3. MATRICES

1. (D) skew symmetric matrix

2. (C) 0

3. (D) $\begin{bmatrix} -5 & 10 \\ 0 & -25 \end{bmatrix}$

4. (A) x = 3, y = 5

5. (C) 1

6. (D) Assertion (A) is false, but Reason (R) is true.

7. (B) –5I

8. ?????????

9. (C) x = y

10. (A) $A^2 = I$

11. (B) $A^2 + B^2$

12. (B) $\begin{bmatrix} 4 & 3 \\ -3 & 0 \\ -1 & -2 \end{bmatrix}$

13. (A) is true but (R) is false.

14. (D) 2B

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15. Solution

Sol.

Given $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}, A^2 = \begin{bmatrix} 1 & 0 \\ -8 & 49 \end{bmatrix}$ $\left(\frac{1}{2}\right)$

$A^2 - 8A + kI = 0$ gives

$\begin{bmatrix} 1 & 0 \\ -8 & 49 \end{bmatrix} - 8\begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix} + k\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ $\left(\frac{1}{2}\right)$

$\Rightarrow \begin{bmatrix} 1 - 8 + k & 0 - 0 + 0 \\ -8 + 8 + 0 & 49 - 56 + k \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ $\left(\frac{1}{2}\right)$

$\Rightarrow k = 7$ $\left(\frac{1}{2}\right)$

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16. Solution

Sol.

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

Obtaining at least 4 correct entries **1**

$= \begin{bmatrix} 5 & -6 & -9 \\ -7 & -6 & -15 \\ -4 & 0 & 3 \end{bmatrix}$ **1**

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17. Solution

Sol.

Here, $x - y = -1, 2x - y = 0, 2x + z = 5, 3z + w = 13$ **(1)**

Solving these equations, we get

$x = 1, y = 2, z = 3, w = 4$ **(1)**

18. Solution

Ans.

Let $A = \begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} \Rightarrow A' = \begin{bmatrix} 7 & -1 & -1 \\ -3 & 1 & 0 \\ -3 & 0 & 1 \end{bmatrix}$	½
$P = \frac{A+A'}{2} = \begin{bmatrix} 7 & -2 & -2 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$ and $Q = \frac{A-A'}{2} = \begin{bmatrix} 0 & -1 & -1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$	½+½
So, $P' = P \Longrightarrow$ symmetric, $Q' = -Q \Longrightarrow$ skew symmetric	
$A = \frac{A+A'}{2} + \frac{A-A'}{2} = \begin{bmatrix} 7 & -2 & -2 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & -1 & -1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$	½

19. Solution

$\Rightarrow \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$	
$\Rightarrow \begin{bmatrix} \alpha^2 & 0 \\ \alpha+1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$	**1**
$\Rightarrow \alpha^2 = 1$ **and** $\alpha + 1 = 5$.	**½**
Hence, no real value of α exists.	**½**

20. Solution

$A^2 = A.A = \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} = \begin{bmatrix} 8 & -8 \\ -8 & 8 \end{bmatrix}$	1 Mark
$A^2 = pA \Rightarrow \begin{bmatrix} 8 & -8 \\ -8 & 8 \end{bmatrix} = p\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$	
$\Rightarrow \begin{bmatrix} 8 & -8 \\ -8 & 8 \end{bmatrix} = \begin{bmatrix} 2p & -2p \\ -2p & 2p \end{bmatrix} \Rightarrow p = 4$	1 Mark

21. Solution

$\begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix} = -\begin{bmatrix} 0 & 2 & c \\ a & b & 1 \\ 3 & -1 & 0 \end{bmatrix}$	½ Mark
Comparing a = -2 ; b = -b $\Longrightarrow 2b = 0 \Longrightarrow b = 0$ *and* $c = -3$	1½ Mark
Hence a+b+c = -2+0-3 = -5.	½ Mark

22. Solution

$a - 8 = 1 \Rightarrow a = 9$ $3b = -2 \Rightarrow b = -\frac{2}{3}$ $-c + 2 = -28 \Rightarrow c = 30$	1
$\Rightarrow 2a + 3b - c = -14$	1

23. Solution

Daily diet of team A = $\begin{bmatrix} 2 & 3 & 1 \end{bmatrix} \begin{bmatrix} 2500 & 65 \\ 1900 & 50 \\ 2000 & 54 \end{bmatrix} = \begin{bmatrix} 12700 \\ 334 \end{bmatrix}$ Team A consumes 12700 calories and 334 g vitamin	1.5
Daily diet of team B = $\begin{bmatrix} 1 & 2 & 2 \end{bmatrix} \begin{bmatrix} 2500 & 65 \\ 1900 & 50 \\ 2000 & 54 \end{bmatrix} = \begin{bmatrix} 10300 \\ 273 \end{bmatrix}$ Team B consumes 10300 calories and 273 g vitamin	1.5