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4 SEM TDC ECO M 1

2018

(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 option/Answer the following : 1×8=8

(a) $A \cap A' = ?$

(i) Ω

(ii) ϕ

(iii) A

(iv) A'

(b) If $A = \begin{bmatrix} 3 & 2 \\ 1 & 5 \end{bmatrix}$, then the value of $|A'|$ will be

(i) -13

(ii) 13

(iii) -16

(iv) 16

(c) The maximum number of linearly independent rows or columns of a matrix is called

(i) norm of a matrix

(ii) rank of a matrix

(iii) idempotent matrix

(iv) partitioned matrix

(d) Let A matrix is of dimension $m \times n$ and B matrix is of dimension $o \times p$. A and B are conformable for multiplication in the form AB if

(i) $m = p$

(ii) $n = o$

(iii) $n = p$

(iv) $m = o$

(e) Define producer's surplus.

(f) The elasticity of substitution of CES production function is

(i) 0

(ii) 1

(iii) $\frac{1}{1+p}$

(iv) $\frac{1}{1-p}$

(g) Given, MC = $2aQ+b$. TC will be

(i) $bQ+c$

(ii) aQ^2+c

(iii) aQ^2+bQ

(iv) aQ^2+bQ+c

(h) The function

$$f(x)=\frac{x^2+3x+4}{x-1}$$

is not continuous at

(i) 1

(ii) 2

(iii) 3

(iv) None of the above

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

(a) Mathematically derive the relationship between average revenue, marginal revenue and price elasticity of demand.

(b) Evaluate :

$$\lim_{x \to 1} \frac{x^3 - 3x^2 + 2}{x^2 + 5x - 6}$$

(c) Write the assumptions of input-output analysis.

(d) Solve $Y_t = -7Y_{t-1} + 16,\ Y_0 = 5$.

(e) Draw the graph of $xy = 1$.

(f) Prepare a note on polynomial and rational functions.

3. *(a)* *(i)* Distinguish between equal set and equivalent set. 3

(ii) If $A = \{1, 4, 5, 7\}$ and $B = \{4, 9, 8, 10\}$, find $(A \cup B) \setminus (A \cap B)$. 3

(iii) Show the operations of sets with the help of Venn diagram. 5

Or

(b) *(i)* Write in short on the following with example : 3+3=6

(1) Ordered pairs

(2) Continuity of function

(ii) In a test, 60 percent of the students passed in Economics and 50 percent in Statistics. How many students passed in both the subjects? 5

4. (a) (i) Solve the input-output model $X(I-A)=F$ by using Cramer's rule. Given

$$A=\begin{bmatrix} 0\cdot3 & 0\cdot2 & 0\cdot4 \\ 0 & 0\cdot2 & 0\cdot1 \\ 0\cdot1 & 0\cdot2 & 0\cdot2 \end{bmatrix} \text{ and } F=\begin{bmatrix} 400 \\ 600 \\ 500 \end{bmatrix}$$

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(ii) Distinguish between the following : 2+2=4

(1) Static and Dynamic input-output models

(2) Open and Closed input-output models

Or

(b) (i) Verify that the following matrix A is idempotent : 3

$$A=\begin{bmatrix} \frac{1}{6} & -\frac{1}{3} & \frac{1}{6} \\ -\frac{1}{3} & \frac{2}{3} & -\frac{1}{3} \\ \frac{1}{6} & -\frac{1}{3} & \frac{1}{6} \end{bmatrix}$$

(ii) Find the inverse of the following matrix B : 5

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

(iii) Given

$$A = \begin{bmatrix} 2 \cdot 1 & 3 \cdot 2 & 0 \cdot 1 \\ 5 \cdot 3 & 1 \cdot 7 & 2 \cdot 6 \end{bmatrix} \text{ and } B = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 1 & 5 \end{bmatrix}$$

Find AB. 3

5. *(a)* (i) In a perfectly competitive market, the price of a product (q) is ₹4 and the total cost (c) of a firm is $c = q^3 - 15q^2 + 31q + 500$. Find the profit maximizing output and maximum profit. 6

(ii) If the total productivity is given by

$$Q = \frac{L^2 - K}{L + K^2}$$

find the marginal productivity of L and K. 3+3=6

Or

(b) *(i)* Given the consumption function

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

find the marginal propensity to consume when $Y = 95$. 6

(ii) Prove that the elasticity of substitution is equal to one in case of CD production function. 6

6. *(a)* *(i)* Briefly discuss the uses of integral calculus in Economics. 5

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

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

Or

(b) *(i)* Find the integral of $\int x e^x dx$. 3

(ii) The marginal revenue and marginal cost functions of a firm are $MR = 20 - 2Q$ and $MC = 6Q^2 - 4Q + 5$ respectively. The total fixed cost is £ 20 when it sells 4 units of produce. Find the total profit of the firm. 8

7. *(a)* *(i)* Solve : 4

$$\frac{dy}{dx} + 2y = 4$$

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

$$Q_d = 10 - 5p$$
$$Q_s = -10 + 5p$$
$$\frac{dp}{dt} = 3(Q_d - Q_s)$$

Or

(b) *(i)* Write a note on the Cobweb model. 4

(ii) In a market model

$$Q_{dt} = 12 - 2P_t$$
$$Q_{st} = -4 + 2P_{t-1}$$
and $$P_{t+1} - P_t = -0 \cdot 25(Q_{st} - Q_{dt})$$

find the time path P_t and test whether the time path is convergent. 7

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