their graphs. 6

4. *(a)* *(i)* Show how the sectoral equilibrium output can be estimated in a framework of static open input-output model. 7

(ii) From the following market model, find the equilibrium output and price using Cramer's rule : 4

$$Q_d = a - bP$$
$$Q_s = -c + dP$$
$$Q_d = Q_s$$

Or

(b) (i) Given

$$A = \begin{bmatrix} 2 & 3 & 0 \\ 5 & 1 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 1 & 5 \end{bmatrix}$$

Find AB. 3

(ii) Find the determinant of A, where

$$A = \begin{vmatrix} 6 & 0 & 4 \\ 2 & 1 & 3 \\ 4 & 2 & 2 \end{vmatrix}$$

4

(iii) Given

$$A = \begin{bmatrix} 2 & 3 \\ -4 & 1 \end{bmatrix}$$

Find A^{-1}. 4

5. (a) (i) Find the derivative of the following function : 4

$$y = \frac{5x}{(10 - 2\log x^2)^2}$$

(ii) Given the consumption function

$$C = C(Y) = 2000 - \frac{6000}{(5 + Y)}$$

Find out the marginal propensity to consume (MPC) and marginal propensity to save (MPS). 4

(*Continued*)

(iii) Prove mathematically that for substitutes indifference curves are negatively sloped.   4

Or

(b) *(i)* Explain the geometrical interpretation of derivatives in case of a single-independent variable.   6

(ii) Prove that Cobb-Douglas production function satisfies the Euler's theorem.   6

6. *(a)* *(i)* Find

$$\int \frac{4x^3 + 2}{(4x^4 + 8x)^5} dx$$ 5

(ii) Obtain the consumer's surplus of the following demand function when the market price is Rs 16 per unit :   6

$$Q = \sqrt{16 - \tfrac{3}{2}P}$$

Or

(b) *(i)* Find

$$\int e^x \cdot x \, dx$$ 3

(ii) Derive total cost function from the following marginal cost function when fixed cost is Rs 500 :   3

$$MC = 3q^2 - 4x + 3$$

(iii) Given the supply function $Q = -3 + 2P$. Obtain the producer's surplus when market price is Rs 6.   5

7. *(a)* *(i)* Solve the differential equation

$$\frac{dy}{dx} + 5y = 10$$

with initial condition $y(0) = 5$.   4

(ii) Analyze the following market model for stability :   7

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

Or

(b) *(i)* Solve the following difference equation :   4

$$Y_{t+1} - 5Y_t = 12, \text{ with } Y_0 = 10$$

(ii) In a cobweb model

$$Q_{dt} = a - bP_t \ (a, \ b > 0)$$
$$Q_{st} = -c + dP_{t-1} \ (c, \ d > 0)$$
$$Q_{dt} = Q_{st}$$

obtain the time path of P_t and analyze the condition for its convergence.   7

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