1. What does it mean for vectors $v_1, \ldots, v_k$ to be *linearly independent*? Give the definition.

2. Which of the following sets of vectors are linearly independent? *Hint: No calculations are required.*

\[
\begin{align*}
\left\{ \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 10 \\ 20 \\ 30 \end{pmatrix} \right\} & \quad \text{DEPENDENT} & & \text{INDEPENDENT} \\
\left\{ \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right\} & \quad \text{DEPENDENT} & & \text{INDEPENDENT} \\
\left\{ \begin{pmatrix} 9 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 7 \\ 1 \\ 7 \end{pmatrix}, \begin{pmatrix} 2 \\ 4 \\ 6 \end{pmatrix} \right\} & \quad \text{DEPENDENT} & & \text{INDEPENDENT}
\end{align*}
\]
3. Suppose that $A$ is a $3 \times 2$ matrix and that $T$ is the linear transformation $T(v) = Av$.

What is the domain of $T$?

Is it possible for $T$ to be one-to-one?

YES          NO

4. Write down the standard matrix for the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ that rotates clockwise by $\pi/2$ and then orthogonally projects to the $x$-axis.