This is an “un-quiz” to help you check if you’re understanding the material. You should give yourself 10 minutes to try this problem, and you should not use any notes, texts, or other aids. If you would like to turn this in, I will grade it as if it were an exam problem.

Construct an explicit example of a linear transformation matching each of the descriptions below, or explain why this is impossible.

1. \( S : \mathbb{R}^3 \rightarrow \mathbb{R}^2 \) such that the image of \( S \) is the \( y \)-axis.

2. \( T : \mathbb{R}^2 \rightarrow \mathbb{R}^3 \) such that the image of \( T \) is a plane containing the line \( \{ t \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \mid t \in \mathbb{R} \} \).

3. \( U : \mathbb{R}^3 \rightarrow \mathbb{R}^3 \) such that the image of \( U \) is the plane \( z = 2 \) in \( \mathbb{R}^3 \).

4. \( V : \mathbb{R}^2 \rightarrow \mathbb{R}^2 \) such that the image of \( V \) does not contain the point \( (3, 1) \).