

Q1. JEE Main 2026 (21 January Shift 2)

If the system of equations

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

$$2x + \alpha y - z = -3$$

$$x + 2y + z = 4$$

has no solution, then the value of α is equal to :

(1) 19

(2) 4

(3) 13

(4) 23

Q2. JEE Main 2026 (23 January Shift 1)

Among the statements :

I: If $\begin{vmatrix} 1 & \cos \alpha & \cos \beta \\ \cos \alpha & 1 & \cos \gamma \\ \cos \beta & \cos \gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos \alpha & \cos \beta \\ \cos \alpha & 0 & \cos \gamma \\ \cos \beta & \cos \gamma & 0 \end{vmatrix}$, then $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = \frac{3}{2}$, and

II : If $\begin{vmatrix} x^2 + x & x + 1 & x - 2 \\ 2x^2 + 3x - 1 & 3x & 3x - 3 \\ x^2 + 2x + 3 & 2x - 1 & 2x - 1 \end{vmatrix} = px + q$, then $p^2 = 196q^2$,

(1) only II is true

(2) both are false

(3) both are true

(4) only I is true

Q3. JEE Main 2026 (22 January Shift 2)

Let n be the number obtained on rolling a fair die. If the probability that the system

$$x - ny + z = 6$$

$$x + (n - 2)y + (n + 1)z = 8$$

$$(n - 1)y + z = 1$$
 has a unique solution is $\frac{k}{6}$,

then the sum of k and all possible values of n is :

(1) 20

(2) 24

(3) 21

(4) 22

Q4. JEE Main 2026 (23 January Shift 2)

The system of linear equations

$$x + y + z = 6$$

$$2x + 5y + az = 36$$

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

has

(1) unique solution for $a = 8$ and $b = 16$

(2) infinitely many solutions for $a = 8$ and $b = 16$

(3) unique solution for $a = 8$ and $b = 14$

(4) infinitely many solutions for $a = 8$ and $b = 14$

ANSWERS AND SOLUTIONS

1. (1)

2. (2)

3. (4)

4. (4)

1. (1) For no solution $\Delta = 0$

$$\begin{vmatrix} 3 & 1 & 4 \\ 2 & \alpha & -1 \\ 1 & 2 & 1 \end{vmatrix} = 0$$

$$\Rightarrow 3(\alpha + 2) + 1(-1 - 2) + 4(4 - \alpha) = 0$$

$$\Rightarrow 19 - \alpha = 0 \Rightarrow \boxed{\alpha = 19}$$

& for $\alpha = 19$

$$\Delta_x = \begin{vmatrix} 3 & 1 & 4 \\ -3 & 19 & -1 \\ 4 & 2 & 1 \end{vmatrix} = 3(21) + 1(-1) + 4(-82)$$

$$\neq 0$$

$\therefore$ no solution for $\alpha = 19$

2.

(2) Statement I: Let $D_1 = \begin{vmatrix} 1 & \cos \alpha & \cos \beta \\ \cos \alpha & 1 & \cos \gamma \\ \cos \beta & \cos \gamma & 1 \end{vmatrix} = 1 - \cos^2 \alpha - \cos^2 \beta - \cos^2 \gamma + 2 \cos \alpha \cos \beta \cos \gamma$.

$$D_2 = \begin{vmatrix} 0 & \cos \alpha & \cos \beta \\ \cos \alpha & 0 & \cos \gamma \\ \cos \beta & \cos \gamma & 0 \end{vmatrix} = 2 \cos \alpha \cos \beta \cos \gamma$$

$$D_1 = D_2 \Rightarrow 1 - \cos^2 \alpha - \cos^2 \beta - \cos^2 \gamma = 0 \Rightarrow \cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1 \neq \frac{3}{2}. \text{ Statement I is false.}$$

Statement II: Evaluate by substituting $x = 0$: determinant $= -12$, so $q = -12$.

At $x = 1$: determinant $= 12$, so $p + q = 12 \Rightarrow p = 24$.

$p^2 = 576$ and $196q^2 = 196 \times 144 = 28224$. Since $p^2 \neq 196q^2$, Statement II is false.

Both statements are false.

3. (4) The coefficient matrix has determinant $\det(A) = -(n-1)(n-2)$.

The system has a unique solution when $\det(A) \neq 0$, which requires $n \neq 1$ and $n \neq 2$.

For a fair die, $n \in \{1, 2, 3, 4, 5, 6\}$, so the unique solution occurs for $n \in \{3, 4, 5, 6\}$.

The probability is $\frac{4}{6} = \frac{2}{3}$, giving $k = 4$.

The sum of k and all possible values of n where unique solution exists is $4 + (3 + 4 + 5 + 6) = 22$.

4. (4) Coefficient matrix determinant: $\Delta = 1(15 - 2a) - 1(6 - a) + 1(4 - 5) = 8 - a$.

For $a = 8$, $\Delta = 0$, so unique solution is not possible.

With $a = 8$: $R_2 - 2R_1$ gives $3y + 6z = 24 \Rightarrow y + 2z = 8$.

$R_3 - R_1$ gives $y + 2z = b - 6$.

For consistency: $b - 6 = 8 \Rightarrow b = 14$.

When $a = 8, b = 14$: the system has infinitely many solutions.