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

Answer

The correct answer is B.

It is given that $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$

Equating the corresponding elements, we get:

$3x+7=0 \Rightarrow x = -\frac{7}{3}$

$5 = y-2 \Rightarrow y = 7$

$y+1 = 8 \Rightarrow y = 7$

$2-3x = 4 \Rightarrow x = -\frac{2}{3}$

We find that on comparing the corresponding elements of the two matrices, we get two different values of *x*, which is not possible.

Hence, it is not possible to find the values of *x* and *y* for which the given matrices are equal.

Question 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

Answer

The correct answer is D.

The given matrix of the order 3 × 3 has 9 elements and each of these elements can be either 0 or 1.

Now, each of the 9 elements can be filled in two possible ways.

Therefore, by the multiplication principle, the required number of possible matrices is 2^9 = 512

Exercise 3.2

Question 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

Answer

(i)

$A+B = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix} = \begin{bmatrix} 2+1 & 4+3 \\ 3-2 & 2+5 \end{bmatrix} = \begin{bmatrix} 3 & 7 \\ 1 & 7 \end{bmatrix}$

(ii)

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

(iii)

$3A-C = 3\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$

$$=\begin{bmatrix}3\times2 & 3\times4\\3\times3 & 3\times2\end{bmatrix}-\begin{bmatrix}-2 & 5\\3 & 4\end{bmatrix}$$
$$=\begin{bmatrix}6 & 12\\9 & 6\end{bmatrix}-\begin{bmatrix}-2 & 5\\3 & 4\end{bmatrix}$$
$$=\begin{bmatrix}6+2 & 12-5\\9-3 & 6-4\end{bmatrix}$$
$$=\begin{bmatrix}8 & 7\\6 & 2\end{bmatrix}$$

(iv) Matrix *A* has 2 columns. This number is equal to the number of rows in matrix *B*.

Therefore, *AB* is defined as:

$$AB=\begin{bmatrix}2 & 4\\3 & 2\end{bmatrix}\begin{bmatrix}1 & 3\\-2 & 5\end{bmatrix}=\begin{bmatrix}2(1)+4(-2) & 2(3)+4(5)\\3(1)+2(-2) & 3(3)+2(5)\end{bmatrix}$$
$$=\begin{bmatrix}2-8 & 6+20\\3-4 & 9+10\end{bmatrix}=\begin{bmatrix}-6 & 26\\-1 & 19\end{bmatrix}$$

(v) Matrix *B* has 2 columns. This number is equal to the number of rows in matrix *A*.

Therefore, *BA* is defined as:

$$BA=\begin{bmatrix}1 & 3\\-2 & 5\end{bmatrix}\begin{bmatrix}2 & 4\\3 & 2\end{bmatrix}=\begin{bmatrix}1(2)+3(3) & 1(4)+3(2)\\-2(2)+5(3) & -2(4)+5(2)\end{bmatrix}$$
$$=\begin{bmatrix}2+9 & 4+6\\-4+15 & -8+10\end{bmatrix}=\begin{bmatrix}11 & 10\\11 & 2\end{bmatrix}$$

Question 2:

Compute the following:

(i) $\begin{bmatrix}a & b\\-b & a\end{bmatrix}+\begin{bmatrix}a & b\\b & a\end{bmatrix}$ (ii) $\begin{bmatrix}a^2+b^2 & b^2+c^2\\a^2+c^2 & a^2+b^2\end{bmatrix}+\begin{bmatrix}2ab & 2bc\\-2ac & -2ab\end{bmatrix}$

(iii) $\begin{bmatrix}-1 & 4 & -6\\8 & 5 & 16\\2 & 8 & 5\end{bmatrix}+\begin{bmatrix}12 & 7 & 6\\8 & 0 & 5\\3 & 2 & 4\end{bmatrix}$

(v) $\begin{bmatrix}\cos^2 x & \sin^2 x\\\sin^2 x & \cos^2 x\end{bmatrix}+\begin{bmatrix}\sin^2 x & \cos^2 x\\\cos^2 x & \sin^2 x\end{bmatrix}$

Answer

(i)

$$\begin{bmatrix}a & b\\-b & a\end{bmatrix}+\begin{bmatrix}a & b\\b & a\end{bmatrix}=\begin{bmatrix}a+a & b+b\\-b+b & a+a\end{bmatrix}=\begin{bmatrix}2a & 2b\\0 & 2a\end{bmatrix}$$

(ii) $\begin{bmatrix}a^2+b^2 & b^2+c^2\\a^2+c^2 & a^2+b^2\end{bmatrix}+\begin{bmatrix}2ab & 2bc\\-2ac & -2ab\end{bmatrix}$

$$=\begin{bmatrix}a^2+b^2+2ab & b^2+c^2+2bc\\a^2+c^2-2ac & a^2+b^2-2ab\end{bmatrix}$$
$$=\begin{bmatrix}(a+b)^2 & (b+c)^2\\(a-c)^2 & (a-b)^2\end{bmatrix}$$

(iii) $\begin{bmatrix}-1 & 4 & -6\\8 & 5 & 16\\2 & 8 & 5\end{bmatrix}+\begin{bmatrix}12 & 7 & 6\\8 & 0 & 5\\3 & 2 & 4\end{bmatrix}$

$$=\begin{bmatrix}-1+12 & 4+7 & -6+6\\8+8 & 5+0 & 16+5\\2+3 & 8+2 & 5+4\end{bmatrix}$$
$$=\begin{bmatrix}11 & 11 & 0\\16 & 5 & 21\\5 & 10 & 9\end{bmatrix}$$

(iv) $\begin{bmatrix}\cos^2 x & \sin^2 x\\\sin^2 x & \cos^2 x\end{bmatrix}+\begin{bmatrix}\sin^2 x & \cos^2 x\\\cos^2 x & \sin^2 x\end{bmatrix}$

$$=\begin{bmatrix}\cos^2 x+\sin^2 x & \sin^2 x+\cos^2 x\\\sin^2 x+\cos^2 x & \cos^2 x+\sin^2 x\end{bmatrix}$$
$$=\begin{bmatrix}1 & 1\\1 & 1\end{bmatrix}\qquad(\because \sin^2 x+\cos^2 x=1)$$

Question 3:

Compute the indicated products

(i) $\begin{bmatrix}a & b\\-b & a\end{bmatrix}\begin{bmatrix}a & -b\\b & a\end{bmatrix}$

$\begin{bmatrix}1\\2\\ \end{bmatrix}$[2 3 4]

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

(iii) $\begin{bmatrix}1 & -2\\2 & 3\end{bmatrix}\begin{bmatrix}1 & 2 & 3\\2 & 3 & 1\end{bmatrix}$

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

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

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

Answer

(i) $\begin{bmatrix}a & b\\-b & a\end{bmatrix}\begin{bmatrix}a & -b\\b & a\end{bmatrix}$

$$\begin{bmatrix}a & b\\-b & a\end{bmatrix}\begin{bmatrix}a & -b\\b & a\end{bmatrix}$$

$$=\begin{bmatrix}a(a)+b(b) & a(-b)+b(a)\\-b(a)+a(b) & -b(-b)+a(a)\end{bmatrix}$$

$$=\begin{bmatrix}a^2+b^2 & -ab+ab\\-ab+ab & b^2+a^2\end{bmatrix}=\begin{bmatrix}a^2+b^2 & 0\\0 & a^2+b^2\end{bmatrix}$$

(ii) $\begin{bmatrix}1\\2\\3\end{bmatrix}\begin{bmatrix}2 & 3 & 4\end{bmatrix}=\begin{bmatrix}1(2) & 1(3) & 1(4)\\2(2) & 2(3) & 2(4)\\3(2) & 3(3) & 3(4)\end{bmatrix}=\begin{bmatrix}2 & 3 & 4\\4 & 6 & 8\\6 & 9 & 12\end{bmatrix}$

(iii) $\begin{bmatrix}1 & -2\\2 & 3\end{bmatrix}\begin{bmatrix}1 & 2 & 3\\2 & 3 & 1\end{bmatrix}$

$$=\begin{bmatrix}1(1)-2(2) & 1(2)-2(3) & 1(3)-2(1)\\2(1)+3(2) & 2(2)+3(3) & 2(3)+3(1)\end{bmatrix}$$

$$=\begin{bmatrix}1-4 & 2-6 & 3-2\\2+6 & 4+9 & 6+3\end{bmatrix}=\begin{bmatrix}-3 & -4 & 1\\8 & 13 & 9\end{bmatrix}$$

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

$$=\begin{bmatrix}2(1)+3(0)+4(3) & 2(-3)+3(2)+4(0) & 2(5)+3(4)+4(5)\\3(1)+4(0)+5(3) & 3(-3)+4(2)+5(0) & 3(5)+4(4)+5(5)\\4(1)+5(0)+6(3) & 4(-3)+5(2)+6(0) & 4(5)+5(4)+6(5)\end{bmatrix}$$

$$=\begin{bmatrix}2+0+12 & -6+6+0 & 10+12+20\\3+0+15 & -9+8+0 & 15+16+25\\4+0+18 & -12+10+0 & 20+20+30\end{bmatrix}=\begin{bmatrix}14 & 0 & 42\\18 & -1 & 56\\22 & -2 & 70\end{bmatrix}$$

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

$$=\begin{bmatrix}2(1)+1(-1) & 2(0)+1(2) & 2(1)+1(1)\\3(1)+2(-1) & 3(0)+2(2) & 3(1)+2(1)\\-1(1)+1(-1) & -1(0)+1(2) & -1(1)+1(1)\end{bmatrix}$$

*********** END **********