Symmetry

Illustrative Mathematics®

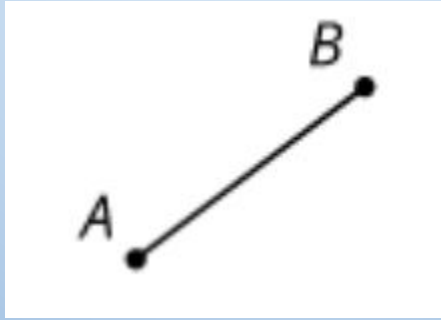
Learning Goal

- I can describe the reflections that take a figure onto itself

15.1 Back to the Start

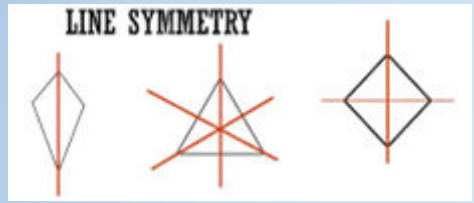
Here is a segment *AB*: If you translate the segment up 5 units then down 5 units, it looks the same as it did originally.

1. What other rigid transformations create an image that fits exactly over the original segment?
2. Are there any single rigid motions that do the same thing?

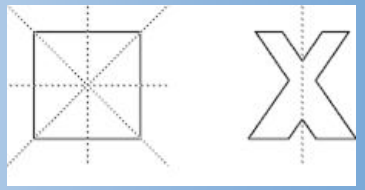


Activity Synthesis

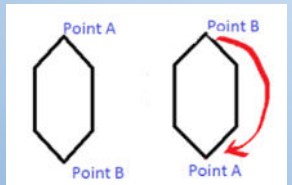
If a Rigid transformation exists that takes a figure onto itself, the figure is said to have <u>symmetry</u>.



Reflection Symmetry: single reflection takes a figure onto itself



Rotation symmetry: a single rotation strictly between 0 and 360 degrees takes a figure onto itself



15.2 Self Reflection

Determine all the **lines of symmetry** for the shape your teacher assigns you. Create a visual display about your shape. Include these parts in your display:

Work with your partner to complete your poster.

- the name of your shape
- the definition of your shape
- drawings of each line of symmetry
- a description in words of each line of symmetry
- one non-example in a different color (a description and drawing of a reflection not over a line of symmetry)

Activity Synthesis

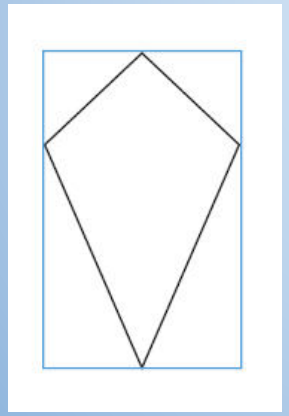
- Was there anything about the organization of the visual display that made the ideas especially clear? Was there anything about the organization that could be improved?
- Was there anything about the way the ideas are explained that made the ideas especially clear? Was there anything about the explanations that could be improved?
- Are there any lines of symmetry that the group missed?
- Are there any lines of symmetry that don't work for all shapes of the given type?

Activity Synthesis

- Which shapes had the fewest lines of symmetry? Which had the most?
- Were there any lines that you thought would be lines of symmetry, but when you tried to reflect, they turned out not to be?
- Describe a shape that would have no lines of symmetry

15.3 Diabolic Diagonals

Kiran thinks both diagonals of a kite are lines of symmetry. Tyler thinks only 1 diagonal is a line of symmetry. Who is correct? Explain how you know.



Work quietly, then compare with your partner.

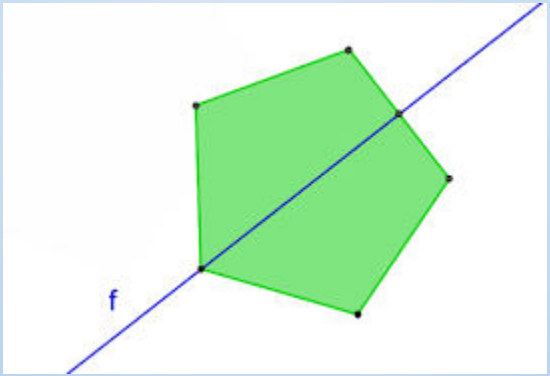
Activity Synthesis

Share your responses

Sample response: A line of symmetry reflects the kite onto itself. Reflections take segments to congruent segments. A kite has two pairs of sides next to each other that are congruent. So in kite $ABCD$, $\overline{AB} \cong \overline{AD}$ and $\overline{BC} \cong \overline{DC}$. Using the diagonal AC as the line of symmetry, the reflection takes side AB to side AD and side BC to side DC, which works. But reflecting over the diagonal BD would try to take side AB to side CB, and those sides are not necessarily congruent, so it's not necessarily a line of symmetry.

Lesson Synthesis

When is a line of reflection also a line of symmetry?



Sketch shapes which have the following symmetries and write a transformation statement for each one. Look at the sentence frame in the definition of reflection in your reference chart if you get stuck.

- exactly 1 line of symmetry
- at least 2 lines of symmetry
- exactly 5 lines of symmetry