

**Name:****Tutorial time:****Problem you want feedback on:**

Please complete all problems below, and indicate above which **one** problem you want feedback on.

1. Given  $\vec{u} = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$  and  $\vec{v} = \begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$ , find the orthogonal decomposition  $\vec{u} = \vec{u}_1 + \vec{u}_2$ , where  $\vec{u}_1$  is parallel to  $\vec{v}$ , and  $\vec{u}_2$  is orthogonal to  $\vec{v}$ . **Include a rough diagram.**

2. Find the point of intersection (if any) of the line  $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix} + t \begin{bmatrix} 3 \\ 5 \\ -1 \end{bmatrix}$  with the plane  $x - 2y + 3z = -6$

3. Find the shortest distance from the point  $P = (1, 3, -2)$  to the line through the point  $P_0 = (2, 0, -1)$  in the direction of  $\vec{v} = [1 \ -1 \ 0]^T$ . Also find the point  $P_1$  on the line that is closest to  $P$ . **Include a diagram.**

4. Find the shortest distance from the point  $P = (2, 8, 5)$  to the plane given by the equation  $x - 2y - 2z = 1$ . Also find the point  $P_1$  on the plane that is closest to  $P$ .  
*Hint:* Begin by finding any point  $P_0$  that lies on the plane. **Include a diagram.**