49. If $Y = SX, Z = tX$ all the variables being differentiable functions of x and lower suffices denote the derivative with respect to x and $\begin{vmatrix} X & Y & Z \\ X_1 & Y_1 & Z_1 \\ X_2 & Y_2 & Z_2 \end{vmatrix} \div \begin{vmatrix} S_1 & t_1 \\ S_2 & t_2 \end{vmatrix} = X^n$, then $n =$

A) 1 B) 2 C) 3 D) 4

50. If A and B are two matrices such that AB = B and BA = A, then

A) $\left(A^6 - B^5\right)^3 = A - B$ B) $\left(A^5 - B^5\right)^3 = A^3 - B^3$

C) A – B is idempotent D) A – B is nilpotent

Section-2
(Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular paragraph should have **only one correct answer** among the four choices A, B, C and D.

Paragraph for Questions 51 & 52

Let x_1, x_2, x_3, x_4 be the roots (real or complex) of the equation

$x^4 + ax^3 + bx^2 + cx + d = 0$

If $x_1 + x_2 = x_3 + x_4$ and $a, b, c, d \in R$, then

51. If $a = 2$, then the value of $b - c$ is

A) -1 B) 1 C) -2 D) 2

52. If $b < 0$ then how many different real values of *'a'* we may have?

A) 3 B) 2 C) 1 D) 0

Paragraph For Questions 53 & 54

A Pythagorean triple is triplet of positive integers (a, b, c) such that $a^2 + b^2 = c^2$. Define the matrices P, Q and R by

$$P = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 2 & 2 & 3 \end{bmatrix}, Q = \begin{bmatrix} 1 & 2 & 2 \\ -2 & -1 & -2 \\ 2 & 2 & 3 \end{bmatrix} \text{ and } R = \begin{bmatrix} -1 & -2 & -2 \\ 2 & 1 & 2 \\ 2 & 2 & 3 \end{bmatrix}$$

53. If we write Pythagorean triples (a, b, c) in matrix form as $\begin{bmatrix} a \\ b \\ c \end{bmatrix}$ then which of the following matrix product is not a Pythagorean triplet ?

A) $Q\begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$ B) $P\begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$ C) $R\begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$ D) none of these

54. Which one of the following does not hold good ?

A) $P^{-1} = adj.P$ B) $(PQ)^{-1} = adj.(PQ)$

C) $(QR)^{-1} = adj.(QR)$ D) $(PQR)^{-1} \neq adj.(PQR)$

Paragraph For Questions 55 & 56

The values of p and q such that the system of equations

$2x + py + 6z = 8$

$x + 2y + qz = 5$

$x + y + 3z = 4$, has

55. unique solution if

A) $p \in R, q \in R$

B) $p \in R - \{2\}, q \in R - \{3\}$

C) $p \in R - \{2\}, q \in R$

D) none of these

56. No solution if

A) $p \in R, q \in R$

B) $p \in R - \{2\}, q \in \{3\}$

C) $p \in R - \{2\}, q \in R - \{2\}$

D) $p \in R - \{2\}\ q \in R$

Section-3
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the **correct match** are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

57. Match the statements of Column I with values of Column II.

Column I	**Column II**
P) The least positive integral values of λ for which $(\lambda-2)x^2+8x+(\lambda+4)>0,$ for all real x is	1) 3
Q) The equation $x^2+2(a^2+1)x+(a^2-14a+48)=0$ possesses roots of opposite signs then x value of $'a'$ can be	2) 5
R) If the equation $ax^2+2bx+4c=16$ has no real roots and $a+c>b+4,$ then integral value of c can not be equal to	3) 7
S) If N be the number of solution of the equation $\lvert x^2-x-6\rvert=x+2$ then the value of N is	4) 12

	P	**Q**	**R**	**S**
A)	2	3	1	2
B)	2	3	2	1
C)	2	1	4	3
D)	2	3	1	1

58. Let $f : R \to R$, $f(x) = 2x^3 - 3(k + 2)x^2 + 12kx - 7$, $-4 \le k \le 6$, $k \in I$ then the exhaustive set of values of k for f(x)

Column – I	**Column – II**
(P) to have only one real root	(1) $\{-1\}$
(Q) to have two equal roots	(2) $\{0, 1, 2, 3, 4, 5\}$
(R) to be invertible	(3) $\{-4, -3, -2, 6\}$
(S) to have three real and distinct roots	(4) $\{2\}$

	P	**Q**	**R**	**S**
(A)	2	1	3	4
(B)	2	1	4	3
(C)	2	4	3	1
(D)	4	3	2	1

59.

	Column I		Column II
(P)	A is a matrix such that $A^2 = A$. If $(I + A)^8 = I + \lambda A$, then $\lambda + 1$ is equal to	(1)	64
(Q)	If A is a square matrix of order 3 such that $\|A\| = 2$, then $\left\|\left(\text{adj}A^{-1}\right)^{-1}\right\|$ is equal to	(2)	1
(R)	Let $\|A\| = \left\|a_{ij}\right\|_{3\times3} \neq 0$. Each element a_{ij} is multiplied by λ^{i-j}. Let $\|B\|$ the resulting determinant, where $\|A\| = \lambda\|B\|$, then λ is equal to	(3)	256
(S)	If A is a diagonal matrix of order 3×3 is commutative with every square matrix of order 3×3 under multiplication and trace (A) = 12, then $\|A\| =$	(4)	4

	P	Q	R	S
A)	3	4	1	2
B)	4	3	2	1
C)	2	4	3	1
D)	3	4	2	1

60. Let $p(\theta)=\begin{vmatrix}-\sqrt{2} & \sin\theta & \cos\theta \\ 1 & \cos\theta & \sin\theta \\ -1 & \sin\theta & -\cos\theta\end{vmatrix}$, $q(\theta)=\begin{vmatrix}\sin 2\theta & -1 & 1 \\ \cos 2\theta & 4 & -3 \\ 2 & 7 & -5\end{vmatrix}$, $r(\theta)=\begin{vmatrix}\cos\theta & \sin\theta & \cos\theta \\ -\sin\theta & \cos\theta & \sin\theta \\ -\cos\theta & -\sin\theta & \cos\theta\end{vmatrix}$ and

$$s(\theta)=\begin{vmatrix}\sec^2\theta & 1 & 1 \\ \cos^2\theta & \cos^2\theta & \operatorname{cosec}^2\theta \\ 1 & \cos^2\theta & \cot^2\theta\end{vmatrix}$$

Match the functions on the left with their range on the right.

Column I	**Column II**
(P) $p(\theta)$	(1) [0, 1]
(Q) $q(\theta)$	(2) $\left[0, 2\sqrt{2}\right]$
(R) $r(\theta)$	(3) [–2, 2]
(S) $s(\theta)$	(4) $\left[-\sqrt{5}-2, \sqrt{5}-2\right]$

	P	**Q**	**R**	**S**
A)	2	4	1	3
B)	4	3	2	1
C)	2	4	3	1
D)	3	4	2	1