

Vector lengths, unit vectors, and distance

Lesson 8 · Module 0 — Vectors & Geometry · Linear Algebra · dailymaths.uk/linalg

Practice problems

1. Find the length of the vector $\mathbf{v} = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$.
2. Find the unit vector $\mathbf{u}$ in the direction of $\mathbf{v} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$.
3. Calculate the distance between point $A(2, -3)$ and point $B(-1, 1)$.

Solutions

1. Find the length of the vector $\mathbf{v} = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$.

- Square the components: $8^2 = 64$ and $6^2 = 36$.
- Sum the squares: $64 + 36 = 100$.
- Take the square root: $\sqrt{100} = 10$.

Answer: 10

2. Find the unit vector $\mathbf{u}$ in the direction of $\mathbf{v} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$.

- Calculate the length of $\mathbf{v}$: $|\mathbf{v}| = \sqrt{1^2 + 1^2} = \sqrt{2}$.
- Divide each component by the length: $u_1 = 1/\sqrt{2}$ and $u_2 = 1/\sqrt{2}$.

Answer: $\begin{bmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix}$

3. Calculate the distance between point $A(2, -3)$ and point $B(-1, 1)$.

- Find the difference vector $\mathbf{b} - \mathbf{a}$: $\begin{bmatrix} -1 - 2 \\ 1 - (-3) \end{bmatrix} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$.
- Calculate the length of this vector: $\sqrt{(-3)^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$.

Answer: 5