Very Short Answer Questions (1 Mark Each)

Find the product of the following matrices

1. $\begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$
2. $\begin{pmatrix} -1 & 5 \\ 2 & 3 \end{pmatrix} \cdot \begin{pmatrix} 4 & -2 \\ 0 & 1 \end{pmatrix}$
3. $\begin{pmatrix} 3 & 4 \\ 1 & -1 \end{pmatrix} \cdot \begin{pmatrix} -2 & 5 \\ 4 & 3 \end{pmatrix}$
4. $\begin{pmatrix} 6 & -3 \\ 2 & 4 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
5. $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \cdot \begin{pmatrix} 7 & -6 \\ 5 & 4 \end{pmatrix}$
6. $\begin{pmatrix} -4 & 2 \\ 3 & 5 \end{pmatrix} \cdot \begin{pmatrix} 2 & -1 \\ -3 & 4 \end{pmatrix}$
7. $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \cdot \begin{pmatrix} -1 & -2 \\ -3 & -4 \end{pmatrix}$
8. $\begin{pmatrix} 5 & 0 \\ 0 & 5 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$
9. $\begin{pmatrix} 2 & 4 \\ 6 & 8 \end{pmatrix} \cdot \begin{pmatrix} -1 & -1 \\ 1 & 1 \end{pmatrix}$
10. $\begin{pmatrix} 3 & -3 \\ 2 & -2 \end{pmatrix} \cdot \begin{pmatrix} -2 & 2 \\ -1 & 1 \end{pmatrix}$

Short Answer Questions (2 Marks Each)

11. Given $A = \begin{pmatrix} 2 & 1 \\ 0 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -4 \\ 2 & 1 \end{pmatrix}$, find $A \cdot B$.
12. If $X = \begin{pmatrix} x & y \\ z & w \end{pmatrix}$ and $Y = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$, and $X \cdot Y = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$, find X.
13. Compute the product of $\begin{pmatrix} 4 & -2 \\ 2 & 1 \end{pmatrix}$ and $\begin{pmatrix} -1 & 3 \\ 4 & -2 \end{pmatrix}$.
14. Find the result of multiplying $\begin{pmatrix} -3 & 6 \\ 2 & -4 \end{pmatrix}$ by $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$.
15. Calculate the product of two matrices $P = \begin{pmatrix} 5 & 3 \\ 2 & 4 \end{pmatrix}$ and $Q = \begin{pmatrix} -2 & 0 \\ 1 & -1 \end{pmatrix}$.

Long Answer Questions (4 Marks Each)

16. For matrices $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and $N = \begin{pmatrix} e & f \\ g & h \end{pmatrix}$, given that $M \cdot N = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find the values of a, b, c, d, e, f, g, and h assuming they are integers and M and N are inverses of each other.
17. Given $C = \begin{pmatrix} x & 3 \\ 4 & y \end{pmatrix}$ and $D = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$, if the product $C \cdot D = \begin{pmatrix} 5 & x \\ y & 10 \end{pmatrix}$, find x and y.
18. If $\begin{pmatrix} p & q \\ r & s \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} 7 & 10 \\ 15 & 22 \end{pmatrix}$, determine the values of p, q, r, and s.

Answers

1. $\begin{pmatrix} 11 & 14 \\ 4 & 8 \end{pmatrix}$
2. $\begin{pmatrix} -1 & 3 \\ 6 & 3 \end{pmatrix}$
3. $\begin{pmatrix} -14 & 17 \\ 2 & 1 \end{pmatrix}$
4. $\begin{pmatrix} 6 & 6 \\ 2 & 4 \end{pmatrix}$
5. $\begin{pmatrix} 5 & 4 \\ -1 & 4 \end{pmatrix}$
6. $\begin{pmatrix} 8 & -14 \\ -3 & 5 \end{pmatrix}$
7. $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ (This assumes x, y, z, w are such that the product with Y zeroes out; this could be a trick question as it implies a certain dependency between x, y, z, w which typically results in $x = y = z = w = 0$ under the given conditions, but more solutions could exist depending on interpretation.)
8. $\begin{pmatrix} 0 & 12 \\ 10 & -6 \end{pmatrix}$
9. $\begin{pmatrix} -9 & 18 \\ 8 & -14 \end{pmatrix}$
10. $\begin{pmatrix} -5 & -15 \\ 2 & -8 \end{pmatrix}$
11. $\begin{pmatrix} 10 & -2 \\ 4 & 2 \end{pmatrix}$
12. $a = 1, b = 0, c = 0, d = 1, e = 1, f = 0, g = 0, h = 1$ (This is one of the possible sets of values for the inverse scenario, assuming a simplistic case where M and N are identity matrices.)
13. $x = 3, y = 8$
14. $p = 1, q = 2, r = 3, s = 4$