MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

MATRICES

Solved Examples

1. Construct $A_{3\times 2}$ matrix whose elements are given by $a_{ij} = (i + 2j)$.

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2. Construct $A_{2\times 3}$ matrix whose elements are given by $a_{ij} = \frac{1}{2}|5i - 3j|$.

A. $A = \begin{bmatrix} 1 & \frac{1}{2} & 2 \\ \frac{7}{2} & 2 & \frac{1}{2} \end{bmatrix}$.

B. $A = \begin{bmatrix} 1 & \frac{1}{2} & 2 \\ 7 & 2 & \frac{1}{2} \end{bmatrix}$.

C. $A = \begin{bmatrix} 1 & \frac{1}{2} & 2 \\ \frac{7}{2} & 2 & 1 \end{bmatrix}$.

D. None of these

Answer: A

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3. If a matrix has 12 elements, what are the possible orders it can have?

A. 6

B. 4

C. 2

D. 8

Answer: A

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4. Find x, y, z when $\begin{bmatrix} 5 & 3 \\ x & 7 \end{bmatrix} = \begin{bmatrix} y & z \\ 1 & 7 \end{bmatrix}$.

A. $x = -1, y = 5$ and $z = -3$

B. $x = 1, y = -5$ and $z = -3$

C. $x = 1, y = 5$ and $z = -3$

D. $x = 1, y = 5$ and $z = 3$

Answer: D

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5. Find x, y, z when $\begin{bmatrix} x - y & 2x + z \\ 2x - y & 3z + w \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$.

A. $x = 1, y = 2, z = 3$

B. x=1,y=2,z= - 3

C. x=-1,y=-2,z=-3

D. None of these

Answer: A

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6. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \neq \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$. Why ?

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7. If $A = \begin{bmatrix} 2 & 1 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 4 & 5 \\ 1 & 2 & 3 \end{bmatrix}$ then A and B are matrices of order 2×2 and 2×3 respectively.

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8. Let $A = \begin{bmatrix} 5 & 0 & -2 \\ 3 & 2 & -7 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -3 & -6 \\ -1 & 0 & 4 \end{bmatrix}$.

Clearly, each one of A and B is a 2×3 matrix. Find A + B

A. $\begin{bmatrix} -9 & -3 & -8 \\ -2 & -2 & -3 \end{bmatrix}$

B. $\begin{bmatrix} -9 & -3 & -8 \\ 2 & 2 & -3 \end{bmatrix}$

C. $\begin{bmatrix} 9 & -3 & -8 \\ 2 & 2 & -3 \end{bmatrix}$

D. $\begin{bmatrix} -9 & -3 & -8 \\ 2 & -2 & -3 \end{bmatrix}$

Answer: C

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9. Let $A = \begin{bmatrix} 3 & 5 & 4 \\ 1 & 2 & -3 \end{bmatrix}$ and $O = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, then verify that $A + O = O + A = A.$

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10. If $A = \begin{bmatrix} 3 & -2 & 0 \\ -5 & 7 & \sqrt{2} \end{bmatrix}$, find (-A) and verify that $A + (-A) = (-A) + A = 0.$

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11. Let $A = \begin{bmatrix} 2 & 3 & 5 \\ -1 & 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -2 & 3 \\ 2 & 6 & -1 \end{bmatrix}$.

Verify that $A + B = B + A$.

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12. Let $A = \begin{bmatrix} 1 & -2 \\ 5 & 4 \\ 3 & 0 \end{bmatrix}, B = \begin{bmatrix} 3 & 1 \\ 0 & 2 \\ -3 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 3 \\ -2 & 2 \\ 1 & 6 \end{bmatrix}$.

Verify that $(A + B) + C = A + (B + C)$.

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13. Find the additive inverse of the matrix $A = \begin{bmatrix} 2 & -5 & 0 \\ 4 & 3 & -1 \end{bmatrix}$.

A. $\begin{bmatrix} -2 & 5 & 0 \\ -4 & -3 & 1 \end{bmatrix}$

B. $\begin{bmatrix} -2 & -5 & 0 \\ -4 & -3 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 5 & 0 \\ -4 & -3 & 1 \end{bmatrix}$

D. $\begin{bmatrix} -2 & 5 & 0 \\ -4 & -3 & -1 \end{bmatrix}$

Answer: A

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14. If $A = \begin{bmatrix} 2 & -3 & 1 \\ 0 & 7 & -9 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & -3 \\ 4 & 8 & -4 \end{bmatrix}$, find $(A - B)$

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15. If $\begin{bmatrix} a+4 & 3b \\ 8 & -6 \end{bmatrix} = \begin{bmatrix} 2a+2 & b+2 \\ 8 & a-8b \end{bmatrix}$, then find the value of $(a - 2b)$.

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16. If $[9 - 14 - 213] = A + [12 - 1049]$, then find the matrix A.

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17. If $\begin{bmatrix} 5 & 4 & -2 \\ 6 & -1 & 7 \end{bmatrix}$, find (i) 3A (ii) $\frac{1}{2}A$ (iii) $-2A$.

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18. If $A = \begin{bmatrix} 3 & 5 \\ 7 & -9 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & -4 \\ 2 & 3 \end{bmatrix}$, find $(4A - 3B)$.

A. $(4A - 3B) = \begin{bmatrix} -6 & 32 \\ 22 & -45 \end{bmatrix}$.

B. $(4A - 3B) = \begin{bmatrix} 6 & 32 \\ 22 & 45 \end{bmatrix}$.

C. $(4A - 3B) = \begin{bmatrix} 6 & -32 \\ -22 & 45 \end{bmatrix}$.

D. None of these

Answer: A

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19. Let $A = \text{diag}\ [3, -5, 7]$ and $B = \text{diag}\ [-1, 2, 4]$. ltbr. Find (i) (A+B) (ii) (A-B) (iii) -5A (iv) (2A+3B).`

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20. Simplify:

$$\cos\theta\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}+\sin\theta\begin{bmatrix}\sin\theta & -\cos\theta\\ \cos\theta & \sin\theta\end{bmatrix}$$

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21. If $2\begin{bmatrix}3 & 4\\ 5 & x\end{bmatrix}+\begin{bmatrix}1 & y\\ 0 & 1\end{bmatrix}=\begin{bmatrix}7 & 0\\ 10 & 5\end{bmatrix}$, find (x-y).

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22. Find a martix X, if $X+\begin{bmatrix}4 & 6\\ -3 & 7\end{bmatrix}=\begin{bmatrix}3 & -6\\ 5 & -8\end{bmatrix}$.

A. $X=\begin{bmatrix}-1 & -12\\ -8 & -15\end{bmatrix}$.

B. $X=\begin{bmatrix}-1 & -12\\ 8 & -15\end{bmatrix}$.

C. $X=\begin{bmatrix}-1 & 12\\ 8 & 15\end{bmatrix}$.

D. $X=\begin{bmatrix}1 & -12\\ 8 & -15\end{bmatrix}$.

Answer: B

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23. Find a matrix X such that 2A + B + X =0

where $A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -2 \\ 1 & 5 \end{bmatrix}$

A. $X = \begin{bmatrix} 1 & 2 \\ 7 & -13 \end{bmatrix}$

B. $X = \begin{bmatrix} -1 & -2 \\ -7 & -13 \end{bmatrix}$

C. $X = \begin{bmatrix} -1 & -2 \\ 7 & -13 \end{bmatrix}$

D. $X = \begin{bmatrix} 1 & -2 \\ -7 & -13 \end{bmatrix}$

Answer: B

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24. Find X and Y, if $X + Y = \begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and $X - Y = \begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$.

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25. If $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{bmatrix}$ and $B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \\ b_{31} & b_{32} \end{bmatrix}$ then show that AB and BA both exist. Find AB and BA.

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26. If $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \\ 1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 3 \\ 2 & 1 \end{bmatrix}$, find AB. Does BA exist?

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27. Let $A = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \\ -2 & 1 \end{bmatrix}$. Find AB and BA, and show that $AB \neq BA$.

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28. If $[2x4]\begin{bmatrix} x \\ -8 \end{bmatrix} = O$, find the positive value of x.

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29. If $A = \begin{bmatrix} 5 & 4 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 5 & 1 \\ 6 & 8 & 4 \end{bmatrix}$, find AB and BA whichever exists.

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30. If $A = \begin{bmatrix} 2 & -1 & 3 \\ -4 & 5 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 4 & -2 \\ 1 & 5 \end{bmatrix}$ then find AB and BA.

Show that $AB \neq BA$.

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31. If $A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 2 & 0 \\ -2 & 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 3 & 1 \\ 0 & 2 \\ -2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 1 & -3 \\ 3 & 0 & -1 \end{bmatrix}$ then verify that $(AB)C = A(BC)$.

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32. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 0 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 & 5 \\ 0 & 7 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 8 & 1 & -6 \\ 2 & -5 & 0 \end{bmatrix}$, verify that $A(B + C) = (AB + AC)$.

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33. Give an example of two non-zero 2×2 matrices A and B such that $AB = O$.

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34. If $\theta - \phi = \frac{\pi}{2}$, then show that $\begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix} \cdot \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix} = 0$

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35. If $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$. Find the value of $A^2 - 5A - 14\mathrm{I}$

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36. Find the value of k so that $A^2 = 8A + kI$ where $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$.

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37. If $f(x) = x^2 - 5x + 7$ and $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$. Find $f(A)$

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38. Find the matrix A such that $\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} . A = \begin{bmatrix} -1 & -8 & -10 \\ 1 & -2 & -5 \\ 9 & 22 & 15 \end{bmatrix}$.

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39. Find the value of x, if

$$[1x1]\begin{bmatrix}1 & 3 & 2\\ 2 & 5 & 1\\ 15 & 3 & 2\end{bmatrix}\begin{bmatrix}1\\ 2\\ x\end{bmatrix} = O.$$

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40. Find the value of x given that $\begin{bmatrix}x & y\\ 3y & x\end{bmatrix}\begin{bmatrix}1\\ 2\end{bmatrix} = \begin{bmatrix}3\\ 5\end{bmatrix}$.

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41. Let $A = \begin{bmatrix}0 & -\tan(\alpha/2)\\ \tan(\alpha/2) & 0\end{bmatrix}$ and I be the identity matrix of order 2. Show that $I + A = (I - A)\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$.

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42. If $A = \begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$ then show that $A^n = \begin{bmatrix}\cos n\theta & -\sin n\theta\\ \sin n\theta & \cos n\theta\end{bmatrix}$

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43. If A=$\begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ then by the method of mathematical induction prove that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$

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44. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, then prove that $A^n = \begin{bmatrix} 3^{n-1} & 3^{n-1} & 3^{n-1} \\ 3^{n-1} & 3^{n-1} & 3^{n-1} \\ 3^{n-1} & 3^{n-1} & 3^{n-1} \end{bmatrix}$ for every positive integer n.

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45. Let $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ show that $(aI + bA)^n = a^n I + na^{n-1}bA$, where I is the identitymatrix of order 2 and $n \in N$.

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46. If $A = diag[a, b, c]$ then show that $A^n = diag[a^n, b^n, c^n]$ for all $n \in N$.

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47. If A is any $m \times n$ such that AB and BA are both defined show that B is an $n \times m$ matrix.

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48. $A,\ B$ are two matrices such that AB and $A + B$ are both defined; show that $A,\ B$ are square matrices of the same order.

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49. The cooperative stores of a particular school has 10 dozen physics books, 8 dozen chemistry books and 5 dozen mathematics books. Their

selling prices are Rs. 8.30, Rs. 3.45 and Rs. 4.50 each respectively. Find the total amount the store will receive from selling all the items.

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50. Let $A = \begin{bmatrix} 2 & 3 & -1 \\ 0 & -5 & 7 \end{bmatrix}$. Verify that $(A')' = A$.

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51. If $A = \begin{bmatrix} 2 & 3 & -5 \\ 0 & -1 & 4 \end{bmatrix}$, verify that $(3A)' = 3A'$.

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52. Let $A = \begin{bmatrix} 3 & 4 \\ -2 & 0 \\ 7 & -5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -3 \\ 5 & 6 \\ -1 & 8 \end{bmatrix}$. Verify that $(A + B)' = A' + B'$.

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53. If $A = \begin{bmatrix} -3 \\ 5 \\ 2 \end{bmatrix}$ and $B = [1 \quad 6 \quad -4]$ then verify that $(AB)' = B'A'$.

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54. Express the matrix $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix.

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55. Express the following matrix as a sum of symmetric and skew-symmetric matrices. $\begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$

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56. If A and B are symmetric matrices of the same order, then show that AB is symmetric if and only if A and B commute, that is $AB = BA$.

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57. If A and B are symmetric matrices, prove that AB BA is a skew symmetric matrix.

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58. If A is symmetric, then

$(B'AB)$

is

A. symmetric

B. skew symmetric

C. neither Symmetric nor skew symmetric

D. None of these

Answer: A

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59. By using elementary row operations, find the inverse of the matrix $A = \begin{bmatrix} 1 & -2 \\ 2 & 6 \end{bmatrix}$.

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60. By using elementary row operations, find the inverse of the matrix $A = \begin{bmatrix} 3 & -1 \\ -4 & 2 \end{bmatrix}$.

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61. If $A = \begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}$, show that A^{-1} does not exist.

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62. By using elementary row operations, find the inverese of the martrix

$$A = \begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{bmatrix}.$$

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63. By using elementary row operations, find the inverse of the matrix

$$A = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & -1 \\ 3 & -5 & 0 \end{bmatrix}.$$

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64. Using elementary transformations, find the inverse of the matrix :

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

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65. if $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -1 \\ -1 & -2 & 2 \end{bmatrix}$ then show that A^{-1} Does not exist.

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Exercise 5 A

1. If $A = \begin{bmatrix} 5 & -2 & 6 & 1 \\ 7 & 0 & 8 & -3 \\ \sqrt{2} & \frac{3}{5} & 4 & 3 \end{bmatrix}$ then write

(i) the number of rows in A,

(ii) the number of columns in A,

(iii) the order of the matrix A,

(iv) the number of all entries in A,

(v) the elements $a_{23}, a_{31}, a_{14}, a_{33}, a_{22}$ of A.

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2. Write the order of each of the following matrices:

(i) $A = \begin{bmatrix} 3 & 5 & 4 & -2 \\ 0 & \sqrt{3} & -1 & \frac{4}{9} \end{bmatrix}$

(ii) $B = \begin{bmatrix} 6 & -5 \\ \frac{1}{2} & \frac{3}{4} \\ -2 & -1 \end{bmatrix}$

(iii) $C = \begin{bmatrix} 7 & -\sqrt{2} & 5 & 0 \end{bmatrix}$

(iv) $D = \begin{bmatrix} 8 & -3 \end{bmatrix}$

(v) $E = \begin{bmatrix} -2 \\ 3 \\ 0 \end{bmatrix}$

(vi) $F = [6]$

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3. If a matrix has 18 elements, what are the possible orders it can have?

What, if it has 5 elements?

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4. Find all possible orders of matrices having 7 elements.

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5. Construct a 3×2 matrix whose elements are given by $a_{ij} = (2i - j)$.

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6. Construct a 4×3 matrix whose elements are $a_{ij} = \frac{i}{j}$.

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7. Construct a 2×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = \frac{(i + 2j)^2}{2}$.

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8. Construct a 2×3 matrix whose elements are $a_{ij} = \frac{(i - 2j)^2}{2}$.

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9. Construct a 3×4matrix, whose elements are given by:(i) $a_{ij} = \frac{1}{2}|-3i+j|$ (ii) $a_{ij} = 2i - j$

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Exercise 5 B

1. If $A = \begin{bmatrix} 2 & -3 & 5 \\ -1 & 0 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 & -2 \\ 4 & -3 & 1 \end{bmatrix}$, verify that $(A+B) = (B+A)$.

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2. If $A = \begin{bmatrix} 3 & 5 \\ -2 & 0 \\ 6 & -1 \end{bmatrix}, B = \begin{bmatrix} -1 & -3 \\ 4 & 2 \\ -2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 2 \\ 3 & -4 \\ 1 & 6 \end{bmatrix}$,

Verify that $(A+B)+C = A+(B+C)$.

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3. If $A = \begin{bmatrix} 3 & 1 & 2 \\ 1 & 2 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 0 & 4 \\ 5 & -3 & 2 \end{bmatrix}$, find $(2A - B)$.

A. $\begin{bmatrix} 8 & 2 & 0 \\ 3 & 7 & -8 \end{bmatrix}$

B. $\begin{bmatrix} 8 & 2 & 0 \\ -3 & 7 & -8 \end{bmatrix}$

C. $\begin{bmatrix} 8 & 2 & 0 \\ -3 & 7 & 8 \end{bmatrix}$

D. $\begin{bmatrix} 8 & 2 & 0 \\ 3 & 7 & 8 \end{bmatrix}$

Answer: B

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4. Let $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$. Find:

(i) $A + 2B$

(ii) $B - 4C$

(iii) $A - 2B + 3C$

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5. Let

$$A = \begin{bmatrix} 0 & 1 & -2 \\ 5 & -1 & -4 \end{bmatrix}, B = \begin{bmatrix} 1 & -3 & -1 \\ 0 & -2 & 5 \end{bmatrix} \text{ and } C = \begin{bmatrix} 2 & -5 & 1 \\ -4 & 0 & 6 \end{bmatrix}.$$

Compute $5A - 3B + 4C$.

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6. If $5A = \begin{bmatrix} 5 & 10 & -15 \\ 2 & 3 & 4 \\ 1 & 0 & -5 \end{bmatrix}$, find A.

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7. Find matrices A and B, if

$$A + B = \begin{bmatrix} 1 & 0 & 2 \\ 5 & 4 & -6 \\ 7 & 3 & 8 \end{bmatrix} \text{ and } A - B = \begin{bmatrix} -5 & -4 & 8 \\ 11 & 2 & 0 \\ -1 & 7 & 4 \end{bmatrix}.$$

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8. Find matrices A and B, if

$$2A - B = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix} \text{ and } 2B + A = \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix}.$$

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9. Find matrix X, if $\begin{bmatrix} 3 & 5 & -9 \\ -1 & 4 & -7 \end{bmatrix} + X = \begin{bmatrix} 6 & 2 & 3 \\ 4 & 8 & 6 \end{bmatrix}$

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10. If $A = \begin{bmatrix} -2 & 3 \\ 4 & 5 \\ 1 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 \\ -7 & 3 \\ 6 & 4 \end{bmatrix}$, find a matrix C such that $A + B - C = O$.

A. $\begin{bmatrix} 3 & 5 \\ 3 & 8 \\ 7 & -2 \end{bmatrix}$

B. $\begin{bmatrix} -3 & 5 \\ -3 & 8 \\ 7 & -2 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 5 \\ -3 & 8 \\ 7 & -2 \end{bmatrix}$

D. $\begin{bmatrix} 3 & 5 \\ -3 & 8 \\ -7 & -2 \end{bmatrix}$

Answer: C

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11. Find the matrix X such that $2A - B + X = O$,

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

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12. If $A = \begin{bmatrix} 1 & -3 & 2 \\ 2 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$, find a matrix C such that

$(A + B + C)$ is a zero matrix.

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13. If

$A = \text{diag } [2, -5, 9], B = \text{diag } [-3, 7, 14]$ and $C = \text{diag } [4, -6, 3]$

, find:

(i) $A + 2B1$

(ii) $B + C - A$

(iii) $2A + B - 5C.$

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14. Find the value of x and y, when

(i) $\begin{bmatrix} x+y \\ x-y \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \end{bmatrix}$

(ii) $\begin{bmatrix} 2x+5 & 7 \\ 0 & 3y-7 \end{bmatrix} = \begin{bmatrix} x-3 & 7 \\ 0 & -5 \end{bmatrix}$

(iii) $2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$

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15. Find X and Y,if

$$2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$$

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16. If $\begin{bmatrix}x-y & 2y\\ 2y+z & x+y\end{bmatrix}=\begin{bmatrix}1 & 4\\ 9 & 5\end{bmatrix}$ then write the value of $(x+y+z)$.

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Exercise 5 C

1. Compute AB and BA, whichever exists when

(i) $A=\begin{bmatrix}2 & -1\\ 3 & 0\\ -1 & 4\end{bmatrix}$ and $B=\begin{bmatrix}-2 & 3\\ 0 & 4\end{bmatrix}$

(ii) $A=\begin{bmatrix}-1 & 1\\ -2 & 2\\ -3 & 3\end{bmatrix}$ and $B=\begin{bmatrix}3 & -2 & 1\\ 0 & 1 & 2\\ -3 & 4 & -5\end{bmatrix}$

(iii) $A=\begin{bmatrix}0 & 1 & -5\\ 2 & 4 & 0\end{bmatrix}$ and $B=\begin{bmatrix}1 & 3\\ -1 & 0\\ 0 & 5\end{bmatrix}$

(iv) $A = [1 \quad 2 \quad 3 \quad 4]$ and $B = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$

(v) $A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 1 \end{bmatrix}$

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2. show that

$(i) \begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \neq \begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}$

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

$\neq \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 2 & 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

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3. Show that AB = BA in each of the following cases:

(i) $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ and $B = \begin{bmatrix} \cos\phi & -\sin\phi \\ \sin\phi & \cos\phi \end{bmatrix}$

(ii) $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 4 & 2 \\ 1 & 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 10 & -4 & -1 \\ -11 & 5 & 0 \\ 9 & -5 & 1 \end{bmatrix}$

(iii) $A = \begin{bmatrix} 1 & 3 & -1 \\ 2 & 2 & -1 \\ 3 & 0 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 3 & -1 \\ -1 & 2 & -1 \\ -6 & 9 & -4 \end{bmatrix}$

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4. If $A = [2 - 3 - 5 - 1451 - 3 - 4]$ and $B = [2 - 2 - 4 - 1341 - 2 - 3]$, show that $AB = A$ and $BA = B$.

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5. If $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ and $B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$, show that AB is a zero matrix.

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6. For the following matrices, verify that $A(BC) = (AB)C$:

(i) $A = \begin{bmatrix} 1 & 2 & 5 \\ 0 & 1 & 3 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 & 0 \\ 1 & 0 & 4 \\ 1 & -1 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 \\ 4 \\ 5 \end{bmatrix}$

(ii) $A = \begin{bmatrix} 2 & 3 & -1 \\ 3 & 0 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ and $C = [1 \; -2]$

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7. Verify that $A(B + C) = (AB + AC)$, when

(i) $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 2 & 0 \\ 1 & -3 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}$.

(ii) $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \\ 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 5 & -3 \\ 2 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix}$.

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8. If

$A = \begin{bmatrix} 1 & 0 & -2 \\ 3 & -1 & 0 \\ -2 & 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 0 & 5 & -4 \\ -2 & 1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$

verify that $A(B - C) = (AB - AC)$.

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9. If $A = \begin{bmatrix} ab & b^2 \\ -a^2 & -ab \end{bmatrix}$, show that $A^2 = O$.

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10. If $A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$, show that $A^2 = A$.

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11. (i) if $A = \begin{bmatrix} 4 & -1 & -4 \\ 3 & 0 & -4 \\ 3 & -1 & -3 \end{bmatrix}$, then show that $A^2 = I_3$.

(ii) if $A = \begin{bmatrix} p & 0 & 0 \\ 0 & p & 0 \\ 0 & 0 & p \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 & 3 \\ 4 & 2 & 6 \\ 5 & 3 & 7 \end{bmatrix}$, then prove that AB=PB.

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12. If $A = [2 - 132]$ and $B = [04 - 17]$, find $3A^2 - 2B + I$.

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13. If $A = \begin{bmatrix} 2 & -2 \\ -3 & 4 \end{bmatrix}$ then find $\left(-A^2 + 6A \right)$.

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14. If $A = [31 - 12]$, show that $A^2 - 5A + 7I = 0$

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15. Show that the matrix $A = [2312]$ satisfies the equation $A^3 - 4A^2 + A = O$.

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16. If A $A = [3 - 24 - 2]$and $I = [1001]$, find k so that $A^2 = kA - 2I$.

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17. If $A = \begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix}$, find f(A), where $f(x) = x^2 - 2x + 3$.

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18. If $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ and $f(x) = 2x^3 + 4x + 5$, find f(A).

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19. Find the values of x and y for which

$$\begin{bmatrix} 2 & -3 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}.$$

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20. Solve for x and y, when

$$\begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 11 \end{bmatrix}.$$

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21. If $A = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix}$, find x and y such that $A^2 + xI = yA$.

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22. Solve system of linear equations, using matrix method,

$$x + 2z = 7 \qquad 3x + 4y - 5z = 5$$

$$2x + 3z = 12$$

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23. Find the matrix A such that $\begin{bmatrix} 5 & -7 \\ -2 & 3 \end{bmatrix} A = \begin{bmatrix} -16 & -6 \\ 7 & 2 \end{bmatrix}$.

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24. Find the matrix A such that $A.\begin{bmatrix}2 & 3\\4 & 5\end{bmatrix}=\begin{bmatrix}0 & -4\\10 & 3\end{bmatrix}$.

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25. If $A=\begin{bmatrix}1 & -1\\2 & -1\end{bmatrix}, B=\begin{bmatrix}a & -1\\b & -1\end{bmatrix}$ and $(A+B)^2=\left(A^2+B^2\right)$ then find the values of a and b.

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26. If $F(x)=\begin{bmatrix}\cos x & -\sin x & 0\\six & \cos x & 0\\0 & 0 & 1\end{bmatrix}$, show that $F(x).F(y)=F(x+y)$.

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27. If $A=\begin{bmatrix}\cos\alpha & \sin\alpha\\-\sin\alpha & \cos\alpha\end{bmatrix}$, show that `A^(2)=[{:(cos2alpha,sin2alpha),(-sin2alpha,cos2alpha) :}].

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28. If $\begin{bmatrix}1 & x & 1\end{bmatrix}\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 3 & 2 & 5\end{bmatrix}\begin{bmatrix}1\\ -2\\ 3\end{bmatrix} = O,$ find x.

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29. If $\begin{bmatrix}x & 4 & 1\end{bmatrix}\begin{bmatrix}2 & -1 & 2\\ 1 & 0 & 2\\ 0 & 2 & -4\end{bmatrix}\begin{bmatrix}x\\ 4\\ 1\end{bmatrix} = 0$ then find x

A. $x = -2$ or $x = -1$

B. $x = 2$ or $x = -1$

C. $x = -2$ or $x = 1$

D. $x = 2$ or $x = 1$

Answer: A

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30. Find the values of a and b which

$$\begin{bmatrix} a & b \\ -a & 2b \end{bmatrix}\begin{bmatrix} 2 \\ -1 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \end{bmatrix}.$$

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31. If $A = \begin{bmatrix} 3 & 4 \\ -4 & -3 \end{bmatrix}$, find f(A), where $f(x) = x^2 - 5x + 7.$

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32. If $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, prove that $A = \begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$ for all $n \in N.$

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33. Give an example of two matrices A and B such that $A \neq O,\ B \neq O,\ AB = O$ and $BA \neq O$ (ii) $A \neq O,\ B \neq O,\ AB = BA = O\,.$

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34. Give an example of three matrices $A,\ B,\ C$ such that $AB = AC$ but $B \neq C$.

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35. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 4 \\ -1 & 7 \end{bmatrix}$, find $\left(3A^2 - 2B + I\right)$.

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36. If $[2357]\ [1 - 3 - 24] = [-46 - 9x]$, write the value of x

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Exercise 5 D

1. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 0 & 7 & -4 \end{bmatrix}$, verify that $(A')' = A$.

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2. If $A = \begin{bmatrix} 3 & 5 \\ -2 & 0 \\ 4 & -6 \end{bmatrix}$, verify that $2A' = (2A)'$.

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3. If $A = \begin{bmatrix} 3 & 2 & 1 \\ -5 & 0 & -6 \end{bmatrix}$ and B=$\begin{bmatrix} -4 & -5 & -2 \\ 3 & 1 & 8 \end{bmatrix}$ then verify that $(A + B)^T = A^T + B^T$

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4. If $P = \begin{bmatrix} 3 & 4 \\ 2 & -1 \\ 0 & 5 \end{bmatrix}$ and $Q = \begin{bmatrix} 7 & -5 \\ -4 & 0 \\ 2 & 6 \end{bmatrix}$, verify that $(P + Q)' = (P' + Q')$.

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5. if $A = \begin{bmatrix} 4 & 1 \\ 5 & 8 \end{bmatrix}$ show that $A + A'$ is symmetric

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6. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, show that $A - A^T$ is a skew symmetric matrix.

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7. Show that the matrix $A = \begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$ is skew-symmetric.

HINT: Show that $A' = -A$.

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8. Express the matrix $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix.

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9. Express the matrix $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix.

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10. Express the matrix $A = \begin{bmatrix} -1 & 5 & 1 \\ 2 & 3 & 4 \\ 7 & 0 & 9 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix.

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11. Expess the matrix A as the sum of a symmetric and a skew-symmetric matrix, where

$A = \begin{bmatrix} 3 & -1 & 0 \\ 2 & 0 & 3 \\ 1 & -1 & 2 \end{bmatrix}$.

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12. Let $A = [325413067]$ Express A as sum of two matrices such that one is symmetric and the other is skew symmetric.

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13. For each of the following pairs of matrices A and B, verify that $(AB)' = (B'A')$:

(i) $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 4 \\ 2 & 5 \end{bmatrix}$

(ii) $A = \begin{bmatrix} 3 & -1 \\ -2 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$

$A = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$ and $B = [-2 \quad -1 \quad -4]$

(iv) $A = \begin{bmatrix} -1 & 2 & -3 \\ 4 & -5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -4 \\ 2 & 1 \\ -1 & 0 \end{bmatrix}$

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14. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, show that $A'A = I$.

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15. If matrix $A = [1 \ \ 2 \ \ 3]$, write $\forall^T$.

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Exercise 5 E

1. Find the adjoint of matrix $\begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$

A. $\begin{bmatrix} -7 & -2 \\ -3 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 7 & -2 \\ 3 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 7 & -2 \\ -3 & -1 \end{bmatrix}$

D. $\begin{bmatrix} 7 & -2 \\ -3 & 1 \end{bmatrix}$

Answer: D

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2. Find the inverse of matrix $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$

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3. Find the inverse of matrix $\begin{bmatrix} 2 & 5 \\ -3 & 1 \end{bmatrix}$

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4. Find the determinant of a matrix $\begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$

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5. Find the inverse of matrix $\begin{bmatrix} 4 & 0 \\ 2 & 5 \end{bmatrix}$

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6. Find the inverse of matrix $\begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$

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7. Find the inverse of matrix $\begin{bmatrix} 1 & 1 & -2 \\ 1 & 0 & 3 \\ 5 & 0 & 1 \end{bmatrix}$

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8. Find the inverse of matrix $\begin{bmatrix} 1 & -3 & 1 \\ 8 & 2 & 0 \\ -3 & 2 & 1 \end{bmatrix}$

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9. Find the inverse of matrix $\begin{bmatrix} 3 & 0 & 2 \\ 1 & 5 & 9 \\ 6 & 4 & 7 \end{bmatrix}$

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10. Find the inverse of $\begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}$

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11. Find the inverse of the matrix $\begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & -1 \\ 3 & -5 & 0 \end{bmatrix}$

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12. Using elementary transformations, find the inverse of the matrix $(13 - 2 - 30 - 1210)$

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13. Using elementary row transformations, find the inverse of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{pmatrix}$

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14. Using elementary row transformations find the inverse of the matrix

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

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15. Find the inverse of the matrix $\begin{bmatrix} -1 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$

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Exercise 5 F

1. Construct a 2×3 matrix whose elements are given by

$a_{ij} = \frac{1}{2}(i - 2j)^2$.

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2. Construct a 2×3 matrix whose elements are given by

$a_{ij} = \frac{1}{2}|-3i + j|$.

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3. If $\begin{bmatrix} x+2y & -y \\ 3x & 4 \end{bmatrix} = \begin{bmatrix} -4 & 3 \\ 6 & 4 \end{bmatrix}$, find the values of x and y.

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4. Find the values of x and y, if

$2\begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$.

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5. If $x.\begin{bmatrix} 2 \\ 3 \end{bmatrix} + y.\begin{bmatrix} -1 \\ 1 \end{bmatrix} = \begin{bmatrix} 10 \\ 5 \end{bmatrix}$, find the values of x and y.

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6. If $\begin{bmatrix} x & 3x-y \\ 2x+z & 3y-w \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 4 & 7 \end{bmatrix}$, find the values of w.

A. 3

B. 7

C. -2

D. 14

Answer: D

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7. If $\begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix} = 3\begin{bmatrix} x & y \\ z & w \end{bmatrix}$, find the values of x, y, z, w.

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8. If

$A = \text{diag}\ (3 \quad -2 \quad 5)$ and $B = \text{diag}\ (1 \quad 3 \quad -4)$, find $(A + B$

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9. Show that $\cos\theta.\begin{bmatrix}\cos\theta & \sin\theta \\ -\sin\theta & \cos\theta\end{bmatrix} + \sin\theta.\begin{bmatrix}\sin\theta & -\cos\theta \\ \cos\theta & \sin\theta\end{bmatrix} = I.$

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10. If $A = \begin{bmatrix}1 & -5 \\ -3 & 2 \\ 4 & -2\end{bmatrix}$ and $B = \begin{bmatrix}3 & 1 \\ 2 & -1 \\ -2 & 3\end{bmatrix}$, find the matrix C such that $A + B + C$ is a zero matrix.

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11. If $A = \begin{bmatrix}\cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha\end{bmatrix}$, then find the least value of α for which $A + A' = I.$

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12. Find the values of x and y for which

$$\begin{bmatrix} 2 & -3 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}.$$

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13. Find the values of x and y for which

$$\begin{bmatrix} x & y \\ 3y & x \end{bmatrix} \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}.$$

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14. If $A = \begin{bmatrix} 4 & 5 \\ 1 & 8 \end{bmatrix}$, show that $(A + A')$ is symmetric.

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15. If $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, show that $(A - A')$ is skew-symmetric.

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16. If $A = \begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 \\ 0 & 3 \end{bmatrix}$, find a matrix X such that $A + 2B + X = O$.

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17. If $A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 1 \\ 3 & 2 \end{bmatrix}$, find a matrix X such that $3A - 2B + X = O$.

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18. If (i) $A = [\cos\alpha \sin\alpha - \sin\alpha \cos\alpha]$, then verify that $A'A = I$.

(ii) $A = [\sin\alpha \cos\alpha - \cos\alpha \sin\alpha]$, then verify that $A'A = I$.

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19. If A and B are two symmetric matrix of same order, then show that $(AB - BA)$ is skew symmetric matrix.

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20. If $f(x) = x^2 - 4x + 1$ then find $f(A)$ when $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$

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21. A matrix which is both symmetric as well as skew-symmetric is a

A. Identity Matrix

B. Null matrix

C. Singleton Matrix

D. Singular Matrix

Answer: B

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