

MA 442 - Quiz

February 18

Name: _____ **BUID:** _____

There are two questions, you must answer both.

Question 1. Is there a linear transformation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ such that $T(1, 0, 1) = (1, 1)$, $T(1, 0, -1) = (1, 1)$ and $T(0, 0, 2) = (2, 1)$? You must justify your answer.

Question 2. Let P_k be the vector space of polynomials of degree $\leq k$. Recall that this is a vector space of dimension $k + 1$. Let $T: P_2 \rightarrow \mathbb{R}[x]$ be the linear map defined by

$$T(f(x)) = f'(x) + xf(x). \quad (1)$$

For example $T(x^2) = 2x + x^3$. (You do not need to check that this is linear.)

Compute $\dim \ker T$ and $\dim \operatorname{Im} T$. (Hint: You should only need to compute one of these explicitly.)