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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) $A + B$

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(Continued)

(3)

(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 $y = \frac{5}{2x^2}$, $\frac{dy}{dx}$ is

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

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

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

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

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(Turn Over)

(4)

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

- (i) 0
- (ii) 1
- (iii) more than 1
- (iv) less than 1

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

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

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(Continued)

(5)

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

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

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

$$Q_d = a - bP$$

$$Q_s = -c + dP$$

$$Q_d = Q_s$$

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(Turn Over)

(6)

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 .

(ii) Find the determinant of A , where

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

(iii) Given

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

Find A^{-1} .

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

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

(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).

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(Continued)

(7)

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

Or

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

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

6. (a) (i) Find

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

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

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

Or

(b) (i) Find

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

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

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

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(Turn Over)

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

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

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

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

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

$$Q_d = 14 - 3P$$

$$Q_s = -10 + 2P$$

$$\frac{dP}{dt} = 4(Q_d - Q_s)$$

Or

- (b) (i) Solve the following difference equation :

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

- (ii) In a cobweb model

$$Q_{dt} = a - bP_t \quad (a, b > 0)$$

$$Q_{st} = -c + dP_{t-1} \quad (c, d > 0)$$

$$Q_{dt} = Q_{st}$$

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