

1. $B = \{(1, 1, 0), (0, 0, 1), (1, -1, 0)\}$
2. $Q = \frac{\sqrt{2}}{2} \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & -1 \\ 0 & \sqrt{2} & 0 \end{bmatrix}, \quad R = \begin{bmatrix} \sqrt{2} & \sqrt{2} & \frac{\sqrt{2}}{2} \\ 0 & 1 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{2} \end{bmatrix}.$
3. a) $\begin{bmatrix} 21 & 25 \\ 25 & 35 \end{bmatrix} \begin{bmatrix} \hat{x}_1 \\ \hat{x}_2 \end{bmatrix} = \begin{bmatrix} 20 \\ 20 \end{bmatrix}$
 b) $\begin{bmatrix} \hat{x}_1 \\ \hat{x}_2 \end{bmatrix} = \begin{bmatrix} \frac{20}{11} \\ -\frac{8}{11} \end{bmatrix}$
4. $\left\{ \begin{bmatrix} 5 \\ -1 \\ 3 \end{bmatrix}, \begin{bmatrix} -1 \\ -2 \\ 1 \end{bmatrix}, \begin{bmatrix} -5 \\ 8 \\ 11 \end{bmatrix} \right\}$
5. $\begin{bmatrix} 13 \\ 4 \\ 3 \end{bmatrix}$
6. $R = \begin{bmatrix} \sqrt{35} & \sqrt{35} & -\sqrt{35} \\ 0 & \sqrt{6} & -\sqrt{6} \\ 0 & 0 & \sqrt{210} \end{bmatrix}$
7. $U^T U \vec{x} = \vec{x} \quad \text{et} \quad U U^T \vec{y} = \text{proj}_W \vec{y}$
8. $\hat{x}_2 = -4$
9. a) F b) V c) F d) V
10. a) F b) F c) V d) V
13. $B = \{(2, 1, -2), (4, 2, 5), (1, -2, 0)\}$
14. $Q = \begin{bmatrix} \frac{2}{3} & \frac{4\sqrt{5}}{15} & \frac{\sqrt{5}}{5} \\ \frac{1}{3} & \frac{2\sqrt{5}}{15} & -\frac{2\sqrt{5}}{5} \\ -\frac{2}{3} & \frac{\sqrt{5}}{3} & 0 \end{bmatrix}, \quad R = \begin{bmatrix} 3 & 1 & -\frac{5}{3} \\ 0 & \sqrt{5} & -\frac{\sqrt{5}}{15} \\ 0 & 0 & \frac{\sqrt{5}}{5} \end{bmatrix}.$
15. $Q = \frac{1}{5} \begin{bmatrix} 1 & -2 & -4 \\ 2 & 1 & 2 \\ 2 & -4 & 2 \\ 4 & 2 & -1 \end{bmatrix}, \quad R = \begin{bmatrix} 5 & -2 & 1 \\ 0 & 4 & -1 \\ 0 & 0 & 2 \end{bmatrix}.$
17. a) $\begin{bmatrix} 9 & -4 & 0 \\ -4 & 6 & -5 \\ 0 & -5 & 6 \end{bmatrix} \begin{bmatrix} \hat{x}_1 \\ \hat{x}_2 \\ \hat{x}_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -6 \\ 6 \end{bmatrix}$
 b) $\begin{bmatrix} \hat{x}_1 \\ \hat{x}_2 \\ \hat{x}_3 \end{bmatrix} = \begin{bmatrix} 14 \\ 30 \\ 26 \end{bmatrix}$
 c) $\|A\hat{x} - \vec{b}\| = \sqrt{12} = 2\sqrt{3}$