

### Exercises on linear transformations and their matrices

**Problem 26.1:** 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 26.2:** Describe a transformation which leaves the zero vector fixed but which is not a linear transformation.