1. Suppose that $\{\mathbf{u}, \mathbf{v}, \mathbf{w}\}$ is a linearly independent set of vectors in a vector space V. Determine whether or not the set $\{\mathbf{u}+\mathbf{w}, \mathbf{v}+\mathbf{w}, \mathbf{v}-\mathbf{u}\}$ is linearly independent.

2. Define $T : M_{2\times 2} \to \mathcal{P}_1$ by $T\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = (a+d)t + b$. Find a basis for the kernel of T.

3. Find all values of a and b for which the given system is consistent. Your answer should be in the form of an equation.

$$\begin{aligned} x_1 + 2x_2 + 11x_3 &= a \\ x_1 - 4x_2 + 5x_3 &= 7 \\ x_2 + x_3 &= b \end{aligned}$$

4. Let $T\colon \mathbb{R}^2 \to \mathbb{R}^3$ be a linear transformation. Suppose that

$$T\left(\begin{bmatrix} 1 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \quad \text{and} \quad T\left(\begin{bmatrix} 2 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}.$$

Find the standard matrix representing the transformation T.