

# Linear algebra - Worksheet

## 1. Matrix dimensions

$$1.1) A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 7 & 4 \end{bmatrix} \rightarrow 2 \text{ rows} \times 3 \text{ columns}$$

$$1.2) B = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \rightarrow 2 \times 2$$

$$1.3) C = \begin{bmatrix} 5 & -1 \\ 9 & 1 \\ 6 & 0 \end{bmatrix} \rightarrow 3 \times 2$$

$$1.4) D = \begin{bmatrix} 3 & -2 & -1 \\ 1 & 2 & 3 \end{bmatrix} \rightarrow 2 \times 3$$

$$1.5) u = \begin{bmatrix} 6 & 2 & -3 & 5 \end{bmatrix} \rightarrow 1 \times 4$$

$$1.6) w = \begin{bmatrix} 1 \\ 8 \\ 0 \\ 5 \end{bmatrix} = 4 \times 1$$

## 2. Vector Operations

$$\alpha = 6$$
$$2.1) \vec{u} + \vec{v} = \begin{bmatrix} 6 & 2 & -3 & 5 \end{bmatrix} + \begin{bmatrix} 3 & 5 & -1 & 4 \end{bmatrix}$$
$$= \begin{bmatrix} 9 & 7 & -4 & 9 \end{bmatrix}$$

$$2.2) \vec{u} - \vec{v} = \begin{bmatrix} 3 & -3 & -2 & 1 \end{bmatrix}$$

$$2.3) \alpha \vec{u} = 6 \begin{bmatrix} 6 & 2 & -3 & 5 \end{bmatrix} = \begin{bmatrix} 36 & 12 & -18 & 30 \end{bmatrix}$$

Optional

$$\begin{bmatrix} 3 & 4 \end{bmatrix} \text{ not defined}$$

$$2.4) \vec{u} \cdot \vec{v} = [18 \ 10 \ 3 \ 20]$$

$$2.5) \|\vec{u}\| = [6 \ 2 \ -3 \ 5]$$

$$\begin{aligned} &= \sqrt{6^2 + 2^2 + (-3)^2 + 5^2} \\ &= \sqrt{36 + 4 + 9 + 25} \\ &= \sqrt{74} \approx 8.6 \end{aligned}$$

### 3. Matrix Operations

$$3.1) A+C = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 7 & 4 \end{bmatrix} + \begin{bmatrix} 5 & -1 \\ 9 & 6 \\ 6 & 0 \end{bmatrix}$$

= not defined

$$3.2) A-C^T = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 7 & 4 \end{bmatrix} - \begin{bmatrix} 5 & 9 & 6 \\ -1 & 1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & -7 & -3 \\ 3 & 6 & 4 \end{bmatrix}$$

$$3.3) C^T + 3D = \begin{bmatrix} 5 & 9 & 6 \\ -1 & 1 & 0 \end{bmatrix} + 3 \begin{bmatrix} 3 & -2 & -1 \\ 1 & 2 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & 9 & 6 \\ -1 & 1 & 0 \end{bmatrix} + \begin{bmatrix} 9 & -6 & -3 \\ 3 & 6 & 9 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 3 & 3 \\ 2 & 7 & 9 \end{bmatrix}$$

$$3.4) BA = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 2 & 7 & 4 \end{bmatrix} = \text{Not defined}$$

$$3.5) BAT = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 2 & 7 \\ 3 & 4 \end{bmatrix} = \text{Not defined}$$

Optional

$$BC = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 5 & -1 \\ 9 & 1 \\ 6 & 0 \end{bmatrix} = \text{Not defined}$$