Name: _____

1. (5 points) Find the matrix B of the linear transformation

$$T(\vec{x}) = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \vec{x}$$

with respect to the basis

$$\mathcal{B} = \left\{ \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \end{pmatrix} \right\}.$$

2. (4 points) Prove the set of 3×3 matrices A such that the vector $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ is in the kernel of A is a subspace of $\mathbb{R}^{3\times 3}$.

3. (2 points) True or false. Indicate whether the following statements are true or false.

   (a) The function $T(M) = 7M$ from $\mathbb{R}^{2\times 2}$ to $\mathbb{R}^{2\times 2}$ is a linear transformation.

   (b) The function $T(M) = M^2$ from $\mathbb{R}^{2\times 2}$ to $\mathbb{R}^{2\times 2}$ is a linear transformation.