For this whole quiz: Simplify all your answers completely, but you don't need to rationalize denominators.

1. Given points P(4, 2, 7), Q(3, 1, 8), and R(5, -1, 11), and plane W that contains the points P, Q, and R. [2 pts each]

a)
$$\overrightarrow{PQ} = \langle -1, -1, 1 \rangle$$

b)
$$\overrightarrow{PR} = \langle 1, -3, 4 \rangle$$

c)
$$\overrightarrow{PQ} \cdot \overrightarrow{PR} = -1 + 3 + 4$$

= $\boxed{6}$

d)
$$proj_{\overrightarrow{PR}} \overrightarrow{PQ} = \frac{\overrightarrow{PR} \cdot \overrightarrow{PQ}}{|\overrightarrow{PR}|^2} \cdot \overrightarrow{PR}$$

$$= \frac{6}{26} \le 1, -3, 47$$

$$= \frac{3}{13} \cdot 2 - \frac{9}{13} \cdot 2 + \frac{12}{13} \cdot 2$$

e)
$$\overrightarrow{PQ} \times \overrightarrow{PR} = \langle -1, -1, 1.7 \times \langle 1, -3, 4 \rangle$$

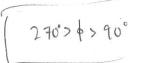
= $\left[-\frac{1}{C} + 5 \frac{1}{2} + 4 \frac{1}{2} \right]$

f) Write a vector equation of plane W.

g) Find a unit vector that is normal to plane W.

h) Find the area of the triangle that has P, Q, and R as its vertices.

The dot product of two (non-zero) vectors is negative. What does that mean about the angle between the vectors?
 pt]



3. The cross product of two (non-zero) vectors is 0. What does that mean about the angle between the two vectors? [2 pt]

4. Vector $\vec{n} = \langle -2,8,5 \rangle$ is normal to plane P, and the point A(1, -3, 6) is in the plane. Give the equation of the plane in standard form (Ax + By + Cz = D). [3 pts]

$$-2x+8y+5=D',(1,-3,6)$$

$$-2-24+30=D$$

$$D=4$$

$$-2x+8y+5=4$$

- $\text{(§. The vector equation of plane R is given as } \langle x,y,z\rangle = \langle 8,-5,2\rangle + s\langle 0,1,3\rangle + t\langle -1,0,4\rangle.$
 - a) Write the equation of the plane in standard form (Ax + By + Cz = D). [3 pts]

$$\{0, 1, 3\} \times \{-1, 0, 4\}$$

= $\{4, -3, 1\}$
 $\{2, -3, 1\}$
 $\{4, -3, 1\}$
 $\{4, -3, 1\}$
 $\{4, -3, 1\}$
 $\{4, -3, 1\}$
 $\{4, -3, 1\}$

b) Find the distance from plane R to the point (10, 11, 12). [2 pts]

6. Consider the points A(x, 11, -1), B(8, 10, -8), and C(12, 2, 1). A and B are in Plane P, and vector \overrightarrow{AC} is normal to the plane. Find all possible values for x. [4 pts]

$$\begin{aligned}
\vec{AC} &= (R-x')\hat{i} - q\hat{j} + 2\vec{\pi} \\
(12-x')x - qy + 2z = 0
\end{aligned}$$

$$\begin{aligned}
(12-x')x - q0 + (-16) &= 0
\end{aligned}$$

$$\begin{aligned}
D &= -8x' - 10
\end{aligned}$$

$$(12-x')x' - q1 + (-2) &= 0 = -8x' - 10
\end{aligned}$$

$$\begin{aligned}
-q1 &= x'^2 - 20x' + q1 = 0; (x'-7)(x'-13) = 0
\end{aligned}$$
7. Given: $\vec{u} \cdot \vec{v} = 0$, $|\vec{u}| = 12$, and $|\vec{u} \times \vec{v}| = 6$.
$$|\vec{v}| &= \frac{1}{2} \quad [1 \text{ pt}]$$

8. $\langle 4, y, z \rangle \times \langle 9, 1, 3 \rangle = \langle -13, 51, 22 \rangle$. Solve for y and z. Show all your work to receive credit. [4 pts]

$$\begin{array}{lll}
\alpha \times b &= |\alpha_{x}b_{y} - b_{x}\alpha_{y}|^{2} + (\alpha_{z}b_{y} - \alpha_{x}b_{z}) \vec{j} + (\alpha_{z}b_{y} - \alpha_{y}b_{x}) \vec{k} \\
-13 &= 3y - 2 \\
51 &= 9z - 12 \\
22 &= 4 - 9y \\
7 &= -2, z - 7
\end{array}$$

$$\begin{array}{ll}
y &= -2, z - 7 \\
y &= -2
\end{array}$$

9. Plane P is determined by the equation -3x + 4y + 5z = 21. Find the rectangular equations of both planes that are parallel to Plane P and $\sqrt{2}$ units away from Plane P. [3 pts]