

Addition and multiplication of matrices

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} 2 & 4 \\ 6 & 8 \end{pmatrix}$$

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

Multiplication

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

$$\begin{pmatrix} x & y \\ z & a \end{pmatrix} \begin{pmatrix} b & c \\ d & f \end{pmatrix} = \begin{pmatrix} xb + yd & xc + yf \\ zb + ad & zc + af \end{pmatrix}$$

$$\boxed{A \cdot B \neq B \cdot A}$$

Matrices do not commute.

$$\begin{pmatrix} b & c \\ d & f \end{pmatrix} \begin{pmatrix} x & y \\ z & a \end{pmatrix} = \begin{pmatrix} xb + zc & yb + ac \\ xd + zf & yd + af \end{pmatrix}$$

Rule II

$$\begin{matrix} (m \times n) & \cdot & (n \times p) \\ \downarrow & & \downarrow \\ A & & B \\ & = & C \end{matrix}$$

$$C = A \cdot B$$

$$c_{ij} = \sum_{k=1}^n a_{ik} b_{kj}$$