Isometries, Orientation, and Other Properties:

A line reflection can be thought of as a flip, a rotation as a turn, and a translation as a slide. The image of a figure is congruent to the original figure that was flipped, turned, or slid. Thus, we can say that distance is preserved. Angle measure, parallelism, midpoint area, and collinearity are also preserved. A transformation that preserves distance is called an **isometry**.

A dilation, however, changes the size of the image. Thus, we can say that a dilation is not an isometry; neither distance nor area is preserved. A dilation image is similar to the original figure. On the other hand, line reflection, point reflection, rotation, and translation are all examples of isometries.

The order in which the vertices of a figure appear is called the orientation of the figure. A transformation may or may not preserve this orientation. A **direct isometry** is an isometry that preserves orientation (the order of the vertices). An **opposite isometry** is an isometry that changes the order of the vertices from counterclockwise to clockwise or vice versa.

Vocabulary to Memorize:

Preserved – kept the same

Distance – lengths of segments

Parallelism – parallel lines remain parallel

Collinearity – points stay on the same lines

Orientation – ordering of the letters (vertices)

Isometry – Length is preserved. The figures are congruent.

Direct Isometry – Orientation is preserved. The order of the lettering in the figure and the image are the same, either both clockwise or counterclockwise.

Opposite Isometry – Orientation is not preserved. The order of the lettering is reversed; either clockwise becomes counterclockwise or counterclockwise becomes clockwise.

Try the following examples:

1) Triangle JAN has vertices J(-2,6), A(4,2), and N(8,2).
   a) On the coordinate plane, graph and label ΔJAN.
   b) Graph and state the coordinates of ΔJ'A'N', the image of ΔJAN after $D_{1/2}$.
   c) Graph and state the coordinates of ΔJ''A''N'', the image of ΔJAN after $r_{x\text{-axis}}$.

d) Which of the transformations is not an isometry? Explain your answer.

e) In which of the transformations is the orientation changed?

2) The coordinates of ΔABC are A(3,2), B(7,6), and C(7,1).

a) On the coordinate plane, draw and label ΔABC.

b) Graph and state the coordinates of ΔA'B'C', the image of ΔABC after $r_{x\text{-axis}}$.

c) Graph and state the coordinates of ΔA''B''C'', the image of ΔA'B'C' after $T_{0,-7}$.

d) Which of the above transformations is an example of a direct isometry?