Math 20C Practice Midterm 1

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1) Let $\mathbf{u} = \langle 1, 2, -2\rangle$ and $\mathbf{v} = \langle 1, -3, 2\rangle$ and $\mathbf{w} = \langle 11, -3, -2\rangle$

a) Compute $\mathbf{u} \times \mathbf{v}$
b) Find the area of the paralellogram spanned by $\mathbf{u}$ and $\mathbf{v}$.
c) Express $\mathbf{w}$ as a linear combination of $\mathbf{u}$ and $\mathbf{v}$.
d) Find $\mathbf{w} \cdot (\mathbf{u} \times \mathbf{v})$
e) Find $\mathbf{e_u}$
f) Find the projection of $\mathbf{v}$ along $\mathbf{u}$
g) Find the point of intersection between the following two lines:

$$\mathbf{r}(t) = \langle 6+t, 12-3t, -12+2t\rangle \qquad \mathbf{s}(t) = \langle 5, -15, 10\rangle + t\langle 1, 2, -2\rangle$$

2) Suppose $\mathbf{u}$ is a unit vector and suppose $\mathbf{v}$ is a vector with $||\mathbf{v}|| = 2$, for which $||\mathbf{u}+\mathbf{v}|| = \frac{3}{2}$.
Find $||\mathbf{4u} - \mathbf{2v}||$

3)

$$P = (5, 15, -10), \quad Q = (20, -5, 10), \quad R = (-1, -1, -1), \quad S = (4, 3, -2), \quad T = (-1, 2, 3)$$

Find a vector parametrization for the line with the given description:

Line that passes through the point on $\overline{PQ}$ lying three fifths ($\frac{3}{5}$) of the way from P to Q, and is perpendicular to the plane that contains points R, S, and T.

4)
a) Find the equation of a plane that contains the line $\mathbf{r}(t) = \langle 3t, t, 2t+1\rangle$ and is perpendicular to the plane $2x - y + 5z = 9001$. Express your answer in 3 forms (one vector form, and two scalar forms).
b) Find $\cos(\theta)$, where θ is the angle between the plane found in part a) and the xz-plane.