Precalculus

6-05 Dot Products

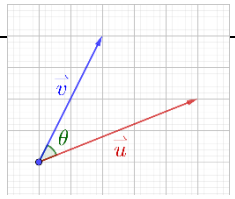
Dot Product

- $\vec{u} = \langle u_1, u_2 \rangle, \vec{v} = \langle v_1, v_2 \rangle$
- $\vec{u} \bullet \vec{v} = u_1 v_1 + u_2 v_2$

Find $\langle 5, -4 \rangle \bullet \langle 9, -2 \rangle$

Angle between vectors

- $\vec{u} \bullet \vec{v} = \|\vec{u}\| \|\vec{v}\| \cos\theta$



Find the angle between $\langle 5, -4 \rangle$ and $\langle 9, -2 \rangle$

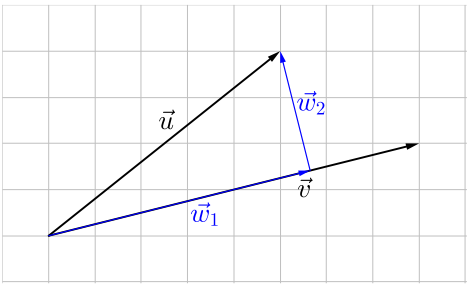
Parallel and Perpendicular Vectors

- If $\vec{u} \bullet \vec{v} = 0$, then $\vec{u}$ and $\vec{v}$ are _____(perpendicular)
- If $\vec{u} = k\vec{v}$, then $\vec{u}$ and $\vec{v}$ are _____(or antiparallel)

Are $\langle 1, -4 \rangle$ and $\langle 6, 2 \rangle$ orthogonal, parallel, or neither?

Find Vector Components

- Let $\vec{u}$ and $\vec{v}$ be vectors such that $\vec{u} = \overrightarrow{w_1} + \overrightarrow{w_2}$ where $\overrightarrow{w_1}$ and $\overrightarrow{w_2}$ are orthogonal and $\overrightarrow{w_1}$ is parallel to $\vec{v}$. $\overrightarrow{w_1}$ and $\overrightarrow{w_2}$ are components of $\vec{u}$.
- $\overrightarrow{w_1}$ is the projection of $\vec{u}$ onto $\vec{v}$: $\overrightarrow{w_1} = proj_{\vec{v}}\vec{u}$
- $\overrightarrow{w_1} = proj_{\vec{v}}\vec{u} = \frac{\vec{u}\bullet\vec{v}}{\|\vec{v}\|^2}\vec{v}$
- $\overrightarrow{w_2} = \vec{u} - \overrightarrow{w_1}$
- $Work = \vec{F} \bullet \vec{d}$



Find the projection of $\vec{u} = \langle 3,\ 4\rangle$ onto $\vec{v} = \langle 8,\ 2\rangle$. Then write $\vec{u}$ as the sum of 2 orthogonal vectors.