Name: _____

Directions: Show all work. No credit for answers without work.

1. **[3 points]** Given that $L\colon P_2 \to P_1$ is a linear transformation and

$$L(t^2) = 2t + 4 \qquad L(t) = -3t + 6 \qquad L(1) = t + 2,$$

find $L(2t^2 + 3t - 1)$.

2. **[3 points]** Let $L\colon M_{22} \to \mathbb{R}^2$ be the linear transformation given by

$$L\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = \begin{bmatrix} a - d \\ b - c \end{bmatrix}.$$

Find a basis for $\ker L$.

3. **[4 points]** We define a function $L\colon \mathbb{R}^2 \to \mathbb{R}^2$ by

$$L\left(\begin{bmatrix} u_1 \\ u_2 \end{bmatrix}\right) = \begin{bmatrix} 3u_2 - u_1 \\ u_1 + u_2 \end{bmatrix}.$$

Is L a linear transformation? Justify your answer.