1. Determine if the following statements are true or false.
   (a) [2 pts] If $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \cdot \mathbf{c}$, and $\mathbf{a}$ is not the zero-vector (i.e. $\mathbf{a} \neq \mathbf{0}$), then $\mathbf{b} = \mathbf{c}$.

   (b) [2 pts] If the vector $\mathbf{a}$ satisfies the equation $\mathbf{a} \cdot \mathbf{b} = 0$ for all vectors $\mathbf{b}$, then $\mathbf{a}$ is the zero-vector.

2. [3 pts] If $\mathbf{a} = \langle 2, -1, 2 \rangle$ and $\mathbf{b} = \langle 1, -1, 2 \rangle$, find a non-zero vector $\mathbf{c}$ such that $\mathbf{a} \cdot \mathbf{c} = \mathbf{b} \cdot \mathbf{c} = 0$.

3. [3 pts] Determine the projection vector $\mathsf{proj}_{\mathbf{a}}(\mathbf{b})$ of $\mathbf{b}$ onto $\mathbf{a}$ where $\mathbf{a} = \langle 1, 2, 3 \rangle$ and $\mathbf{b} = \langle 1, 2, 2 \rangle$.

4. [3 pts] If the scalar projection of $\mathbf{b}$ onto $\mathbf{a}$ is $\|\mathsf{proj}_{\mathbf{a}}(\mathbf{b})\| = 1$, determine the value of $\|\mathsf{proj}_{2\mathbf{a}}(3\mathbf{b})\|$.

5. Consider the points $P(3,1,1), Q(4,1,2)$, and $R(4,4,1)$ in $\mathbb{R}^3$.

   (a) [3 pts] Find an equation for the plane containing the points P, Q, and R.

   (b) [2 pts] Find the area of the triangle with vertices P, Q, and R.

6. [4 pts] Find an equation of the plane which passes through the points $(2,2,1)$ and $(-1,1,-1)$ and is perpendicular to the plane $2x - 3y + z = 3$.

7. [4 pts] Find a set of parametric equations for the line of intersection of the planes:

$$\begin{cases} 6x - 3y + z = 5 \\ -x + y + 5z = 5 \end{cases}$$

 Points earned: ______
out of a possible 16 points