1. Let $y = \begin{bmatrix} 6 \\ 3 \\ -2 \end{bmatrix}$, $u_1 = \begin{bmatrix} 3 \\ 4 \\ 0 \end{bmatrix}$ and $u_2 = \begin{bmatrix} -4 \\ 3 \\ 0 \end{bmatrix}$.

Find the orthogonal projection of $y$ onto $W = \text{span } \{u_1, u_2\}$.

2. Let $u_1 = (3, 6, 0)$, $u_2 = (1, 2, 2)$. Find the projection of $y = (0, 5, 1)$ onto $W = \text{span } \{u_1, u_2\}$.

3. Find a QR factorization of
$$A = \begin{bmatrix} -1 & 3 \\ 1 & 5 \end{bmatrix}.$$

4. a) Find a least-squares solution of $Ax = b$ where

$$A = \begin{bmatrix} 1 & -2 \\ -1 & 2 \\ 0 & 3 \\ 2 & 5 \end{bmatrix} \quad , \quad b = \begin{bmatrix} 3 \\ 1 \\ -4 \\ 2 \end{bmatrix}.$$

b) What is the least-squares error?
(i.e., if $\hat{x}$ is the least-squares solution, what is $\|A\hat{x} - b\|$?)