Directions: Please show all work for maximum credit. This quiz is worth 14 points. Good luck!

1. Given $\vec{u} = 2\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{v} = 2\hat{i} + 5\hat{j} - 4\hat{k}$. Determine the following:

(2 points) *a.* $\vec{u} \cdot \vec{v}$

$$2 \cdot 2 + (-2) \cdot 5 + 3 \cdot (-4)$$

$$= 4 + (-10) + (-12)$$

$$= -18$$

(3 points) *b.* $\vec{u} \times \vec{v}$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -2 & 3 \\ 2 & 5 & -4 \end{vmatrix} = \hat{i}(8-15) - \hat{j}(-8-6) + \hat{k}(10+4)$$

$$= -7\hat{i} + 14\hat{j} + 14\hat{k}$$

(3 points) *c.* $\text{proj}_{\vec{v}}\vec{u}$

$$\frac{\vec{u} \cdot \vec{v}}{|\vec{v}|} \cdot \frac{\vec{v}}{|\vec{v}|}$$

$$|\vec{v}| = \sqrt{4 + 25 + 16} = \sqrt{45} = 3\sqrt{5}$$

$$\frac{-18}{\sqrt{45}} \cdot \frac{\langle 2, 5, -4 \rangle}{\sqrt{45}}$$

$$= -\frac{18}{45} \langle 2, 5, -4 \rangle = -\frac{2}{5} \langle 2, 5, -4 \rangle$$

$$= \langle -\frac{4}{5}, -2, \frac{8}{5} \rangle$$

(3 points) 2. Find parametric equations for the line through the points $(4,2,-1)$ and $(6,-3,2)$.

$$\overrightarrow{PQ} = \langle 2, -5, 3 \rangle$$

$$x = 4 + 2t$$
$$y = 2 - 5t$$
$$z = -1 + 3t$$

(3 points) 3. Find the equation of the plane that contains the points $(2,3,-1)$, $(-1,4,1)$ and $(4,-1,5)$.

$$\overrightarrow{PQ} = \langle -3, 1, 2 \rangle \qquad \overrightarrow{PR} = \langle 2, -4, 6 \rangle$$

$$\overrightarrow{PQ} \times \overrightarrow{PR} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ -3 & 1 & 2 \\ 2 & -4 & 6 \end{vmatrix} = \hat{\imath}\,(6+8) - \hat{\jmath}\,(-18-4) + \hat{k}\,(12-2)$$

$$= 14\hat{\imath} + 22\hat{\jmath} + 10\hat{k}$$

$$14(x-2) + 22(y-3) + 10(z+1) = 0$$
$$14x - 28 + 22y - 66 + 10z + 10 = 0$$
$$14x + 22y + 10z - 84 = 0$$
$$7x + 11y + 5z - 42 = 0$$