Honors Geometry
Rigid Transformations

DATE: 10/18

Target 2B. Perform rigid transformations: translation, reflection, and rotation

Reflections

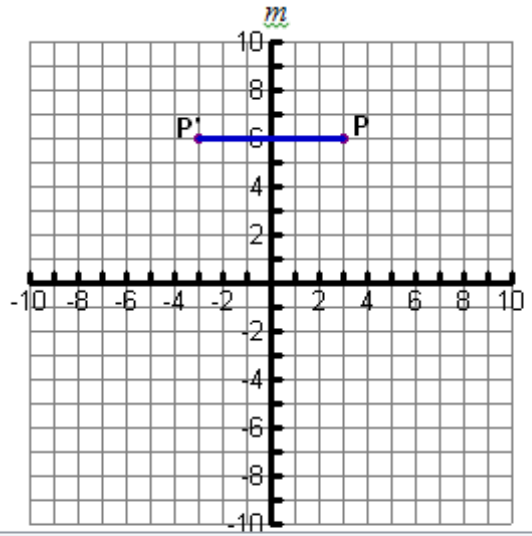
A reflection (a flip) is the mirror image of a figure across a line. This line is called the reflecting line, line of reflection, or mirror line.

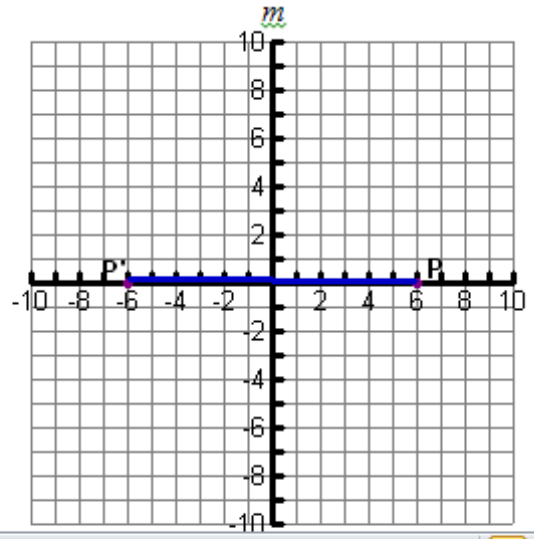
$r_m(P) = P'$ is read as: "reflection over line m of point P is P'."

Definition of **reflection**:

A reflection in line m maps every point P to a point P′ such that:

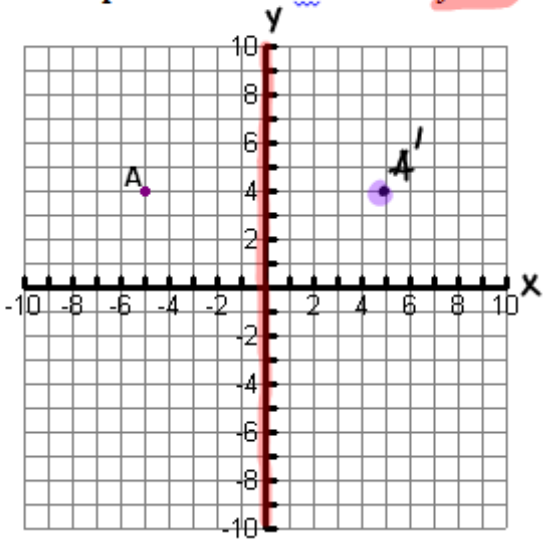
1. If P is not on line m, then $r_m(P) = P'$ where m is the perpendicular bisector of PP'.
2. If P is on line m, then $r_m(P) = P$. (P is its own reflection in line m.)



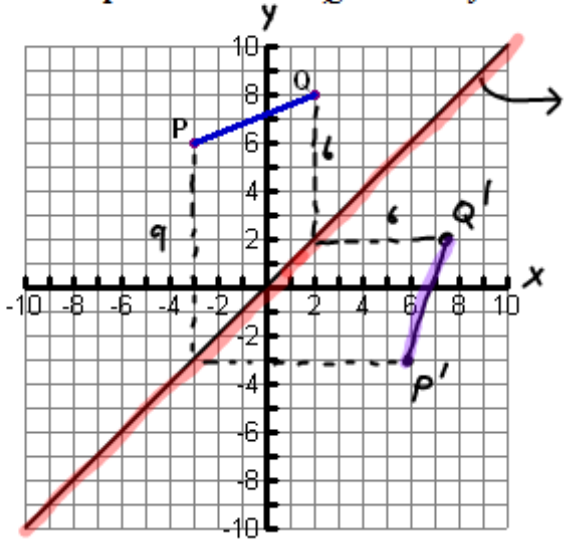


In a reflection, as in every rigid transformation, P is the original or pre-image point and P′ is the new or image point. Each point of the image is the same distance from the reflecting line as its pre-image point.

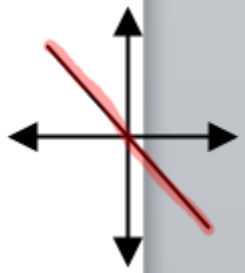
Example 1: Reflect A over the y-axis.



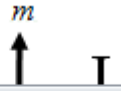
Example 2: Reflect $\overline{PQ}$ over the $y=x$ line.



what is the $y=-x$ line?



Example 3: Reflect the figure on the right over line m.



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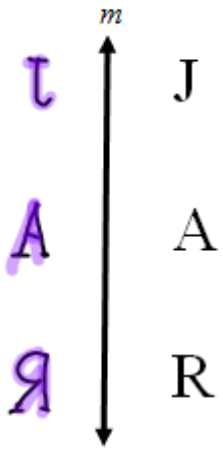
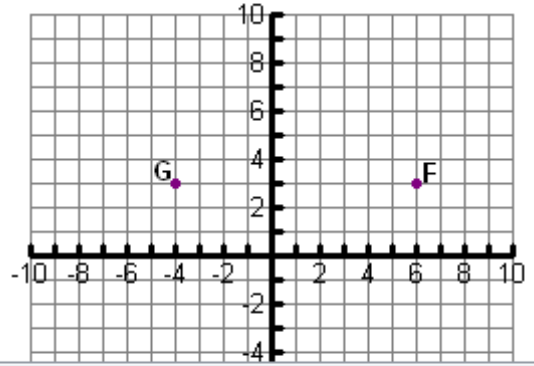


we used wax/patty paper!
Trace, flip, trace

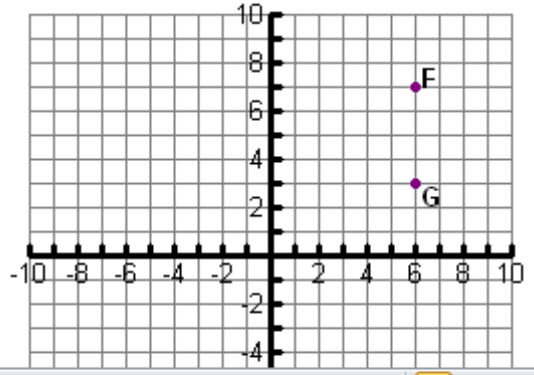
Approximately

Example 4: Draw each reflection.

1. Reflect F across the x-axis.
Reflect G across the x-axis.
What are the coordinates of F′?
What are the coordinated of G′?
What is the length of FG?
What is the length of F′G′?

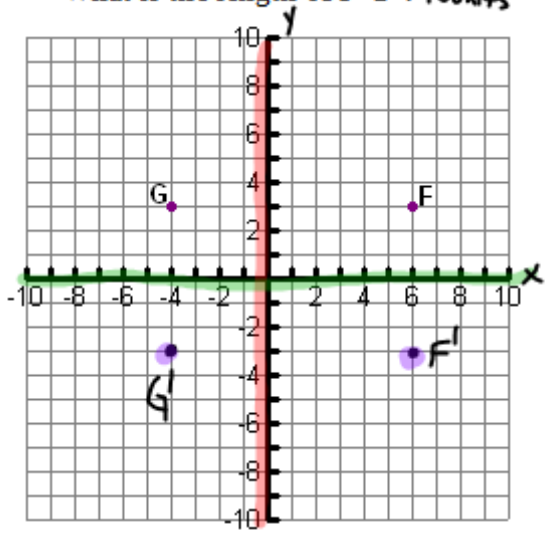


2. Reflect F across the y-axis
Reflect G across the y-axis.
What are the coordinates of F′?
What are the coordinated of G′?
What is the length of FG?
What is the length of F′G′?

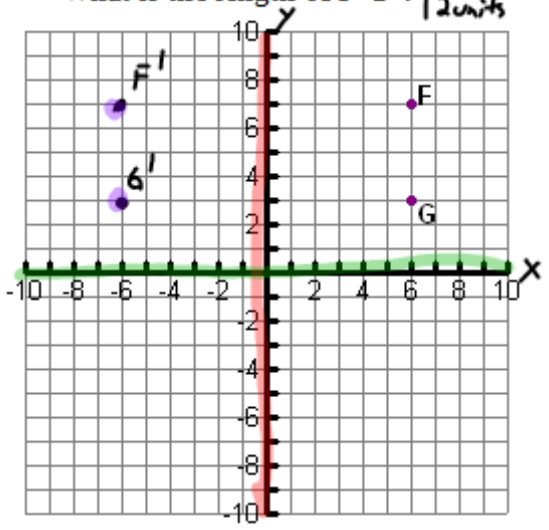


Example 4: Draw each reflection.

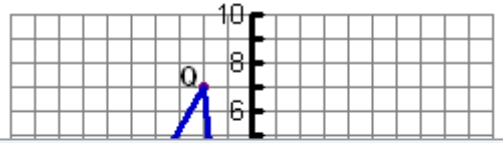
1. Reflect F across the *x*-axis.
Reflect G across the *x*-axis.
What are the coordinates of F′? (6, −3)
What are the coordinated of G′? (−4, −3)
What is the length of FG? 10 units
What is the length of F′G′? 10 units



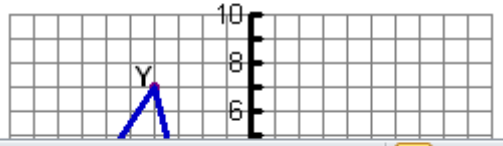
2. Reflect F across the *y*-axis
Reflect G across the *y*-axis.
What are the coordinates of F′? (−6, 7)
What are the coordinated of G′? (−6, 3)
What is the length of FG? 12 units
What is the length of F′G′? 12 units

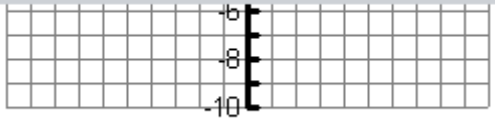


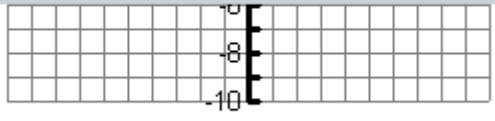
3. Reflect ΔPQR across the *y*-axis.
Label $\Delta P'Q'R'$.



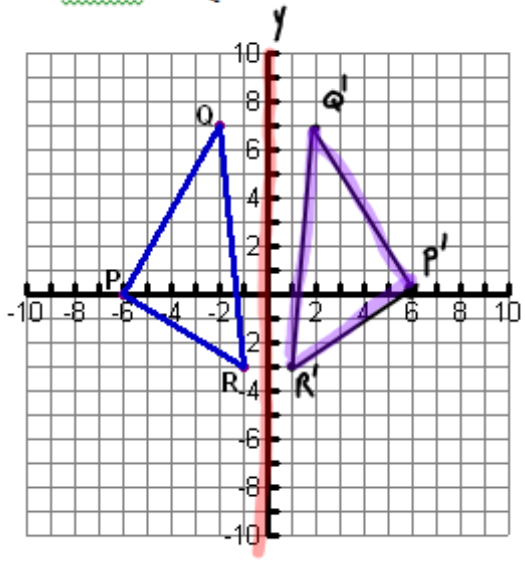
4. Reflect ΔXWZ over the line $y = x$.







3. Reflect ΔPQR across the y-axis. Label $\Delta P'Q'R'$.



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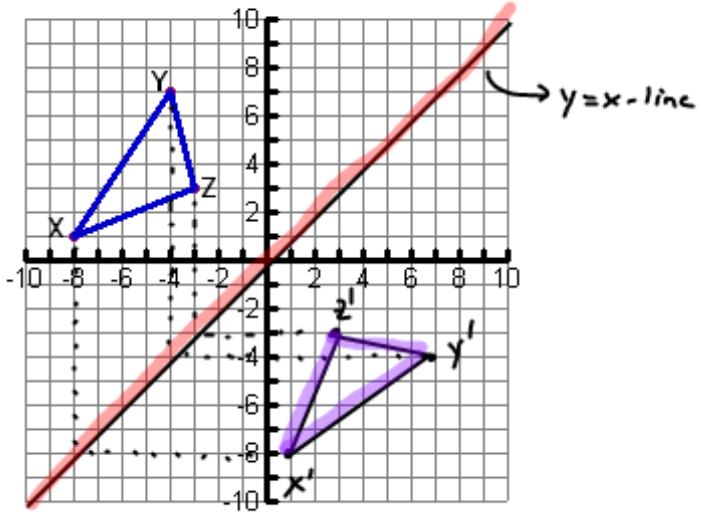

Practice

5. Reflect ΔABC over the x-axis.

6. Reflect ABCDE over the y-axis.

Symmetry

Symmetry is one idea by which man through the ages has tried to comprehend and create order, beauty, and perfection.

H. Weyl

The word **symmetry** may bring to the mind of an artist other words like *balance, harmony, and equally proportioned*. Flowers, insects, fish, birds, and many other natural objects are symmetric. The human body is symmetric. The chambered nautilus and crystals grow with the aid of symmetry. Since symmetry appears so abundantly in nature – plants, animals, and crystalline structures – it is not surprising that artists throughout history have taken pleasure in symmetric designs.

Symmetry in Nature

Because symmetric designs are so naturally pleasing, symmetric symbols are very popular. As a young child you probably made symmetric designs in school by folding or cutting paper, or using ink blots. Many companies use symmetric designs (logos) as their corporate symbols. Many countries throughout the world use symmetry in their flags.

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Jamaica

Burundi

Great Britian

Chrysler

Toyota

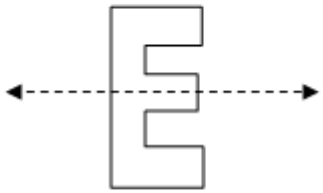
If a figure can be reflected about some line in such a way that the resulting image coincides with the original, then the figure has a **reflectional symmetry**. Reflection symmetry is also called **line symmetry**. The line is called the **axis of symmetry** or **line of symmetry**.

The letter **T** when reflected about its axis of symmetry is identical to the **T** in the original position. You can test a figure for reflectional symmetry by tracing and folding it. If you can fold it so that one half exactly coincides with the other half, the figure has reflectional symmetry.

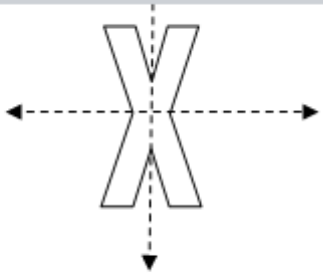
Reflectional symmetry is also called **mirror symmetry** because half a figure with reflectional symmetry is a mirror image of the other half. If you place a mirror on a figure's line of symmetry, perpendicular to the place of the figure, the half-figure and its image produce a complete figure.

If a figure's line of symmetry is vertical, the figure has a vertical symmetry. The letter **V** has a vertical axis of symmetry. Likewise, if the line of symmetry is horizontal, the figure has a horizontal symmetry. The letter **E** has horizontal symmetry. Some figures, like the letter **X** have both horizontal and vertical symmetry.

Vertical Symmetry

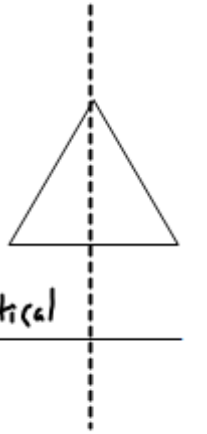


Horizontal Symmetry

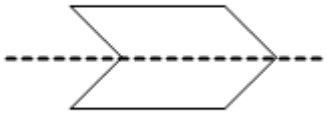


Horizontal and Vertical Symmetry

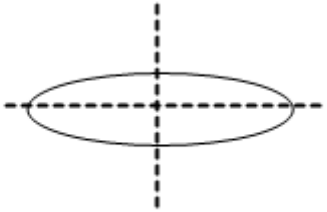
Example 1: What kind of symmetry does each of the following figures have?



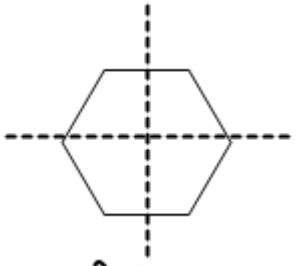
vertical



horizontal



Both hor. and vert.



Both hor. and vert.