1. Give an example of a linear transformation from R^4 to R^3.

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}\right) = \begin{bmatrix} 3x_1 + 4x_4 \\ 5x_3 \\ 2x_2 - x_4 \end{bmatrix}$$

2. Give an example of a function that is NOT a linear transformation from R^4 to R^3.

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}\right) = \begin{bmatrix} 5x_1 + x_4 \\ 5x_3^3 \\ 5x_2 - x_4 \end{bmatrix}$$

3. True or False: If T: R^n --> R^m is a linear transformation, then there exists an m x n matrix A such that T = T_A; that is T(x) = T_A(x) = Ax.

True

4. What is the standard matrix? How is it defined for a linear transformation T?

The standard matrix is a unique m x n matrix whose columns are the images under T of the standard vectors for R^n. It is defined as A= [T($\mathbf{e}_1$) T($\mathbf{e}_2$) ... T($\mathbf{e}_n$)].

5. In Practice Problem 3 on pp. 175, what is the standard matrix for this linear transformation?

$$T(e_1) = \begin{bmatrix} 2 \\ 0 \end{bmatrix} \quad T(e_2) = \begin{bmatrix} 0 \\ -3 \end{bmatrix} \quad T(e_3) = \begin{bmatrix} -5 \\ 4 \end{bmatrix}$$

$$A = \begin{bmatrix} 2 & 0 & -5 \\ 0 & -3 & 4 \end{bmatrix}$$