1. For the vectors 
\[ \overrightarrow{u} = [3, 1, 5], \quad \overrightarrow{v} = [1, 1, 2], \]
find \( \text{proj}_{\overrightarrow{u}} \overrightarrow{v} \) and find the cross product \( \overrightarrow{u} \times \overrightarrow{v} \).

2. Find the distance of the point \( A(2, -1, 0) \) from the plane \( P : x - 2y - 5z = 0 \).

3. Find the equation of the plane containing the points \( A(1, 1, 6), B(-2, 2, 4), C(0, 1, 4) \).

4. Find the vector equation for the line that contains the point \( (2, -1, 2) \) and is parallel to both the planes \( P_1 : x - y + 2z = 4 \) and \( P_2 : 2x - 3y + z = 4 \) (note that a line is parallel to a plane if the direction vector of the line is orthogonal to the normal vector of the plane).

5. Decide whether or not the following lines in \( \mathbb{R}^3 \) intersect, and if they intersect, find the coordinates of the intersection point.

\[ L_1 : \overrightarrow{r}(t) = [-3, 1, 5] + t[1, 2, -4] \]
\[ L_2 : \overrightarrow{m}(s) = [8, -1, 0] + s[3, -2, 1] \]

6. Show that
\[ \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} \]
is an eigenvector of the matrix
\[ \begin{pmatrix} 4 & 0 & 1 \\ 2 & 3 & 2 \\ 1 & 0 & 4 \end{pmatrix} \]
and find the corresponding eigenvalue.

7. Find the eigenvalues of the matrix
\[ \begin{pmatrix} 0 & -3 & 5 \\ -4 & 4 & 10 \\ 0 & 0 & 4 \end{pmatrix} \]
and find a non-zero eigenvector for each eigenvalue.