1. Let
$$A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 5 \\ -1 & 2 & 0 \end{bmatrix}.$$

   Show that the column vectors of A form an orthogonal basis for the column space of A with respect to the standard dot-product, and then find an orthonormal basis for that column space.

2. Find an orthonormal basis for the plane $x - y + z = 0$ in $\mathbb{R}^3$.

3. Find QR decomposition of
$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}.$$

4. Find a QR decomposition of the matrix
$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{bmatrix}.$$

5. * Use the Gram–Schmidt orthogonalization process to obtain an orthonormal basis for the column space of the matrix
$$A = \begin{bmatrix} 0 & 1 & 1 & 2 \\ 1 & 2 & 0 & 2 \\ -1 & 1 & 0 & 1 \end{bmatrix}.$$