IM 9–12 MATH v.1

Unit 1

Constructions and Rigid Transformations

GEOMETRY

Lesson 18

Practicing Point by Point Transformations

Illustrative Mathematics®

Kendall Hunt

Learning Goal

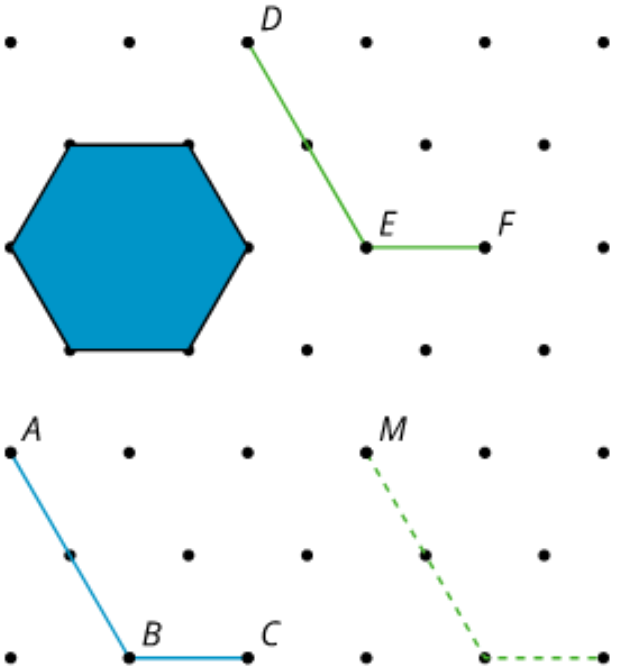
Let's figure out some transformations.

Geometry

Obstacles

Warm-up: Notice and Wonder

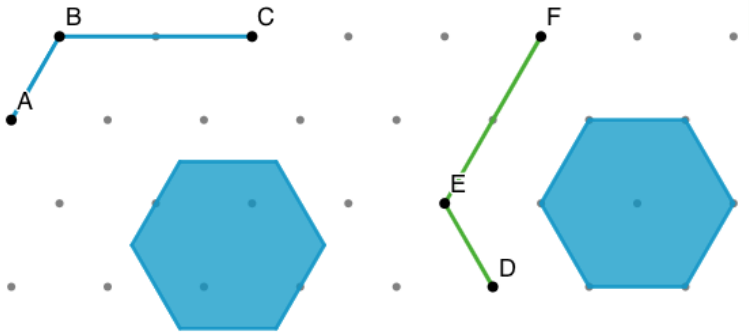
What do you notice? What do you wonder?



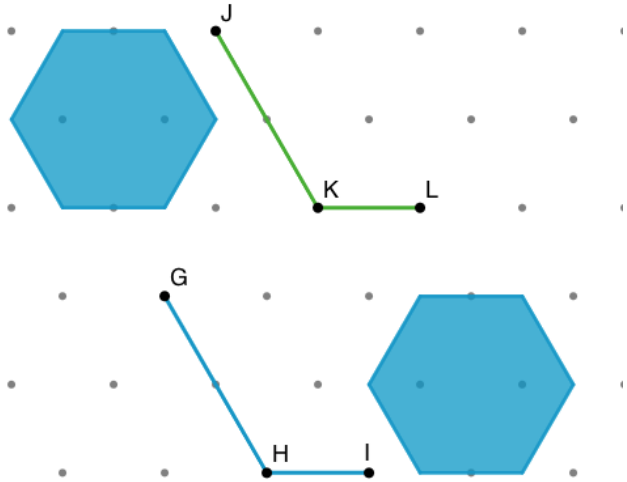
Obstacle Course

For each diagram, find a sequence of translations and rotations that take the original figure to the image, so that if done physically, the figure would not touch any of the solid obstacles and would not leave the diagram. Test your sequence by drawing the image of each step.

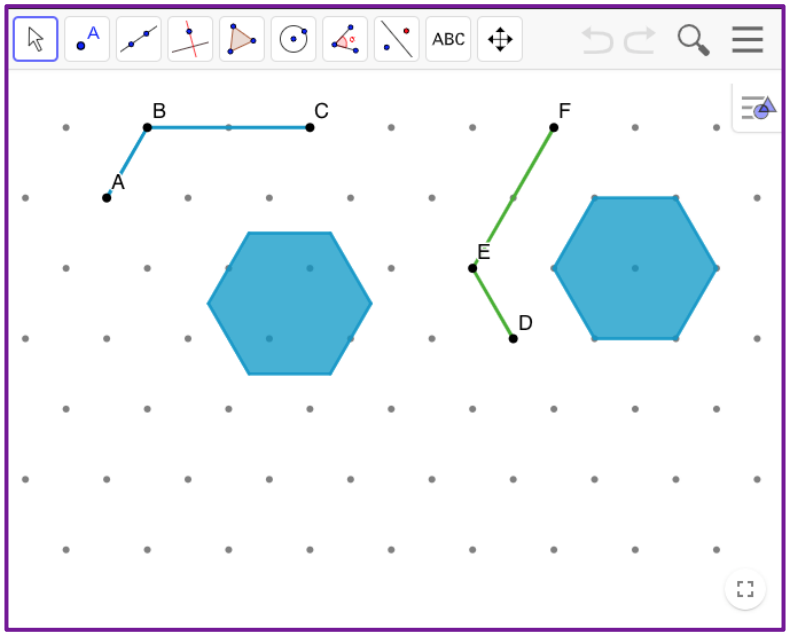
1. Take *ABC* to *DEF*.



2. Take *GHI* to *JKL*.

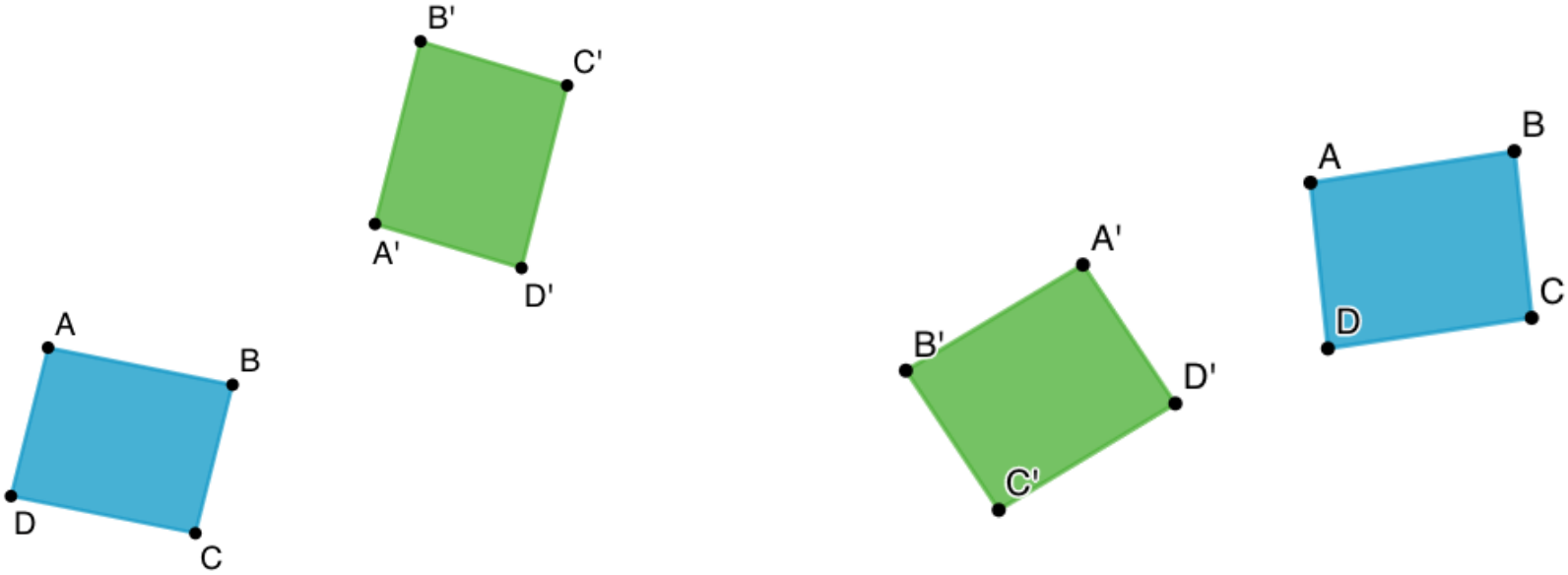


Obstacle Course

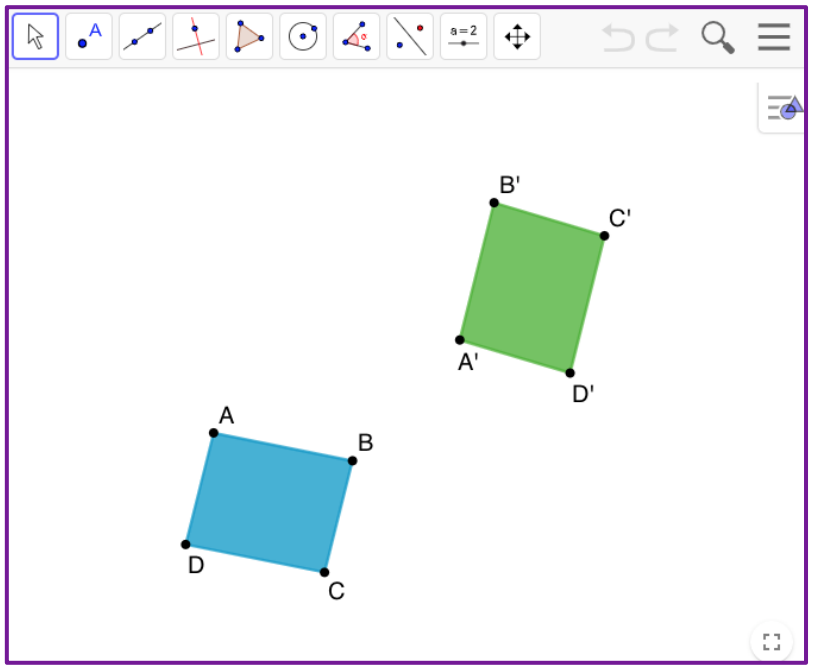


Point by Point

For each question, describe a sequence of translations, rotations, and reflections that will take parallelogram *ABCD* to parallelogram *A′B′C′D′*.



Point by Point



Practicing Point by Point Transformations

Lesson Synthesis

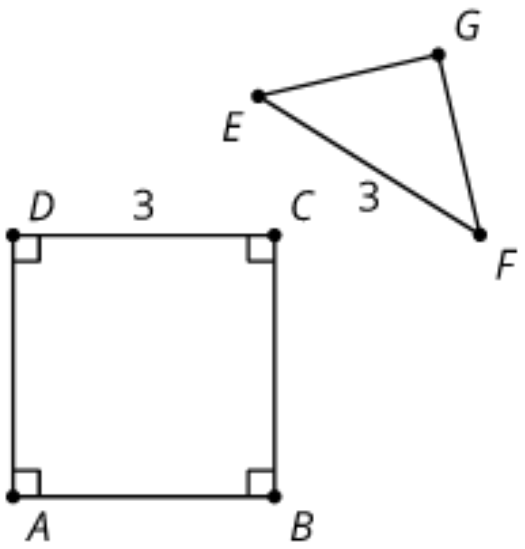
Sketch an example to match each description:

- A pair of figures that you could take one to the other with one rigid motion.
- A pair of figures that you could take one to the other with more than one rigid motion.
- A pair of figures that you couldn't take one to the other, no matter how many rigid motions.

Build Another House

Cool-down

Find a sequence of translations, rotations, and reflections that transform triangle *EFG* so that its image rests on square *ABCD* to together form a simple drawing of a house.

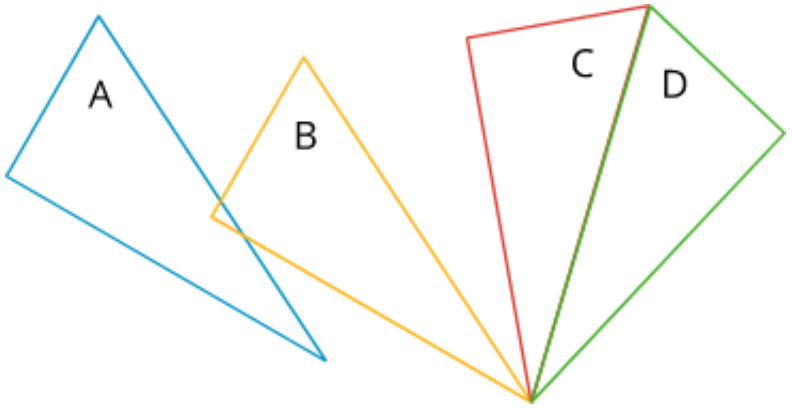


assertion

A statement that you think is true but have not yet proved.

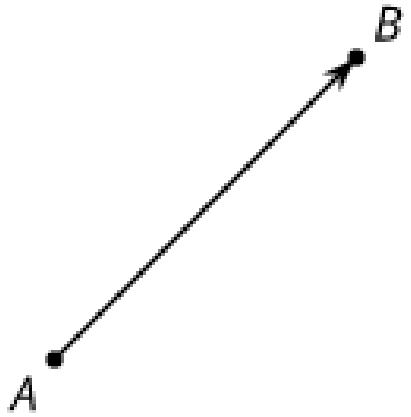
congruent

One figure is called congruent to another figure if there is a sequence of translations, rotations, and reflections that takes the first figure onto the second.



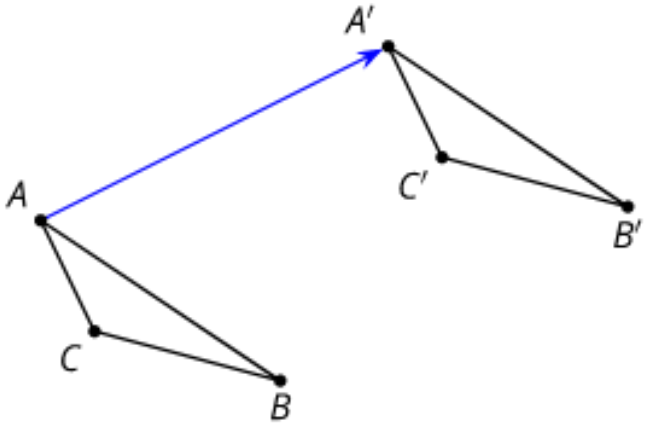
directed line segment

A line segment with an arrow at one end specifying a direction.



image

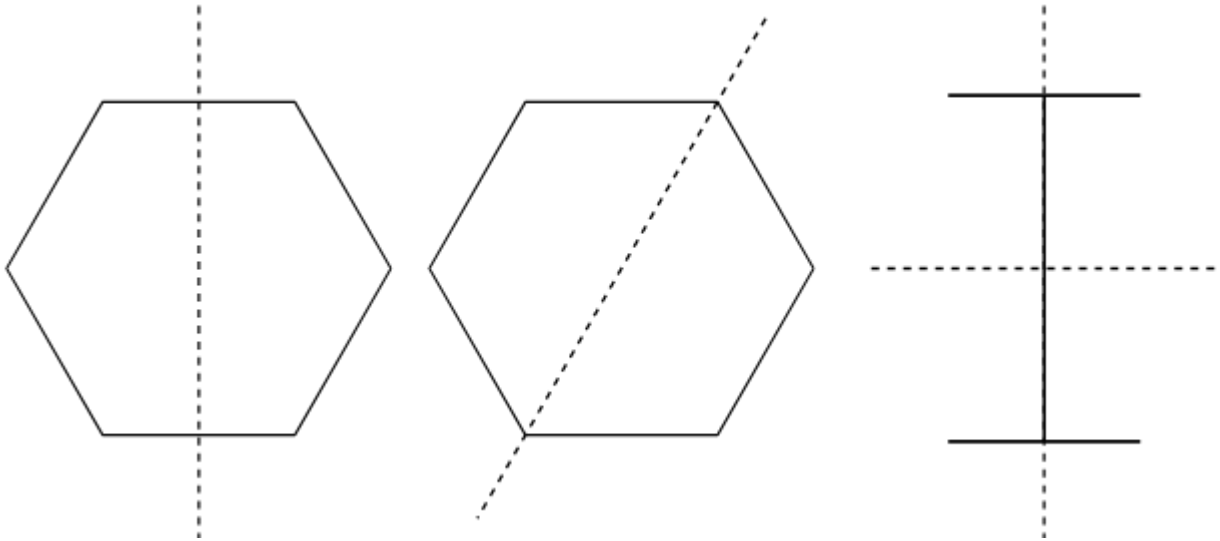
If a transformation takes A to A', then A is the original and A' is the image.



line of symmetry

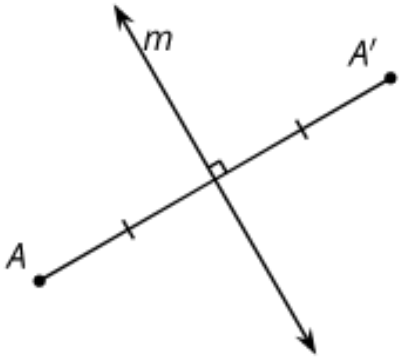
A line of symmetry for a figure is a line such that reflection across the line takes the figure onto itself.

The figure shows two lines of symmetry for a regular hexagon, and two lines of symmetry for the letter I.



reflection

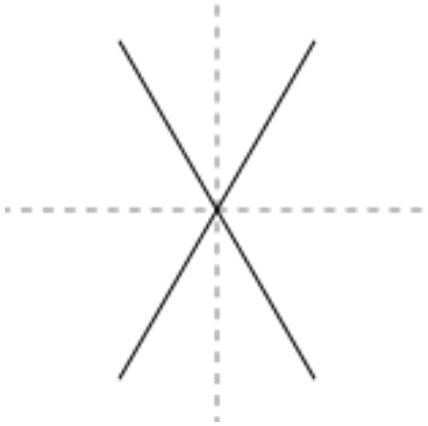
A reflection is defined using a line. It takes a point to another point that is the same distance from the given line, is on the other side of the given line, and so that the segment from the original point to the image is perpendicular to the given line.



In the figure, A is the image of A under the reflection across the line m.

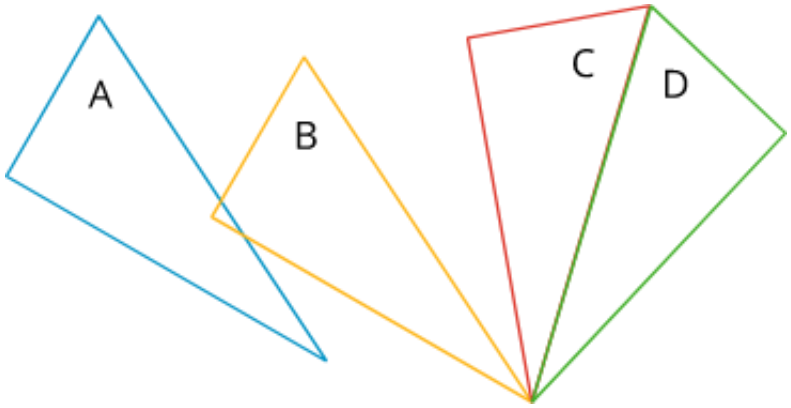
reflection symmetry

A figure has reflection symmetry if there is a reflection that takes the figure to itself.



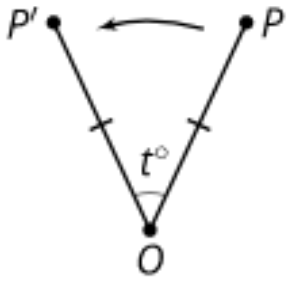
rigid transformation

A rigid transformation is a translation, rotation, or reflection. We sometimes also use the term to refer to a sequence of these.

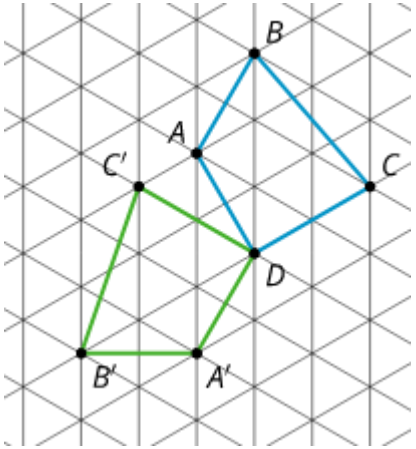


rotation

A rotation has a center and a directed angle. It takes a point to another point on the circle through the original point with the given center. The 2 radii to the original point and the image make the given angle.



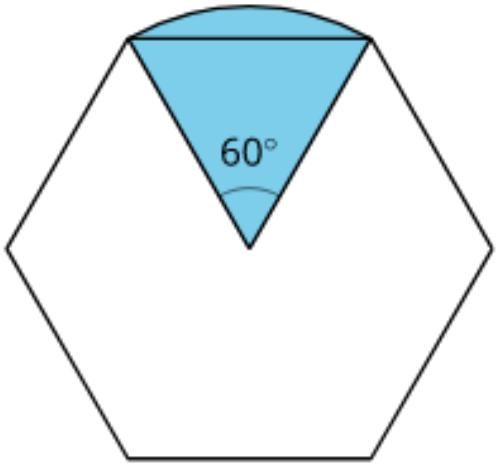
P′ is the image of *P* after a counterclockwise rotation of t^o using the point *O* as the center.



Quadrilateral ABCD *is rotated 120 degrees counterclockwise using the point* D *as the center.*

rotation symmetry

A figure has rotation symmetry if there is a rotation that takes the figure onto itself. (We don't count rotations using angles such as 0^o and 360^o that leave every point on the figure where it is.)



symmetry

A figure has symmetry if there is a rigid transformation which takes it onto itself (not counting a transformation that leaves every point where it is).

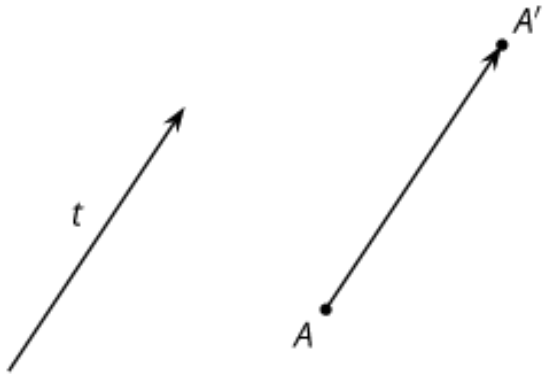
theorem

A statement that has been proved mathematically.

translation

A translation is defined using a directed line segment. It takes a point to another point so that the directed line segment from the original point to the image is parallel to the given line segment and has the same length and direction.

In the figure, A' is the image of A under the translation given by the directed line segment t.



- Given a figure and the description of a transformation, I can draw the figure's image after the transformation.
- I can describe a transformation that takes given points to another set of points.

Learning Targets

Geometry