6.2) Matrix multiplication

Worked example

Determine the size of the matrix AB given the dimensions of A and B

Dimensions of A	Dimensions of B	Dimensions of AB (if valid)
3×2	2×1	
3×2	2×4	
3×2	4×2	
3×4	4×2	
2×4	4×2	
2×4	2×4	
2×2	2×4	
2×2	2×2	

Your turn

Determine the size of the matrix AB given the dimensions of A and B

Dimensions of A	Dimensions of B	Dimensions of AB (if valid)
2×3	3×1	2×1
1×4	1×4	Not valid
1×4	4×1	1×1
2×5	3×4	Not valid
3×3	3×3	3×3

Worked example

Find the product of these matrices where possible:

$$\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}\begin{pmatrix}5 & 6\\7 & 8\end{pmatrix}$$

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

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

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

Your turn

Find the product of these matrices where possible:

$$\begin{pmatrix}1 & 2\\3 & 4\\5 & 6\end{pmatrix}\begin{pmatrix}7 & 8 & 9\\10 & 11 & 12\end{pmatrix}$$

$$\begin{pmatrix}27 & 30 & 33\\61 & 68 & 75\\95 & 106 & 117\end{pmatrix}$$

Worked example

Find:

$$\begin{pmatrix}4 & 5 & 6\end{pmatrix}\begin{pmatrix}7\\8\\9\end{pmatrix}$$

$$\begin{pmatrix}4\\5\\6\end{pmatrix}\begin{pmatrix}7 & 8 & 9\end{pmatrix}$$

Your turn

Find:

$$\begin{pmatrix}1 & 2 & 3\end{pmatrix}\begin{pmatrix}1\\2\\3\end{pmatrix}$$

$$\begin{pmatrix}14\end{pmatrix}$$

$$\begin{pmatrix}1\\2\\3\end{pmatrix}\begin{pmatrix}1 & 2 & 3\end{pmatrix}$$

$$\begin{pmatrix}1 & 2 & 3\\2 & 4 & 6\\3 & 6 & 9\end{pmatrix}$$

Worked example

Find:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}^2$$

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}^3$$

Your turn

Find:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}^4$$

$$\begin{pmatrix} 199 & 290 \\ 435 & 634 \end{pmatrix}$$

Worked example

Find:

$$\begin{pmatrix} 1 & a \\ 0 & 1 \end{pmatrix}^2$$

$$\begin{pmatrix} 1 & 0 \\ b & 1 \end{pmatrix}^3$$

Your turn

Find:

$$\begin{pmatrix} 1 & 0 \\ c & 1 \end{pmatrix}^k$$

$$\begin{pmatrix} 1 & 0 \\ ck & 1 \end{pmatrix}$$

Worked example

$$A = \begin{pmatrix} 1 & a & 1 \\ -1 & 2 & 0 \\ b & 0 & 3 \end{pmatrix}$$

Given that $A^2 = \begin{pmatrix} 6 & -9 & 4 \\ -3 & 7 & -1 \\ 8 & -6 & 11 \end{pmatrix}$, find the values of a and b

Your turn

$$A = \begin{pmatrix} 1 & -1 & b \\ a & 2 & 0 \\ 1 & 0 & 3 \end{pmatrix}$$

Given that $A^2 = \begin{pmatrix} -4 & -3 & -8 \\ 9 & 1 & -6 \\ 4 & -1 & 7 \end{pmatrix}$, find the values of a and b

$a = 3, b = -2$

Worked example

$A = \begin{pmatrix} -2 \\ a \end{pmatrix}$ and $B = \begin{pmatrix} 1 & b \end{pmatrix}$. Given that $BA = (0)$ find AB in terms of a

Your turn

$A = \begin{pmatrix} -1 \\ a \end{pmatrix}$ and $B = \begin{pmatrix} b & 2 \end{pmatrix}$. Given that $BA = (0)$ find AB in terms of a

$$AB = \begin{pmatrix} -2a & -2 \\ 2a^2 & 2a \end{pmatrix}$$

Worked example

Find:

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

$$\begin{pmatrix}1 & 2\\3 & 4\\5 & 6\end{pmatrix}\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$$

$$\begin{pmatrix}1 & 2 & 3\\4 & 5 & 6\end{pmatrix}\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$$

$$\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}\begin{pmatrix}1 & 2 & 3\\4 & 5 & 6\end{pmatrix}$$

Your turn

Find:

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

$$\begin{pmatrix}1 & 2 & 3\\4 & 5 & 6\\7 & 8 & 9\end{pmatrix}$$