1. Let $T : P_3 \to \mathbb{R}^2$ be the function that takes a polynomial $p(x)$ to the vector $\begin{bmatrix} p(1) \\ p(-1) \end{bmatrix}$.

(a) (Four points) Show that $T$ is a linear transformation.

(b) (One point) Find a nonzero vector in the kernel of $T$. (I don’t want a spanning set for the kernel. Just a single vector is fine.)
2. (Five points) Suppose $A$ is an $n \times n$ matrix. Consider the set

$$W = \{ \vec{v} \in \mathbb{R}^n : A\vec{v} = 5\vec{v} \}.$$ 

Show that $W$ is a subspace of $\mathbb{R}^n$. 
