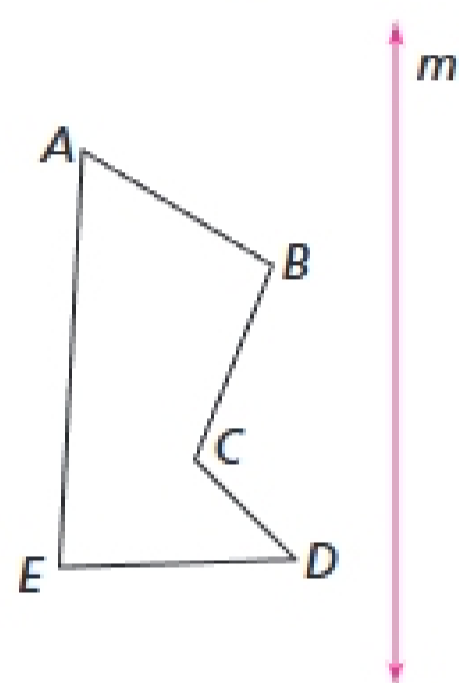


Investigation

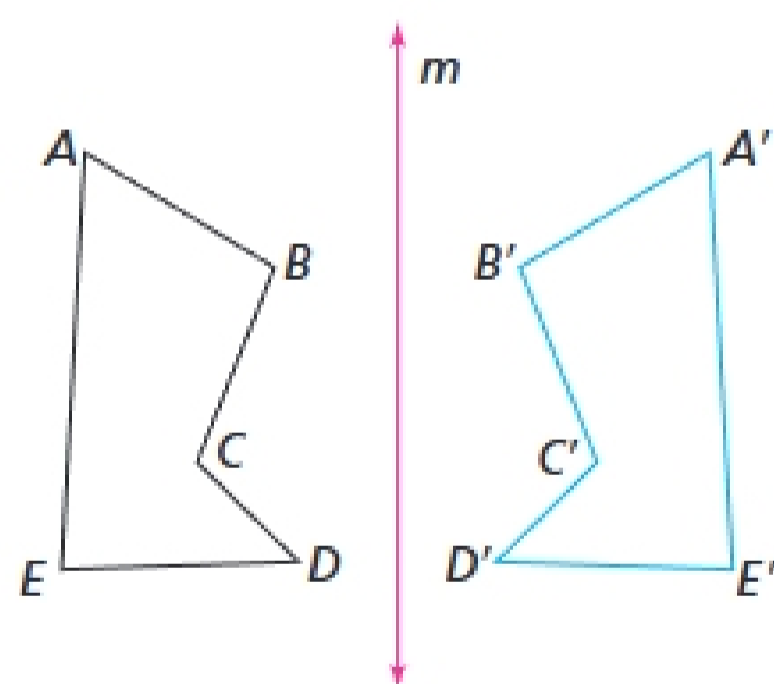
2

Symmetry Transformations

You can make symmetric designs by copying a basic figure to produce a balanced pattern. For example, to construct a design with reflection symmetry, start with pentagon $ABCDE$ and line m below.



Reflect $ABCDE$ in line m to get pentagon $A'B'C'D'E'$.



Reflecting a figure in a line is an example of a geometric operation called a **transformation**. A transformation produces a copy, or *image*, of an original figure in a new position.

In this investigation, you will explore the transformations associated with reflection, rotation, and translation symmetry.

2.1

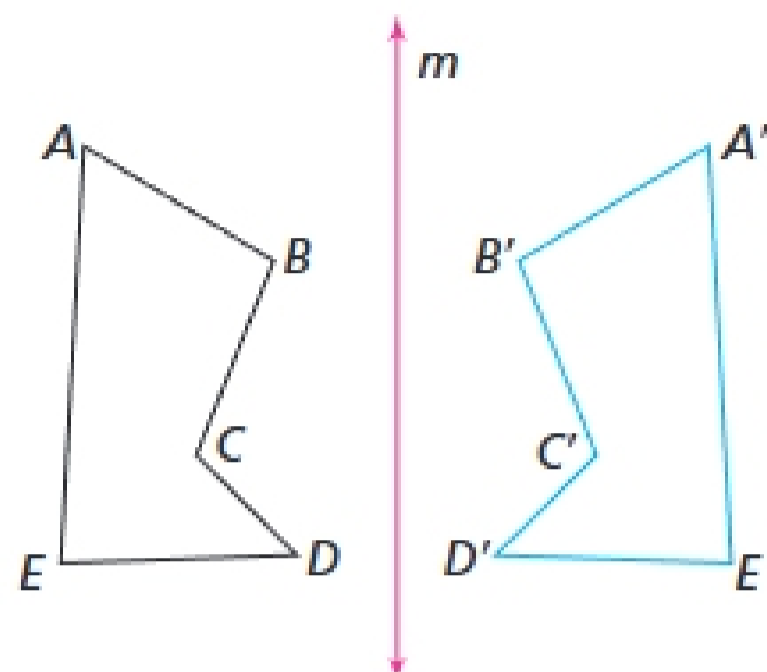
Describing Line Reflections

Transformations that produce patterns with reflection symmetry are called **line reflections**.

Suppose you start with pentagon $ABCDE$ and line m from the previous page.

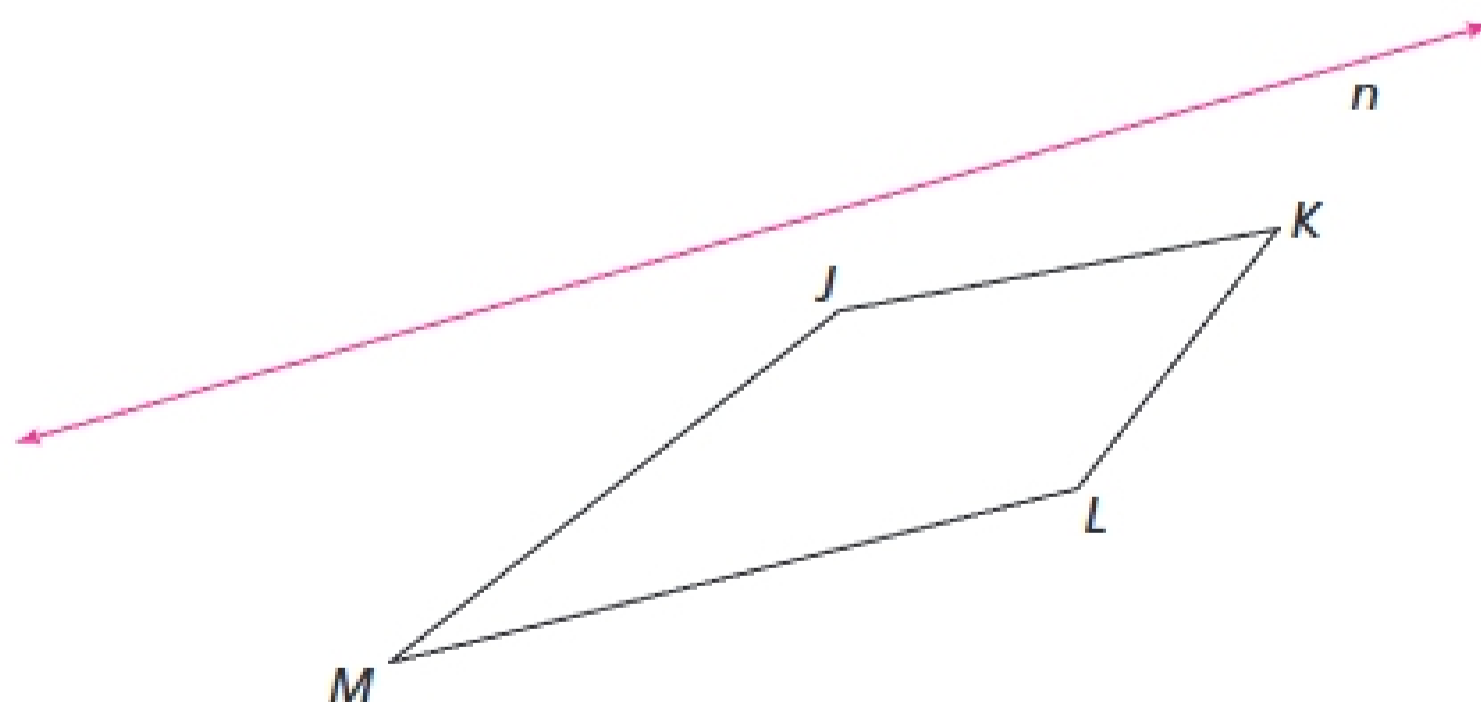
How can you locate the reflection image $A'B'C'D'E'$ without folding, tracing, or using a mirror?

Look for a precise way to describe a line reflection as you work through this problem.



Problem 2.1 Describing Line Reflections

- A.** Copy pentagon $ABCDE$, its image, $A'B'C'D'E'$, and the line of reflection, m .
1. Draw segments connecting each vertex of $ABCDE$ to its image on $A'B'C'D'E'$. In other words, connect A to A' , B to B' , and so on.
 2. Use tools for measuring angles and lengths to see how the line of reflection is related to each segment you drew in part (1).
 3. Describe the patterns in your measurements from part (2).
- B. 1.** Copy quadrilateral $JKLM$ and line n below. Use what you discovered in Question A to draw $J'K'L'M'$, the image of $JKLM$ under a reflection in line n . Use only a pencil, a ruler, and an angle ruler or protractor. Explain how you located the image.

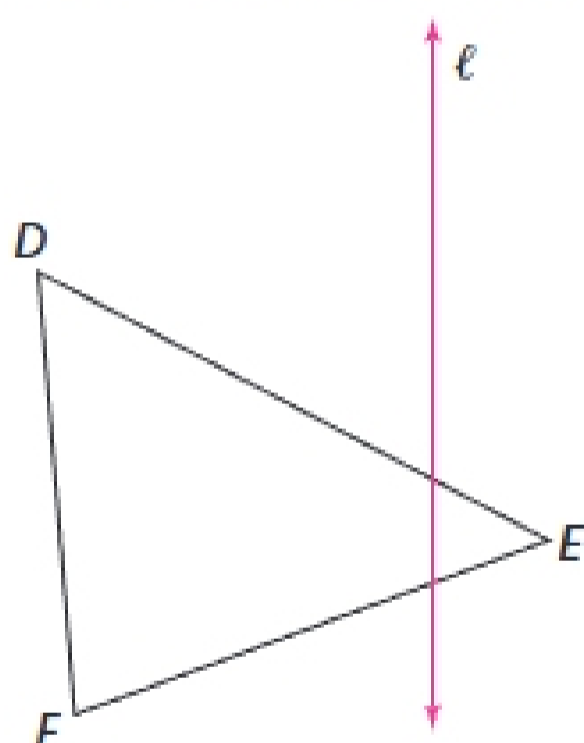


2. Does $JKLM$ have any symmetries? Explain.
3. Does the figure made up of both $JKLM$ and its reflection, $J'K'L'M'$, have any symmetries? Explain.

- C. The design below has reflection symmetry. Copy the design. Use only a pencil, a ruler, and an angle ruler or protractor to locate the line of symmetry. Explain how you found the location of the line.



- D. Complete this definition: A line reflection in a line m matches each point X on a figure to an image point X' so that . . .
- E. Copy triangle DEF and line ℓ . Notice triangle DEF crosses the line.



1. Does triangle DEF have reflection symmetry?
 2. Draw the image of triangle DEF under a reflection in line ℓ .
 3. Does the final figure, made of triangle DEF and its image, have reflection symmetry? Explain.
- F. When you reflect a figure in a line, you can visualize reflecting the entire plane and taking the figure along for the ride. Are any points in the plane unmoved by a reflection? That is, are there any fixed points? Explain.

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ACE Homework starts on page 36.