Math 173 - Quiz 2

January 25, 2018

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (2 points) The vector $\vec{w}$ has initial point $(9, 3, 2)$ and terminal point $(-3, 3, 8)$. Find a vector that is parallel to $\vec{w}$ and has a third component of 5.

$\vec{w} = -12\hat{i} + 6\hat{k}$

$\frac{5}{6}\vec{w} = -10\hat{i} + 5\hat{k}$

2. (3 points) Find the angle between the vectors $\vec{u} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{v} = \hat{i} - 2\hat{j} + \hat{k}$.

$$\cos\theta = \frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\,\|\vec{v}\|} = \frac{2(1)-3(-2)+1(1)}{\sqrt{4+9+1}\sqrt{1+4+1}} = \frac{9}{\sqrt{14}\sqrt{6}} \approx 0.98198$$

$\Rightarrow \theta \approx 10.89^\circ$

3. (2 points) Referring to the vectors in problem #2, find the projection of $\vec{v}$ onto $\vec{u}$.

$$\text{proj}_{\vec{u}}\vec{v} = \frac{\vec{u}\cdot\vec{v}}{\vec{u}\cdot\vec{u}}\vec{u} = \frac{9}{14}\vec{u} = \frac{9}{14}(2\hat{i} - 3\hat{j} + \hat{k})$$

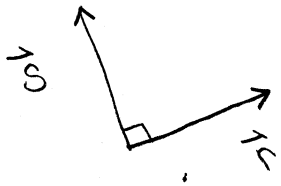
4. (2 points) Let $\vec{w} = 3\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{v} = 2\hat{i} - 2\hat{j} + 3\hat{k}$. Compute $\vec{v} \times \vec{w}$.

$$\vec{v}\times\vec{w} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -2 & 3 \\ 3 & 2 & -1 \end{vmatrix} = \hat{i}(2-6) - \hat{j}(-2-9) + \hat{k}(4+6)$$

$$= -4\hat{i} + 11\hat{j} + 10\hat{k}$$

5. (1 point) Suppose $\vec{r}$ and $\vec{s}$ are nonzero, orthogonal vectors. Describe the projection of $\vec{r}$ onto $\vec{s}$.

$$\text{proj}_{\vec{s}}\vec{r} = \frac{\vec{s}\cdot\vec{r}}{\vec{s}\cdot\vec{s}}\vec{s} = \vec{0}$$



BECAUSE $\vec{s}\cdot\vec{r} = 0$

PROJECTION IS THE ZERO VECTOR..