



Practice: Matrix Addition and Multiplication

Define the matrices

$$A = \begin{pmatrix} 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}, B = \begin{pmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{pmatrix}, C = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}, D = \begin{pmatrix} 3 & 4 \\ 4 & 3 \end{pmatrix}, E = \begin{pmatrix} 1 \\ 2 \end{pmatrix}.$$

Compute if defined:

$$\overset{1}{B - 2A} \quad \overset{2}{3C - E} \quad \overset{3}{AC} \quad \overset{4}{CD} \quad \overset{5}{CB}$$

$$\begin{aligned} \textcircled{1} & \begin{pmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{pmatrix} - 2 \begin{pmatrix} 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix} \\ & \quad \quad \quad - \begin{pmatrix} 4 & 2 & -2 \\ 2 & -2 & 2 \end{pmatrix} \\ & \quad \quad \quad \begin{pmatrix} 0 & -4 & 3 \\ 0 & -2 & -4 \end{pmatrix} \end{aligned}$$

$\textcircled{2}$

Basically the same as 1

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

2×3 \otimes 2×2

Undefined. A 2×3 matrix can't be multiplied by 2×2 matrix.

When is matrix multiplication defined?

In order for matrix multiplication to be defined, the number of columns in the first matrix must be equal to the number of rows in the second matrix.

$$(m \times n) \cdot (n \times k)$$

↔
product is defined

$\textcircled{4}$

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

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

$$\begin{pmatrix} 11 & 10 \\ 10 & 11 \end{pmatrix}$$

$\textcircled{5}$

$$\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix} \cdot \begin{pmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{pmatrix}$$

2×2 OK $2 \times 3 \rightarrow 2 \times 3$

$$\begin{pmatrix} 1 \cdot 4 + 2 \cdot 2 & 1 \cdot (-2) + 2 \cdot (-4) & 1 \cdot 1 + 2 \cdot (-2) \\ 2 \cdot 4 + 1 \cdot 2 & 2 \cdot (-2) + 1 \cdot (-4) & 2 \cdot 1 + 1 \cdot (-2) \end{pmatrix}$$

$$\begin{pmatrix} 8 & -10 & -3 \\ 10 & -8 & 0 \end{pmatrix}$$