

2020-21

Time - 3 hours

Full Marks - 80

*Answer all groups as per instructions.
Figures in the right hand margin indicate marks.*

GROUP – A

1. Answer all questions.

[1 × 12

(a) Write the following set in tabular form :

$$A = \{x \mid x \text{ is a letter in word 'Mathematics'}\}.$$

(b) What is a void set ?

(c) Find $|x + 5|$ for $x = -7$.

(d) What are the bases of a decimal and binary system ?

(e) State the product rule of derivative.

(f) Differentiate the following with respect to x : $y = \frac{1}{x}$.

(g) If $TC = 60 - 12q + 2q^2$, find AC.

(h) If $U = x^3 + y^3 + 3xy$, find $\frac{\partial U}{\partial y}$.

(i) Define Matrix.

(j) If $A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$, find $5A$.

(k) Define symmetric matrix.

(l) Find A' , if $A = \begin{bmatrix} 2 & -3 & 1 \\ 4 & 2 & 3 \end{bmatrix}$.

GROUP - B

2. Answer any eight of the following questions within three sentences each.

[2 × 8

(a) Distinguish between finite and infinite sets.

(b) If $A = \{3, 4, 5, 6\}$, find $P(A)$.

(c) If $A = \{1, 2, 3, 4, 5\}$ and $B = \{3, 4, 5, 6, 7\}$ then show that $A - B \neq B - A$.

(d) $y = 2x + 5$. Is it a function or not and why?

(e) $(11001)_2 = (?)_{10}$

(f) Find the limit of $\frac{x^2 - 9}{x + 3}$ as $x \rightarrow 3$.

(g) Find the derivative of the function

$$y = (x + 3)(x - 3).$$

(h) Find $\frac{dy}{dx}$ of $2x + y^2 = 7$.

[3]

(i) If $Q = AL^\alpha K^\beta$, find 1st order partial derivative with respect to L and K.

(j) Find the determinant of A

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

GROUP - C

3. Answer any eight of the following questions within 75 words each.

[3 × 8

(a) What do you mean by set ? Explain three types of set with example.

(b) If $A = \{1, 2, 3\}$, $B = \{3, 4, 5, 6\}$ and $C = \{6, 7, 8, 9\}$, verify that

$$(A \cup B) \cup C = A \cup (B \cup C).$$

(c) Find the domain and range of relation R, where

$$R = \{(x, y) : y = x + \frac{8}{x}, x, y \in \mathbb{N}, x < 9\}.$$

(d) Evaluate : $\lim_{x \rightarrow 2} \frac{x^2 - 5x + 6}{x^2 - 4}$.

(e) Define continuity. Show that the function $f(x) = x^2 + 4x - 2$ is continuous at $x = 1$.

(f) Find $\frac{dy}{dx}$, when $y = \log(x^3 + 3x^2)$.

- (g) A firm's demand function is given by $P = 10 + 2x + 3x^2$, where P is price and x is quantity. Find AR and MR.
- (h) Calculate the elasticity of demand for the demand function $x = 2P - P^2$ at $P = 1$.
- (i) $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$.
- Show that $AB \neq BA$.
- (j) Write three properties of determinant.

GROUP - D

Answer *any four* questions.

4. If $A = \{1, 2, 3\}$, $B = \{3, 4, 5, 6\}$ and $U = \{1, 2, 3, 4, 5, 6, 7\}$, U is the universal set, then verify [7]
- (i) $(A \cup B)' = A' \cap B'$
- (ii) $(A \cap B)' = A' \cup B'$
5. Prove that $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} = 1$. [7]
6. Show that $n_d = \frac{AR}{AR - MR}$, $n_d =$ elasticity of demand. [7]
7. Find the 1st and 2nd order partial derivative for the function [7]
- $$u = 3x^2 + 7xy - 2y^2.$$

[5]

8. A demand function is given by $x_1 = P_1^{-1.0} P_2^{0.5}$. Find direct and cross partial elasticity of demand. [7]
9. Explain different types of matrix with example. [7]
10. Solve the following equations by matrix method : [7]

$$x + 2y + z = 8$$

$$2x + 3y + 2z = 14$$

$$3x + 2y + 2z = 13$$