

1. Find a unit vector in the direction of $\vec{x} = \begin{bmatrix} 2 \\ -1 \\ 3 \\ 5 \end{bmatrix}$.

2. Find the angle θ in \mathbb{R}^3 between $\vec{a} = \begin{bmatrix} 2 \\ 0 \\ -3 \end{bmatrix}$ and $\vec{b} = \begin{bmatrix} -1 \\ 1 \\ 1 \end{bmatrix}$.

3. Let $\vec{u} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$, and $\vec{w} = \begin{bmatrix} k^2 \\ 2k \end{bmatrix}$.

a. Find all scalars k such that \vec{u} and \vec{w} are orthogonal.

b. Find all scalars k such that \vec{w} is orthogonal to \vec{v} but **not** to \vec{u} .