Geometry Info Sheet #21

Transformations, Dilations, and Scale Factors

Definitions

Transformation: A function that moves or changes a figure in some way to produce a new figure

Pre-Image: An object or figure before it is transformed

Image: An object or figure after undergoing a transformation

Rigid Transformation: A transformation that does not change the size or the shape of a figure

A **dilation** is a transformation that changes the size, but not the shape, of a figure. The size of the transformed image is enlarged or reduced with respect to a fixed point, called the **center of dilation**.

Center of Dilation: The point in a dilation through which every line connecting a pre-image point to an image point passes; it is a fixed point in the plane about which all other points are expanded or contracted

Scale Factor: In a dilation, the number by which the lengths of the sides of a figure (pre-image) are multiplied to determine the lengths of the sides of a new figure (image); it is the length of each side of the image divided by the corresponding side of the pre-image; a scale factor describes the size change from the pre-image to the image

If the absolute value of the scale factor is greater than 1, then the dilation is an **expansion** or **enlargement**.

If the absolute value of the scale factor is between 0 and 1, then the dilation is a **contraction** or **reduction**.

To dilate a figure in a coordinate plane that has a center of dilation at the origin $(0,0)$ and a scale factor of k, multiply the x and y coordinates of each vertex (point) of the figure by k: $D(x,y) = (kx, ky)$

In a coordinate plane, a scale factor can be negative. In a dilation with a negative scale factor, k, the resulting image is the same as the image produced by a composition of a dilation with scale factor $-k$ (the absolute value of k), followed by a **rotation of 180 degrees** about the center of dilation.