

## 1.4: Affine mapping

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An **affine mapping** is any mapping that preserves collinearity and ratios of distances: if three points belong to the same straight line, their images under an affine transformation also belong to the same line. Moreover, the middle point is also conserved under the affine mapping. By contrast, angles and lengths in general are not kept constant by an affine mapping.

Under an affine mapping:

- parallel lines remain parallel;
- concurrent lines remain concurrent (images of intersecting lines intersect);
- the ratio of length of segments of a given line remains constant;
- the ratio of areas of two triangles remains constant;
- ellipses, parabolas and hyperbolas remain ellipses, parabolas and hyperbolas respectively;
- barycenters of polygons map into the corresponding barycenters.

Geometric contraction, expansion, dilation, reflection, rotation, shear, similarity transformations, spiral similarities, and translation are all affine transformations, as are their combinations. Affine mappings that keep also distances and angles are called [Euclidean mappings](#).

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