Class Discussion

Unit 6 Topic 4 Part 2 Planar Vector (dot product)

Objective: students will understand unit vector and the connection to the projection of vectors

The unit vector of $\vec{u} = <u_1, u_2>$

$$\vec{u} = \frac{\vec{u}}{\|\vec{u}\|} \rightarrow \|\vec{u}\| = 1$$

$$\theta_u = \tan^{-1}\left(\frac{u_2}{u_1}\right)$$ [However, caution has to be exercised that $\theta_u \in [0, 2\pi)$

Ex 1: Find the direction and the unit vector $\vec{v} = <-2, -3>$

Define: $\text{Proj}_{\vec{v}}\vec{u} = \left(\|\vec{u}\|\cos\theta\right)\tilde{v}$ as the projection of vector $\vec{u}$ onto vector $\vec{v}$. After simplification

$$\text{Proj}_{\vec{v}}\vec{u} = \frac{\left(\vec{u}\cdot\vec{v}\right)}{\|\vec{v}\|^2}\vec{v}$$ (This is the formula from text book, but students should not memorize it, but instead use definition to derive the projection when needed.)

Ex 2: Given $\vec{u} = <3, 4>$, $\vec{v} = <2, 4>$, if $\vec{u} = \vec{u}_1 + \vec{u}_2$ and $\vec{u}_1$ is the projection of vector $\vec{u}$ onto vector $\vec{v}$,

(a) Show that $\vec{u}_2$ and $\vec{v}$ are orthogonal.

(b) find both $\vec{u}_1$ and $\vec{u}_2$