MAT 238 (Calculus 3), Prof. Jim Swift
Worksheet 3 = Quiz 1: Vectors, Lines, and Planes

Name: _____

As hints for this quiz, I am giving you two formulas that you have hopefully memorized. I will *not* give you these formulas on the exam.

$\mathbf{a} \cdot \mathbf{b} = \|\mathbf{a}\|\|\mathbf{b}\| \cos(\theta)$, so $\theta = \arccos\left(\frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\| \|\vec{b}\|}\right)$. This holds because $0 \le \theta \le \pi$

$\mathbf{n} \cdot (\mathbf{r} - \mathbf{r}_0) = 0.$

Calculators are not allowed on this quiz, or on any exams.

1. Find the angle between $\langle 0, 1, 0 \rangle$ and $\langle 3, 4, \sqrt{7} \rangle$. For almost full credit, give the correct answer in the form $\theta =$ something. For full credit, evaluate any inverse trig functions in your final answer if it is possible to do so without a calculator.

$\vec{a} = \langle 0,1,0 \rangle$, $\vec{b} = \langle 3, 4, \sqrt{7} \rangle$

$\vec{a} \cdot \vec{b} = 0 + 4 + 0 = 4$

$\|\vec{a}\| = 1$, $\|\vec{b}\| = \sqrt{9+16+7} = \sqrt{25+7} = \sqrt{32} = \sqrt{16} \cdot \sqrt{2}$

$= 4\sqrt{2}$

So $\theta = \arccos\left(\frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\| \|\vec{b}\|}\right) = \arccos\left(\frac{4}{4\sqrt{2}}\right)$ *

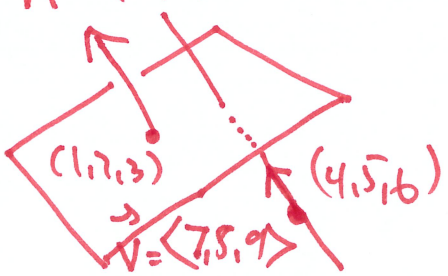
$\theta = \arccos\left(\frac{1}{\sqrt{2}}\right) = \frac{\pi}{4}$

correct

Full credit

2. Find an equation of the plane that goes through the point $(1, 2, 3)$, and which is perpendicular to the line with parametric equation $\mathbf{r}(t) = \langle 4, 5, 6 \rangle + t\langle 7, 8, 9 \rangle$.

$\vec{n} = \langle 7,8,9 \rangle$



$\vec{v}$ of line $= \vec{n}$ of plane $= \langle 7, 8, 9 \rangle$

$\vec{n} \cdot (\vec{r} - \vec{r}_0) = 0$

$\vec{n} = \langle 7,8,9 \rangle$, $\vec{r}_0 = \langle 1,2,3 \rangle$, $\vec{r} = \langle x, y, z \rangle$

$\langle 7,8,9 \rangle \cdot \langle x-1, y-2, z-3 \rangle = 0$

An equation is $\boxed{7(x-1) + 8(y-2) + 9(z-3) = 0}$

Another equation is $7x + 8y + 9z = 50$, but that takes work.