

Let $\vec{u}_1 = \begin{bmatrix} -1 \\ -3 \\ -2 \end{bmatrix}$, $\vec{u}_2 = \begin{bmatrix} -2 \\ 0 \\ 1 \end{bmatrix}$, $\vec{u}_3 = \begin{bmatrix} 3 \\ -5 \\ 6 \end{bmatrix}$, and $\vec{y} = \begin{bmatrix} 9 \\ -8 \\ 4 \end{bmatrix}$

1. Verify that $\mathcal{B} = \{\vec{u}_1, \vec{u}_2, \vec{u}_3\}$ is an orthogonal basis for \mathbb{R}^3
2. Find \hat{y}_1 , the orthogonal projection of \vec{y} onto \vec{u}_1
 \hat{y}_2 , the orthogonal projection of \vec{y} onto \vec{u}_2
 \hat{y}_3 , the orthogonal projection of \vec{y} onto \vec{u}_3
3. Write \vec{y} as a linear combination of $\vec{u}_1, \vec{u}_2, \vec{u}_3$
4. Form the matrix $A = \begin{bmatrix} \vec{u}_1 & \vec{u}_2 & \vec{u}_3 \end{bmatrix}$, and calculate $A^T A$