Problem 1 - 5 Points

Consider the linear transformation $T : \mathbb{P}_2 \to \mathbb{P}_2$ given by $T(p(x)) = p(0) + p(1) \cdot x + p'(x) \cdot 2x$.

1. Using the standard basis $E = \{1, x, x^2\}$, find the standard matrix of the transformation $[T]_E$.

2. Find a basis $B$ such that the matrix representation of the transformation under this basis $[T]_B$ is diagonal. What is $[T]_B$ under this basis?
Problem 2 - 5 Points

1. Show that \( \|u + v\| \leq \|u\| + \|v\| \).

2. If \( \|u + v\| = \|u\| + \|v\| \), what can you say about \( u \), \( v \)? (Hint: This is called the triangle inequality. Why? Draw a picture to see what’s going on!)