

7A Introduction to Linear Transformations with Matrices

Linear Transformations

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1. The three transformations **S**, **T** and **U** are defined below. Find the image of the point (2,3) under each of these transformations. State whether each is a *linear* transformation.

$$\mathbf{S}: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} x + 4 \\ y - 1 \end{bmatrix}$$

$$\mathbf{T}: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} 2x - y \\ x + y \end{bmatrix}$$

$$\mathbf{U}: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} 2y \\ -x^2 \end{bmatrix}$$

Matrices can be used to represent linear transformations:

2. Find matrices to represent these linear transformations:

$$\mathbf{T}: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} 2y + x \\ 3x \end{bmatrix}$$

$$\mathbf{V}: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} -2y \\ 3x + y \end{bmatrix}$$

3. The square S has coordinates $(1,1)$, $(3,1)$, $(3,3)$ and $(1,3)$.

Find the coordinates of the vertices of the image of S after the transformation given by the matrix:

$$\mathbf{M} = \begin{bmatrix} -1 & 2 \\ 2 & 1 \end{bmatrix}$$