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(October)

ECONOMICS

(Honours)

(Mathematics for Economists)

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks
for the questions

Answer **five** questions, taking at least **one**
from each Unit

UNIT—I

1. *(a)* Differentiate between equal and equivalent sets with examples. 3

(2)

(b) Represent the following with Venn diagrams :   2+2=4

  (i) $B \subset A$ and $A \cap B = B$

  (ii) $A \cap (B \cup C)$

(c) In an examination, 32 percent students failed in Economics, 30 percent in Political Science, 46 percent in History, 12 percent in Economics and Political Science, 9 percent in Political Science and History, 10 percent in Economics and History and 3 percent in all three subjects. How many students passed in all the three subjects? How many failed in exactly one subject?   3+5=8

2. (a) Distinguish between domain and range of a function.   5

(b) If the domain of the function $y = 1 + 2x$ is the set $\{ x / 2 \leq x \leq 7 \}$, find the range of the function and express it as a set.   2

(c) Can you always find the domain of a function if the range is given? Explain.   2

(3)

(d) (i) What are homogeneous functions?   2

  (ii) Examine if the following functions are homogeneous and if so, of what degree :   2+2=4

  (1) $f(x, y) = x^3 - xy + y^3$

  (2) $f(x, y, w) = \dfrac{xy^2}{w} + 2xw$

UNIT—II

3. Solve the following system of simultaneous equations using (a) Matrix inversion and (b) Cramer's rule :   8+7=15

$$2x_1 + 3x_2 - x_3 = 15$$
$$4x_2 + 2x_3 = 16$$
$$3x_1 + 2x_2 = 18$$

4. (a) Discuss any three properties of determinants with examples.   6

(b) Show the following without expanding :   3

$$\begin{vmatrix} 2 & 2^2 & 2^3 \\ 2^2 & 2^3 & 2^4 \\ 2^3 & 2^4 & 2^5 \end{vmatrix} = 0$$

(4)

(c) If

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

$$C = \begin{bmatrix} 4 & -2 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$

then show that $AB(C) = A(BC)$.   6

UNIT—III

5. (a) Explain left-hand limit and right-hand limit of a function.   3

(b) State the conditions for continuity of a function at a point $x = a$.   3

(c) Evaluate any *three* of the following : 3×3=9

(i) $\lim\limits_{x \to 1} \dfrac{x^2 - 4x + 3}{x^2 + 2x - 3}$

(ii) $\lim\limits_{x \to a} \dfrac{x^9 - a^9}{x^6 - a^6}$

(iii) $\lim\limits_{x \to \infty} \dfrac{5x^3 + 2}{3x^3 + x + 1}$

(iv) $\lim\limits_{x \to 0} \dfrac{\sqrt{(1+x)} - \sqrt{(1-x)}}{x}$

(5)

6. (a) Find dy/dx of the following (any *three*) :

     2×3=6

(i) $y = (2x - 5)(x^2 + x + 1)$

(ii) $y = \log\left[\dfrac{x^2 + 1}{x^2 - 1}\right]$

(iii) $y = e^{\sqrt{(1 + x^3)}}$

(iv) $y = \dfrac{x^2}{\sqrt{(1 + x^2)}}$

(v) $y = (2x^2 + 7)^{10}$

(b) Find the first- and second-order partial derivatives of the following function :

$$z = 2x^3 + 5x^2y + xy^2 + y^2$$

Verify that $\dfrac{\partial^2 z}{\partial x \, \partial y} = \dfrac{\partial^2 z}{\partial y \, \partial x}$.   4

(c) Find the optimum output of a firm whose total revenue and total cost functions are given by

$$R = 30Q - Q^2$$
$$C = 20 + 4Q$$

where Q = output.   5

UNIT—IV

7. *(a)* Find the integral of the following : 3×2=6

(i) $\int \left(4x^3 + \dfrac{1}{\sqrt{x}} - 3 \right) dx$

(ii) $\int 4(e^{2x} + x)(e^{2x} + x^2)^2 \, dx$

(b) *(i)* What is meant by 'integration by parts'? 4

(ii) Using the above concept, find

$$\int \frac{x+5}{x+2} \, dx \qquad 5$$

8. *(a)* Explain the difference between indefinite and definite integral. 4

(b) *(i)* State the procedure for evaluating a definite integral of $f(x)$ from a to b. 3

(ii) Find

$$\int_{2}^{4} 3x^2 (x^2 + 1) \, dx \qquad 4$$

(Continued)

(c) A consumer's demand function is given by

$$Q = f(P) = \sqrt{(60 - 2P)}$$

Find consumer's surplus when market price $P = 12$. 4

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