Math 1172 - Autumn 2015

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 $\vec{u} \cdot \vec{v}$.

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

$12 + 8 = 20$ ✓

b) [1 pt] Find $\cos\theta$, where $0 \le \theta \le \pi$ 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 $proj_{\vec{v}}\vec{u}$?

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

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

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

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

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

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

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