

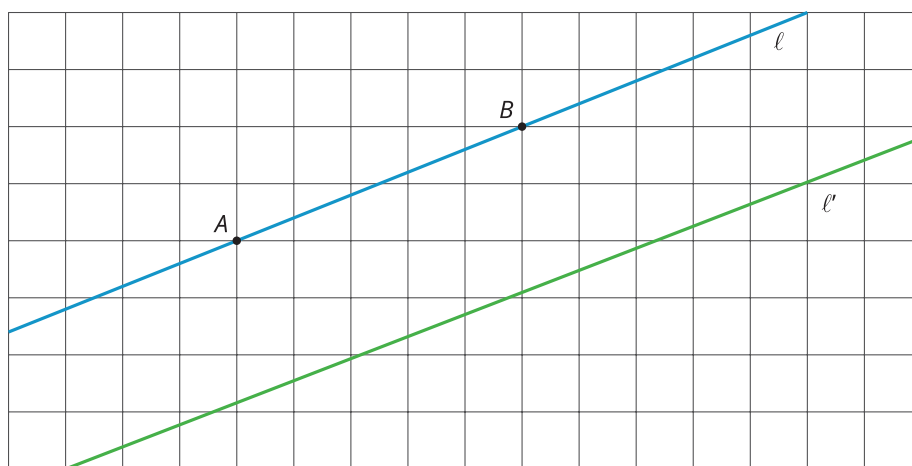
# Moves in Parallel

Let's transform some lines.

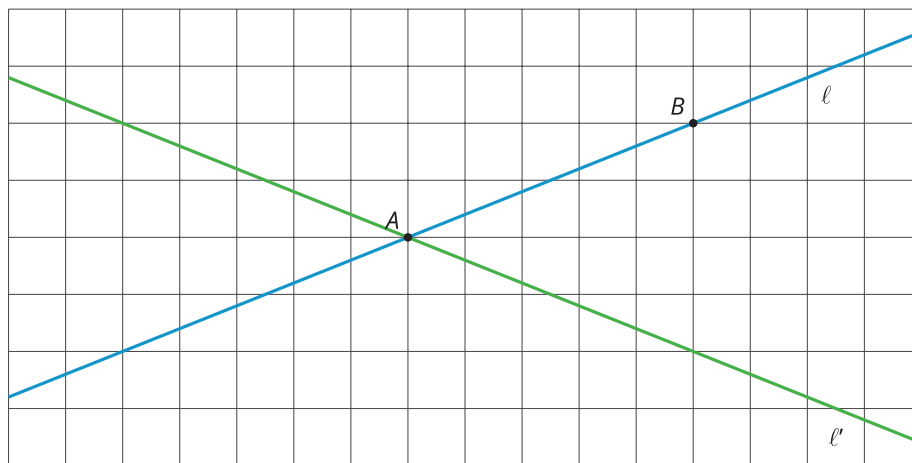
## 8.1 Line Moves

For each diagram, describe a translation, rotation, or reflection that takes line  $\ell$  to line  $\ell'$ . Then plot and label  $A'$  and  $B'$ , the images of  $A$  and  $B$ .

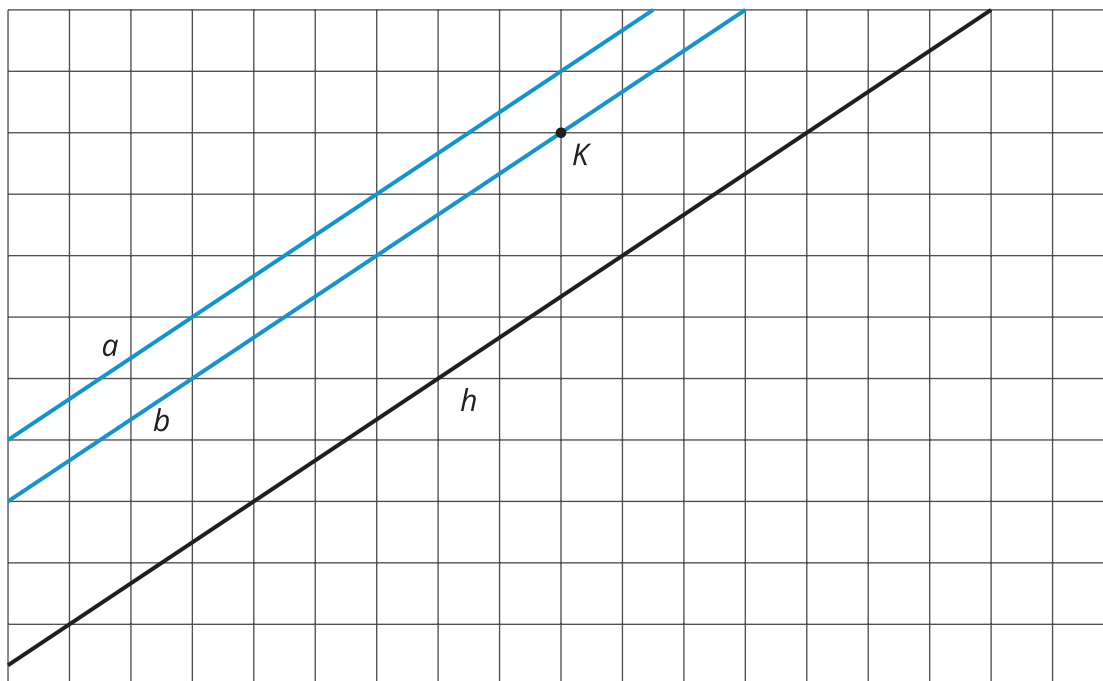
1.



2.



## 8.2 Parallel Lines



Use a piece of tracing paper to trace lines  $a$  and  $b$  and point  $K$ . Then use that tracing paper to draw the images of the lines under the three different transformations listed.

As you perform each transformation, think about the question:

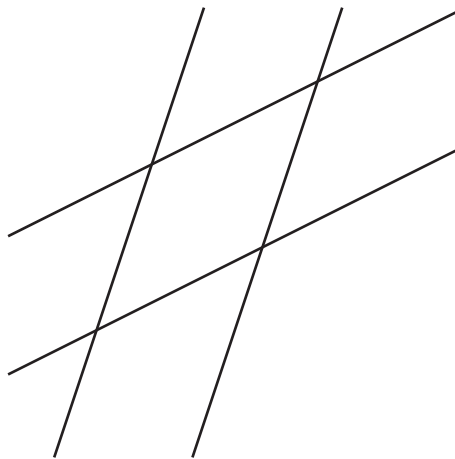
What is the image of two parallel lines under a rigid transformation?

1. Translate lines  $a$  and  $b$  3 units up and 2 units to the right.
  - a. What do you notice about the changes that occur to lines  $a$  and  $b$  after the translation?
  - b. What is the same in the original and the image?

2. Rotate lines  $a$  and  $b$  counterclockwise  $180^\circ$  using  $K$  as the center of rotation.
  - a. What do you notice about the changes that occur to lines  $a$  and  $b$  after the rotation?
  - b. What is the same in the original and the image?
3. Reflect lines  $a$  and  $b$  across line  $h$ .
  - a. What do you notice about the changes that occur to lines  $a$  and  $b$  after the reflection?
  - b. What is the same in the original and the image?

 **Are you ready for more?**

When you rotate two parallel lines, sometimes the two original lines intersect their images and form a quadrilateral. What is the most specific thing you can say about this quadrilateral? Can it be a square? A rhombus? A rectangle that isn't a square? Explain your reasoning.



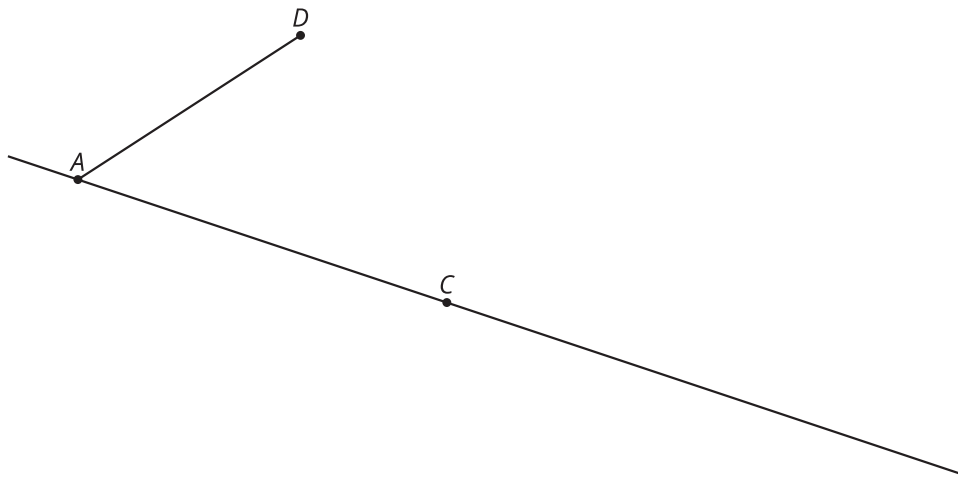
## 8.3

## Let's Do Some 180s

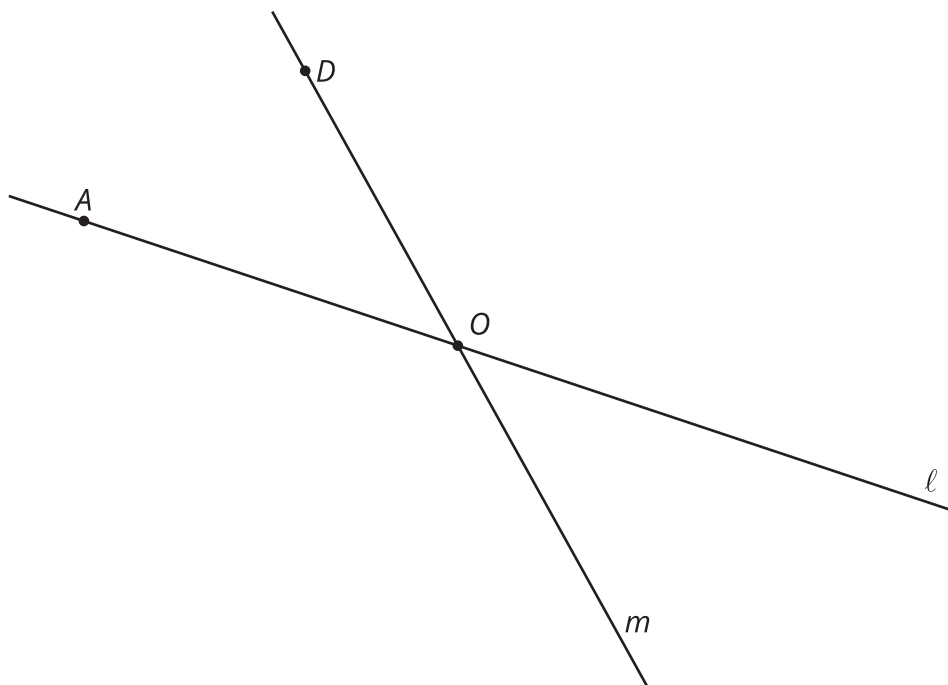
1. The diagram shows a line with points labeled  $A$ ,  $C$ ,  $D$ , and  $B$ .
  - a. On the diagram, draw the image of the line and points  $A$ ,  $C$ , and  $B$  after the line has been rotated  $180^\circ$  around point  $D$ .
  - b. Label the images of the points  $A'$ ,  $B'$ , and  $C'$ .
  - c. What is the order of all seven points? Explain or show your reasoning.



2. The diagram shows a line with points  $A$  and  $C$  on the line and a segment  $AD$  where  $D$  is not on the line.
  - a. Rotate the figure  $180^\circ$  about point  $C$ . Label the image of  $A$  as  $A'$  and the image of  $D$  as  $D'$ .
  - b. What do you know about the relationship between angle  $CAD$  and angle  $CA'D'$ ? Explain or show your reasoning.



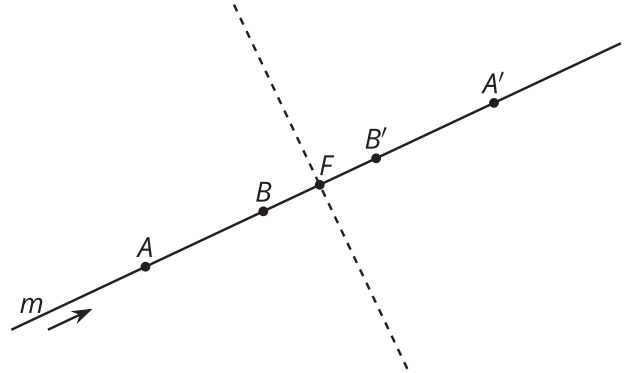
3. The diagram shows two lines  $\ell$  and  $m$  that intersect at a point  $O$  with point  $A$  on  $\ell$  and point  $D$  on  $m$ .
- Rotate the figure  $180^\circ$  around  $O$ . Label the image of  $A$  as  $A'$  and the image of  $D$  as  $D'$ .
  - What do you know about the relationship between the angles in the figure? Explain or show your reasoning.



## Lesson 8 Summary

Rigid transformations have the following properties:

- A rigid transformation of a line is a line.
- A rigid transformation of two parallel lines results in two parallel lines that are the same distance apart as the original two lines.
- Sometimes, a rigid transformation takes a line to itself. For example:



- A translation parallel to the line. The arrow shows a translation of line  $m$  that will take  $m$  to itself.
- A rotation by  $180^\circ$  around any point on the line. A  $180^\circ$  rotation of line  $m$  around point  $F$  will take  $m$  to itself.
- A reflection across any line perpendicular to the line. A reflection of line  $m$  across the dashed line will take  $m$  to itself.

These facts let us make an important conclusion.

If two lines intersect at a point, which we'll call  $O$ , then a  $180^\circ$  rotation of the lines with center  $O$  shows that **vertical angles** are congruent. Here is an example:

Rotating both lines by  $180^\circ$  around  $O$  sends angle  $AOC$  to angle  $A'OC'$ , therefore proving that they have the same measure. The rotation also sends angle  $AOC'$  to angle  $A'OC$ .

