Recall that a *linear transformation* of the plane is a function T that takes vectors in the plane as inputs and outputs such that:

(1) $T(\alpha\, v) \;=\; \alpha\, T(v)$ for all scalars α and all vectors v
(2) $T(v+w) \;=\; T(v) \;+\; T(w)$ for all vectors v and w

The first property means that if you first dialate, then apply T, you get the same result as if you applied T first then dialated. The second property means that T takes triangles to triangles.

Draw the images of $\hat{i}$ and $\hat{j}$ under each of the following linear transformations.

Dialations

Rotations

Reflections

Horizontal contractions/expansions

Vertical contractions/expansions

Horizontal shears, left and right

Vertical shears, up and down

Projections