## Lesson 3: Making the Moves

Let's draw and describe translations, rotations, and reflections.

### 3.1: Notice and Wonder: The Isometric Grid

What do you notice? What do you wonder?



### 3.2: Transformation Information

Your teacher will give you tracing paper to carry out the moves specified. Use $A^{′}$, $B^{′}$, $C^{′}$, and $D^{′}$ to indicate vertices in the new figure that correspond to the points $A$, $B$, $C$, and $D$ in the original figure.



1. In Figure 1, translate triangle $ABC$ so that $A$ goes to $A^{′}$.
2. In Figure 2, translate triangle $ABC$ so that $C$ goes to $C^{′}$.
3. In Figure 3, rotate triangle $ABC$ $90^{∘}$ counterclockwise using center $O$.
4. In Figure 4, reflect triangle $ABC$ using line $ℓ$.
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1. In Figure 5, rotate quadrilateral $ABCD$ $60^{∘}$ counterclockwise using center $B$.
2. In Figure 6, rotate quadrilateral $ABCD$ $60^{∘}$ clockwise using center $C$.
3. In Figure 7, reflect quadrilateral $ABCD$ using line $ℓ$.
4. In Figure 8, translate quadrilateral $ABCD$ so that $A$ goes to $C$.

#### Are you ready for more?

The effects of each move can be “undone” by using another move. For example, to undo the effect of translating 3 units to the right, we could translate 3 units to the left. What move undoes each of the following moves?

1. Translate 3 units up
2. Translate 1 unit up and 1 unit to the left
3. Rotate 30 degrees clockwise around a point $P$
4. Reflect across a line $ℓ$

### 3.3: A to B to C

Here are some figures on an isometric grid.



1. Name a transformation that takes Figure $A$ to Figure $B$. Name a transformation that takes Figure $B$ to Figure $C$.
2. What is one **sequence of transformations** that takes Figure $A$ to Figure $C$? Explain how you know.

#### Are you ready for more?

Experiment with some other ways to take Figure $A$ to Figure $C$. For example, can you do it with. . .

* No rotations?
* No reflections?
* No translations?

### Lesson 3 Summary

A move or combination of moves is called a **transformation**. When we do 1 or more moves in a row, we often call that a **sequence of transformations**. When a figure is on a grid, we can use the grid to describe a transformation. We use the word **image** to describe the figure after a transformation. To distinguish the original figure from its image, points in the image are sometimes labeled with the same letters as the original figure, but with the symbol $​^{′}$ attached, as in $A^{′}$ (pronounced “A prime”) is the image of $A$ after a transformation.

* A translation can be described by two points. If a translation moves point $A$ to point $A^{′}$, it moves the entire figure the same distance and direction as the distance and direction from $A$ to $A^{′}$. The distance and direction of a translation can be shown by an arrow.
* For example, here is a translation of quadrilateral $ABCD$ that moves $A$ to $A^{′}$.
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* A rotation can be described by an angle and a center. The direction of the angle can be clockwise or counterclockwise.
* For example, quadrilateral $KLMN$ is rotated 60 degrees counterclockwise using center $P$. This type of grid is called an **isometric grid**. The isometric grid is made up of equilateral triangles. The angles in the triangles each measure 60 degrees, making the isometric grid convenient for showing rotations of 60 degrees.
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* A reflection can be described by a line of reflection (the “mirror”). Each point is reflected directly across the line so that it is just as far from the mirror line, but is on the opposite side.
* For example, pentagon $ABCDE$ is reflected across line $m$.
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