

Quiz 8 - Take Home

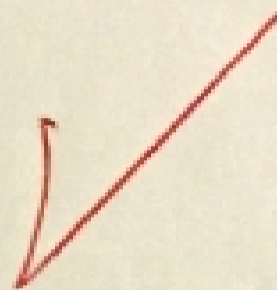
SHOW ALL WORK!!! Unsupported answers might not receive full credit. Use the back of this sheet for additional workspace.

Problem 1 [4 pts] Suppose $\vec{u} = 3\vec{i} + 4\vec{j}$ and $\vec{v} = 4\vec{i} + 2\vec{j}$.

a) [1 pt] Calculate $\vec{u} \cdot \vec{v}$.

$$\langle 3, 4 \rangle \cdot \langle 4, 2 \rangle$$

$$\langle 12 + 8 = 20 \rangle$$



b) [1 pt] Find $\cos \theta$, where $0 \leq \theta \leq \pi$ is the angle between the vectors \vec{u} and \vec{v} . Are \vec{u} and \vec{v} perpendicular?

$$|\vec{u}| = 5$$

$$|\vec{v}| = \sqrt{20}$$

$$\frac{20}{5 \cdot \sqrt{20}} = \cos \theta$$

$$\frac{2\sqrt{5}}{5} = \cos \theta$$

$$\theta = 26.6$$

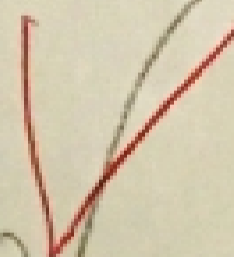
Not
perpendicular

c) [2 pts] Find a vector \vec{P} that is parallel to \vec{v} and a vector \vec{N} perpendicular to \vec{v} such that $\vec{u} = \vec{P} + \vec{N}$.

Hint: Draw a picture. What is $\text{proj}_{\vec{v}} \vec{u}$?

$$\vec{N} = \vec{u} - \left(\frac{\vec{u} \cdot \vec{v}}{|\vec{v}|} \cdot \frac{\vec{v}}{|\vec{v}|} \right)$$

$$\vec{u} - \left(\frac{20}{\sqrt{20}} \cdot \frac{\langle 4, 2 \rangle}{\sqrt{20}} \right)$$



$$\vec{P} = \langle 4, 2 \rangle$$

$$\vec{N} = \langle -1, 2 \rangle$$

$$\vec{N} = \vec{u} - \langle 4, 2 \rangle$$

$$\vec{N} = \langle 3, 4 \rangle - \langle 4, 2 \rangle$$

$$\vec{N} = \langle -1, 2 \rangle$$