# Writing Assignment 6: Due Wednesday, March 13

**Problem 1:** Suppose that $A$ is an $2 \times 2$ idempotent matrix (recall this means that $A^2 = A$).
a. Show that the only possible eigenvalues of $A$ are 0 and 1.
b. Show that if $A \neq I$, then $A$ is not invertible.
c. Show that if $A \neq I$, then 0 must be an eigenvalue of $A$.

**Problem 2:** Let $T\colon \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation. Show that $\mathsf{Null}(T) \neq \{\vec{0}\}$ if and only if there exists a basis $\alpha$ of $\mathbb{R}^2$ such that the second column of $[T]_\alpha$ is the zero vector.
*Note:* Recall that "if and only if" means that each of the two directions are true, so you need to argue both.