EXERCISE 3.1 - Question No. 1

In the matrix $A = \begin{bmatrix} 2 & 5 & 19 & 7 \\ 35 & -2 & \frac{5}{2} & 12 \\ \sqrt{3} & 1 & -5 & 17 \end{bmatrix}$, write: (i) The order of the matrix, (ii) The number of elements, (iii) Write the elements

$a_{13}, a_{21}, a_{33}, a_{24}, a_{23}$.

EXERCISE 3.1 - Question No. 2

If a matrix has 24 elements, what are the possible orders it can have? What, if it has 13 elements?

EXERCISE 3.1 - Question No. 3

If a matrix has 18 elements, what are the possible orders it can have? What, if it has 5 elements?

EXERCISE 3.1 - Question No. 4

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

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EXERCISE 3.1 - Question No. 5

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

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EXERCISE 3.1 - Question No. 6

Find the values of x, y and z from the following equations: (i)

$[43x5] = [yz15]$ (ii) $[x + y35 + zxy] = [6258]$ (iii)

$[x + y + zx + zy + z] = [957]$

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EXERCISE 3.1 - Question No. 7

Find the value of a, b, c and d from the equation:

$[a - b2a + c2a - b3c + d] = [-15013]$

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EXERCISE 3.1 - Question No. 8

$A = \left([a_{ij}]\right)_{m \times n}$ is a square matrix, if (a) $m < n$ (b) $m > n$ (c)

$m = n$ (d) None of these

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EXERCISE 3.1 - Question No. 9

Which of the given values of x and y make the following pair of

matrices equal $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}, \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$ (a)

$x = \frac{-1}{3}, y = 7$ (b) Not possible to find (c) $y = 7, x = \frac{-2}{3}$ (d)

$x = \frac{-1}{3}, y = \frac{-2}{3}$

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EXERCISE 3.1 - Question No. 10

The number of all possible matrices of order 3×3 with each entry 0 or 1 is: (a) 27 (b) 18 (c) 81 (d) 512

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EXERCISE 3.2 - Question No. 1

Let $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}, C = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$ Find each of the following: (i) $A + B$ (ii) $A - B$ (iii) $3A - C$ (iv) AB (v) BA

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EXERCISE 3.2 - Question No. 2

Compute the following: (i) $[ab - ba] + [a\mathbf{a}]$ (ii)

$\left[a^2 + b^2b^2 + c^2a^2 + c^2a^2 + b^2\right] + [2ab2bc - 2ac - 2ab]$ (iii)

$[-14 - 68516285] + [1276805324]$ (iv)

$\left[\cos^2 x \sin^2 x \sin^2 x \cos^2 x\right] + \left[\sin^2 x \cos^2 x \cos^2 x \sin^2 x\right]$

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EXERCISE 3.2 - Question No. 3

Compute the indicated products. (i) $[ab - ba][a - \mathbf{a}]$ (ii) $[123][234]$

(iii) $[1 - 223]$ $[123231]$ (iv) $[234345456][1 - 35024305]$ (v)

$[23 - 1121]$ $[101 - 121]$ (vi) $[3 - 13102]$ `[

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EXERCISE 3.2 - Question No. 4

If $A = [12 - 35021 - 11], B = [3 - 12425203]$ and

$C = [4120321 - 23]$, then compute $(A + B)and(BC)$. Also,

verify that $A + (BC) = (A + B)C$.

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EXERCISE 3.2 - Question No. 5

If $A = \left[\frac{2}{3}1\frac{5}{3}\frac{1}{3}\frac{2}{3}\frac{4}{3}\frac{7}{3}2\frac{2}{3}\right]$ and $B = \left[\frac{2}{3}\frac{2}{5}1\frac{1}{5}\frac{2}{5}\frac{4}{5}\frac{7}{3}\frac{6}{5}\frac{2}{5}\right]$,

then compute $3A - 5B$.

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EXERCISE 3.2 - Question No. 6

Simplify

$\cos\theta[\cos\theta\sin\theta\sin\theta\cos\theta] + \sin\theta[\sin\theta - \cos\theta\cos\theta\sin\theta]$

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EXERCISE 3.2 - Question No. 7

Find X and Y, if (i) $X + Y = [7025]$ and $X - Y = [3003]$ (ii)

$2X + 3Y = [2340]$ and $3X + 2Y = [2 - 2 - 15]$

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EXERCISE 3.2 - Question No. 8

Find X, if $Y = [3214]$ and $2X + Y = [10 - 32]$

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EXERCISE 3.2 - Question No. 9

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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EXERCISE 3.2 - Question No. 10

Solve the equation for x, y, z and t, if

$$2\begin{bmatrix} x & z \\ y & t \end{bmatrix} + 3\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} = 3\begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}$$

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EXERCISE 3.2 - Question No. 11

If $x[2, 3] + y[-1, 1] = [10, 5]$, find the values of x and y.

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EXERCISE 3.2 - Question No. 12

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

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EXERCISE 3.2 - Question No. 13

If $F(x) = [\cos x - \sin x 0 \sin x \cos x 0001]$, show that

$F(x)F(y) = F(x+y)$.

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EXERCISE 3.2 - Question No. 14

Show that (i) $[5 - 167][2134] \neq [2134][5 - 167]$ (ii)

$[123010110][-1100 - 11234] \neq [-1100 - 11234][123010110]$

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EXERCISE 3.2 - Question No. 15

Find $A^2 - 5A + 6I$, if $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$

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EXERCISE 3.2 - Question No. 16

If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, prove that $A^3 - 6A^2 + 7A + 2I = 0$

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EXERCISE 3.2 - Question No. 17

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

$A^2 = kA - 2I$.

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EXERCISE 3.2 - Question No. 18

If $A = \begin{bmatrix} 0 & -\tan\left(\frac{\alpha}{2}\right) \\ \tan\left(\frac{\alpha}{2}\right) & 0 \end{bmatrix} then (I - A) \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} =$

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EXERCISE 3.2 - Question No. 19

A trust fund has Rs 30,000 that must be invested in two different types of bonds. The first bond pays 5% interest per year, and the second bond pays 7% interest per year. Using matrix multiplication, determine how to divide Rs 30,000 among the two types of bonds. If the trust fund must obtain an annual total interest of: (a) Rs 1800 (b) Rs 2000

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EXERCISE 3.2 - Question No. 20

The bookshop of a particular school has 10 dozen chemistry books, 8 dozen physics books, 10 dozen economics books. Their selling prices are Rs 80, Rs 60 and Rs 40 each respectively. Find the total amount the bookshop will receive from selling all the books using matrix algebra.

EXERCISE 3.2 - Question No. 21

Assume X, Y, Z, W and P are matrices of order $2 \times n$, $3 \times k$, $2 \times p$, $n \times 3$ and $p \times k$, respectively. Choose the correct answer

The restriction on n, k and p so that $PY + WY$ will be defined are:

(A) $k = 3, p = n$ (B) k is arbitrary ,p=2 (C) p is arbitray ,k=3 (D) k=2 , p=3

EXERCISE 3.2 - Question No. 22

If $n = p$, then the order of the matrix $7X - 5Z$ is: (A) $p \times 2$ (B) $2 \times n$ (C) $n \times 3$ (D) $p \times n$

EXERCISE 3.3 - Question No. 1

Find the transpose of each of the following matrices: (i) $\left[5\frac{1}{2} \quad -1\right]$

(ii) $[1 \quad -123]$ (iii) $\left[-156\sqrt{35623} \quad -1\right]$

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EXERCISE 3.3 - Question No. 2

If $A = \begin{bmatrix} -1 & 2 & 3 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -4 & 1 & -5 \\ 1 & 2 & 0 \\ 1 & 3 & 1 \end{bmatrix}$, then verify that

(i) $(A+B)' = A' + B'$ (ii) $(A-B)' = A' - B'$

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EXERCISE 3.3 - Question No. 3

If $A = [3 - 10421]$ and $B = [-121123]$, then verify that

$(A + B)' = A' + B'$

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EXERCISE 3.3 - Question No. 4

If $A' = [-2312]$ and $B = [-1012]$, then find $(A + 2B)'$.

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EXERCISE 3.3 - Question No. 5

For the matrices A and B, verify that $(AB)' = B'A'$, where (i)

$A = [1 - 43], B = [-121]$ (iii) $A = [012], B = [157]$

EXERCISE 3.3 - Question No. 6

If (i) $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then verify that $A'A = I$. (ii) $A = \begin{bmatrix} \sin\alpha & \cos\alpha \\ -\cos\alpha & \sin\alpha \end{bmatrix}$, then verify that $A'A = I$.

EXERCISE 3.3 - Question No. 7

(i) Show that the matrix $A = [1 - 15 - 121513]$ is a symmetric matrix. (ii) Show that the matrix $A = [01 - 1 - 1211 - 10]$ is a skew symmetric matrix.

EXERCISE 3.3 - Question No. 8

For the matrix $A = [1567]$, verify that. (i) $\left(A + A'\right)$ is a symmetric matrix (ii) $\left(A - A'\right)$ is a skew symmetric matrix

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EXERCISE 3.3 - Question No. 9

Find $\frac{1}{2}(A + A')$ and $\frac{1}{2}(A - A')$, when $A = [0ab - a0c - b - c0]$

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EXERCISE 3.3 - Question No. 10

Express the following matrices as the sum of a symmetric and a skew symmetric matrix: (i) $[351 \quad -1]$ (ii) $[6 \quad -22 \quad -23 \quad -12 \quad -13]$ (iii) $[33 \quad -1 \quad -2 \quad -21452]$ (iv) $[15 \quad -12]$

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EXERCISE 3.3 - Question No. 11

Choose the correct answer If A, B are symmetric matrices of same order, then AB BA is a (A) Skew symmetric matrix (B) Symmetric matrix (C) Zero matrix (D) Identity matrix

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EXERCISE 3.3 - Question No. 12

If $A = [\cos\alpha - \sin\alpha \sin\alpha \cos\alpha]$, then $A + A' = I$, if the value of α is (A) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) π (d) $\frac{3\pi}{2}$

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EXERCISE 3.4 - Question No. 1

Using elementary transformations, find the inverse of the matrix $[1 - 123]$

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EXERCISE 3.4 - Question No. 2

Using elementary transformations, find the inverse of the matrix $[2111]$

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EXERCISE 3.4 - Question No. 3

Using elementary transformations, find the inverse of the matrix

$[1327]$

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EXERCISE 3.4 - Question No. 4

Using elementary transformations, find the inverse of the matrix

$$\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$$

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EXERCISE 3.4 - Question No. 5

Using elementary transformations, find the inverse of the matrix

$[2174]$

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EXERCISE 3.4 - Question No. 6

Using elementary transformations, find the inverse of the matrices

$[2513]$

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EXERCISE 3.4 - Question No. 7

Using elementary transformations, find the inverse of the matrix

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

EXERCISE 3.4 - Question No. 8

Using elementary transformations, find the inverse of the matrix $\begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix}$

EXERCISE 3.4 - Question No. 9

Using elementary transformations, find the inverse of each of the matrices $\begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix}$

EXERCISE 3.4 - Question No. 10

Using elementary transformations, find the inverse of the matrix $[3 - 1 - 42]$

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EXERCISE 3.4 - Question No. 11

Using elementary transformations, find the inverse of each of the matrices $[2 - 61 - 2]$

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EXERCISE 3.4 - Question No. 12

Using elementary transformations, find the inverse of the matrix

$$\begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}$$

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EXERCISE 3.4 - Question No. 13

Using elementary transformations, find the inverse of the matrix

$[2 - 3 - 12]$

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EXERCISE 3.4 - Question No. 14

Using elementary transformations, find the inverse of the matrix

$[2142]$

EXERCISE 3.4 - Question No. 15

Using elementary transformations, find the inverse of the matrix

$[2 - 332233 - 22]$

EXERCISE 3.4 - Question No. 16

Using elementary transformations, find the inverse of the matrix

$[13 - 2 - 30 - 5250]$

EXERCISE 3.4 - Question No. 17

Using elementary transformations, find the inverse of the matrix

$[20 - 1510013]$

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EXERCISE 3.4 - Question No. 18

Matrices A and B will be inverse of each other only if (A)

$AB = BA$ (B) $AB = BA = 0$ (C) $AB = 0, BA = I$ (D)

$AB = BA = I$

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MISCELLANEOUS EXERCISE - Question No. 1

Let $A = [0100]$ show that $(aI + bA)^n = a^n I + na^{n-1} bA$, where

I is the identity matrix of order 2 and $n \in N$.

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MISCELLANEOUS EXERCISE - Question No. 2

If $A = [111111111]$, prove that

$A^n = [3^{n-1}3^{n-1}3^{n-1}3^{n-1}3^{n-1}3^{n-1}3^{n-1}3^{n-1}3^{n-1}], n \in N.$

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MISCELLANEOUS EXERCISE - Question No. 3

If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then prove that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$,

where n is any positive integer.

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MISCELLANEOUS EXERCISE - Question No. 4

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

MISCELLANEOUS EXERCISE - Question No. 5

Show that the matrix B^, AB is symmetric or skew symmetric according as A is symmetric or skew symmetric.

MISCELLANEOUS EXERCISE - Question No. 6

Find the values of x, y, z if the matrix $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ satisfy the equation $A'A = I$.

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MISCELLANEOUS EXERCISE - Question No. 7

For what values of x : $[121][120201102][02x] = 0$?

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MISCELLANEOUS EXERCISE - Question No. 8

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

MISCELLANEOUS EXERCISE - Question No. 9

Find x, if $[x-5-1]\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}\begin{bmatrix}x\\ 4\\ 1\end{bmatrix} = O$.

MISCELLANEOUS EXERCISE - Question No. 10

A manufacturer produces three products x, y, z which he sells in two markets. Annual sales are indicated below: Market Products I 10.000 2.000 18.000 II 6.000 20.000 8.000 (a) If unit sale prices of x, y and z are Rs 2.50, Rs 1.50 and Rs 1.00, respectively, find the total revenue in each market with the help of matrix algebra. (b) If

the unit costs of the above three commodities are Rs 2.00, Rs 1.00 and 50 paise respectively. Find the gross profit.

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MISCELLANEOUS EXERCISE - Question No. 11

Find the matrix X so that $X\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{bmatrix}=\begin{bmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{bmatrix}$

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MISCELLANEOUS EXERCISE - Question No. 12

If A and B are square matrices of the same order such that $AB = BA$, then prove by induction that $AB^n = B^nA$. Further, prove that $(AB)^n = A^nB^n$ for all $n \in N$.

MISCELLANEOUS EXERCISE - Question No. 13

If $A = [\alpha\beta\gamma\alpha]$ is such that $A^2 - I$, then (A) $1 + \alpha^2 + \beta\gamma = 0$

(B) $1 - \alpha^2 + \beta\gamma = 0$ (C) $1 - \alpha^2 - \beta\gamma = 0$ (D)

$1 + \alpha^2 - \beta\gamma = 0$

MISCELLANEOUS EXERCISE - Question No. 14

If the matrix A is both symmetric and skew symmetric, then (A) A

is a diagonal matrix (B) A is a zero matrix (C) A is a square matrix

(D) None of these

MISCELLANEOUS EXERCISE - Question No. 15

If A is square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to (A) A (B) $I - A$ (C) I (D) $3A$

SOLVED EXAMPLES - Question No. 1

Consider the following information regarding the number of men and women workers in three factories I, II and III. Men workers Women workers I 30 25 II 25 31 III 27 26 Represent the above information in the form of a 3×2 matrix. What does th

SOLVED EXAMPLES - Question No. 2

If a matrix has 8 elements, what are the possible orders it can have?

SOLVED EXAMPLES - Question No. 3

Construct a 3×2 matrix whose elements are given by

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

SOLVED EXAMPLES - Question No. 4

If $\begin{bmatrix} x+3 & z+4 & 2y-7 \\ -6 & a-1 & 0 \\ b-3 & -21 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 6 & 3y-2 \\ -6 & -3 & 2c+2 \\ 2b+4 & -21 & 0 \end{bmatrix}$

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SOLVED EXAMPLES - Question No. 5

Find the values of a, b, c, and d from the following equation:

$[2a+ba-2b5c-d4c+3d] = [4-31124]$

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SOLVED EXAMPLES - Question No. 6

Given $A = \begin{bmatrix} \sqrt{3} & 1 & -1 \\ 2 & 3 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & \sqrt{5} & 1 \\ -2 & 3 & \frac{1}{2} \end{bmatrix}$, find

$A+B$.

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SOLVED EXAMPLES - Question No. 7

If $A - [122331]$ and $B - [3 - 1 - 1032]$, then find $2A - B$.

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SOLVED EXAMPLES - Question No. 8

If $A = [8430 - 26]$ and $B = [24 - 5 - 221]$, then find the matrix X, such that $2A + 3X = 5B$.

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SOLVED EXAMPLES - Question No. 9

Find X and Y, if $X + Y = [5209]$ and $X - Y = [360 - 1]$.

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SOLVED EXAMPLES - Question No. 10

Find the values of x and y from the following equation:

$2[x57y - 3] + [3 - 412] = [761514]$

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SOLVED EXAMPLES - Question No. 11

Two farmers Ramkishan and Gurcharan Singh cultivates only three varieties of rice namely Basmati, Permal and Naura. The sale (in Rupees) of these varieties of rice by both the farmers in the month

of September and October are given by the following matrices A and B. (i) Find the combined sales in September and October for each farmer in each variety. (ii) Find the decrease in sales from September to October. (iii) if both farmers receive 2% profit on gross sales, compute the profit for each farmer and for each variety sold in October.

SOLVED EXAMPLES - Question No. 12

Find AB, if $A = [6923]$ and $B = [260798]$.

SOLVED EXAMPLES - Question No. 13

If $A = [1 - 23425]$ and $B = [242351]$, then find AB, BA. Show that $AB \neq BA$.

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SOLVED EXAMPLES - Question No. 14

If $A = [100 - 1]$ and $B = [0110]$, then $AB = [01 - 10]$ and $BA = [0 - 110]$. Clearly $AB \neq BA$.

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SOLVED EXAMPLES - Question No. 15

Find AB, if $A = [0 \; -1 \; 02]$ and $B = [3500]$.

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SOLVED EXAMPLES - Question No. 16

If $A = [11 \; -1 \; 2033 \; -12]$, $B = [10 \; -13 \; 24]$ and

$C = [123 \; -420 \; -21]$, find A(BC), (AB)C and show that

$(AB)C = A(BC)$.

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SOLVED EXAMPLES - Question No. 17

If $A = [067 - 6087 - 80]$, $B = [011102120]$, $C = [2 - 23]$

Calculate AC, BC and $(A + B)C$. Also, verify that

$(A + B)C = AC + BC$

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SOLVED EXAMPLES - Question No. 18

If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^3 - 23A - 401 = 0$.

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SOLVED EXAMPLES - Question No. 19

In a legislative assembly election, a political group hired a public relations firm to promote its candidate in three ways: telephone, house calls, and letters. The cost per contact (in paise) is given in matrix A as `Cos tp e rcon t a c t . Number of contacts of each type made in two cities X and Y is given by matrix B. Find total amount spent by group in two cities X and Y .

SOLVED EXAMPLES - Question No. 20

If $A = \left[3\sqrt{3}2420\right]$ and $B = [2 - 12124]$, verify that (i) $(A')' = A$ (ii) $(A + B)' = A' + B'$ (iii) $(kB)' = kB'$ where k is any constant.

SOLVED EXAMPLES - Question No. 21

If $A - [-245]$, $B - [13 - 6]$, verify that $(AB)' = B'A'$.

SOLVED EXAMPLES - Question No. 22

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

SOLVED EXAMPLES - Question No. 23

By using elementary operations, find the inverse of the matrix

$A = [1221]$.

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SOLVED EXAMPLES - Question No. 24

Obtain the inverse of the following matrix using elementary

operations $A = [012123311]$.

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SOLVED EXAMPLES - Question No. 25

Find P^{-1}, if it exists, given $P = [10 - 2 - 51]$.

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SOLVED EXAMPLES - Question No. 26

If $A = [\cos\theta \sin\theta - \sin\theta \cos\theta]$, then prove that

$A^n = [\cos n\theta \sin n\theta - \sin n\theta \cos n\theta], n \in N$.

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SOLVED EXAMPLES - Question No. 27

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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SOLVED EXAMPLES - Question No. 28

Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 5 & 4 \\ 7 & 4 \end{bmatrix}, C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$. Find a matrix D such that $CD - AB = 0$

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