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4 SEM TDC ECO M 1

2017

(May)

ECONOMICS

(Major)

Course : 401

(Mathematics for Economics)

Full Marks : 80
Pass Marks : 32/24

Time : 3 hours

The figures in the margin indicate full marks for the questions

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

(a) If $A = \{1, 2, 3\}$ and $B = \{2, 7, 9, 12\}$, then $A \cup B = ?$

(i) $\{1, 2, 3, 7, 9, 12\}$

(ii) $\{2\}$

(iii) $\varnothing$

(iv) $\{1, 3, 7, 9, 12\}$

(b) $\int (ax)^n \, dx = ?$

(i) $\frac{x^{n+1}}{a(n+1)} + c$

(ii) $\frac{(ax)^{n+1}}{a(n+1)} + c$

(iii) $\frac{1}{a} x^{n-1} + c$

(iv) $ax^{n+1} + c$

(c) The number of subsets of a unit set is

(i) 0

(ii) 1

(iii) 2

(iv) 3

(d) If the total variable cost function is $C = x^2 + 15x$, identify the marginal cost function.

(i) $MC = x + 15$

(ii) $MC = x^2 + 15$

(iii) $MC = 2x + 15$

(iv) $MC = x^2 + 15x$

(Continued)

(e) $\frac{d}{dx} \log x = ?$

(i) x (ii) e^x

(iii) $\frac{1}{x}$ (iv) x^2

(f) If

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

what is the value of AB?

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

(ii) $\begin{bmatrix} 9 & 13 \\ 13 & 19 \end{bmatrix}$

(iii) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(iv) None of the above

(g) A consumer has a utility function $U = U(Q) = \alpha Q^{\beta}$; his marginal utility function is given by

(i) $MU = \alpha Q^{\beta - 1}$

(ii) $MU = \beta Q^{\alpha - 1}$

(iii) $MU = \alpha\beta Q^{\alpha - 1}$

(iv) $MU = \alpha\beta Q^{\beta - 1}$

(Turn Over)

(h) $\int x\,dx = ?$

(i) $\log x + c$

(ii) $\frac{1}{x} + c$

(iii) $x + c$

(iv) None of the above

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

(a) Draw the graph of $y = x^2 + 3$.

(b) "In almost all fields of economics, mathematics is useful." Explain.

(c) Given the matrices

$$A = \begin{bmatrix} 3 & 2 & 0 \\ 4 & 1 & 3 \\ 2 & 2 & 3 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 1 & 9 \\ 4 & 0 & 2 \\ -2 & 2 & 6 \end{bmatrix}$$

Find AB.

(d) Given the Cobb-Douglas production function $Q = AK^{\alpha}L^{\beta}$. Find the marginal productivities of labour and capital.

(e) Evaluate :

$$\lim_{x \to 3} \frac{x^3 - 27}{x - 3}$$

(Continued)

3. (a) (i) Define with examples : 2×4=8

(1) Null set

(2) Union of sets

(3) Intersection of sets

(4) Power set

(ii) Define function. What are the different types of function? 1+2=3

Or

(b) (i) If $A = \{1, 2, 3\}$, write the subsets of A. 2

(ii) Define proper subset. 2

(iii) Define limit and continuity of function. 2+2=4

(iv) Given $A = \{2, 4, 6\}$ and $\Omega = \{2, 4, 6, 9, 12\}$. Find A'. 3

4. (a) (i) In the static input-output framework, find the consistent level of sectoral outputs (X), if

$$A = \begin{bmatrix} 0{\cdot}2 & 0{\cdot}4 & 0{\cdot}3 \\ 0{\cdot}1 & 0{\cdot}3 & 0{\cdot}2 \\ 0{\cdot}4 & 0{\cdot}1 & 0{\cdot}1 \end{bmatrix} \text{ and } F = \begin{bmatrix} 200 \\ 400 \\ 600 \end{bmatrix}$$ 8

(ii) If

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 4 & 5 \\ 6 & 7 \end{bmatrix},$$

find a matrix C such that $A + B = 2C$. 3

(Turn Over)

Or

(b) (i) Solve the following national income model by Cramer's rule : 9

$$Y = C + I_0 + G_0$$
$$C = \alpha + \beta(Y - T)$$
$$T = \nu Y$$
Given $(0 < \beta, \ \nu < 1)$

(ii) Define rank of a matrix. 2

5. (a) State and prove the properties of the Cobb-Douglas production function. 12

Or

(b) (i) Given the total cost function

$$TC = 10000 + 100x - 10x^2 + \frac{x^3}{3}$$

Find—

(1) the marginal cost function;

(2) the slope of marginal cost function;

(3) output at which marginal cost is equal to average variable cost. $3 \times 3 = 9$

(ii) If the average revenue function is given by $AR = 50 - 2q$, find the point elasticity of demand at $q = 5$. 3

(Continued)

6. (a) (i) Given the MR function

$$MR = R'(q) = 20 - q$$

Find out the price of the product when $q = 10$. 4

(ii) Define producer's surplus. Given the supply function $q = \sqrt{-4 + 4p}$ and the market price is 10. Find the producer's surplus. 1+6=7

Or

(b) (i) The marginal cost function is given by

$$MC = 5x^2 - 4x + 1$$

Find the average cost function if the total fixed cost is ₹ 200. 5

(ii) Find $\int (3x - 4)^2 \, dx$. 3

(iii) Illustrate the uses of definite integrals in economics. 3

7. (a) (i) Solve $\frac{dy}{dx} = 9$. 4

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

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

(Turn Over)

Or

(b) *(i)* Solve $Y_t = -7Y_{t-1} + 16,\ Y_0 = 5$ 4

(ii) Given the demand and supply functions for cobweb model,

$$Q_{dt} = 10 - 2P_t$$

$$Q_{st} = -5 + 3P_{t-1}$$

Find the time path of P_t. 7

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