Exercises on linear transformations and their matrices

Problem 30.1: Consider the transformation *T* that doubles the distance between each point and the origin without changing the direction from the origin to the points. In polar coordinates this is described by

$$T(r,\theta) = (2r,\theta).$$

- a) Yes or no: is *T* a linear transformation?
- b) Describe *T* using Cartesian (*xy*) coordinates. Check your work by confirming that the transformation doubles the lengths of vectors.
- c) If your answer to (a) was "yes", find the matrix of *T*. If your answer to (a) was "no", explain why the *T* isn't linear.

Problem 30.2: Describe a transformation which leaves the zero vector fixed but which is not a linear transformation.

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