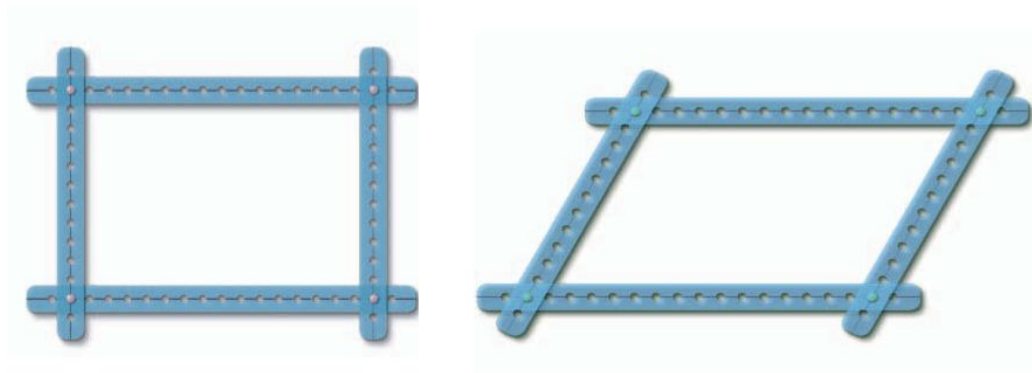


## 3.4 Parallel Lines and Transversals

Suppose you were asked to build a quadrilateral with side lengths 3, 8, 3, and 8. You might expect that the figure is a  $3 \times 8$  rectangle. Your experiments in Problem 3.3 showed that when you push on a vertex of a polystrip rectangle, it loses its square-corner shape.



One thing that does not change about the polystrip figure is the relationship of the opposite sides. They remain equal in length and parallel to each other.

**Parallel lines** are lines in a plane that never meet. They are like railroad tracks, rows of a crop in a field, or lines on notebook paper. They remain the same distance apart and never meet, even if extended forever in both directions.

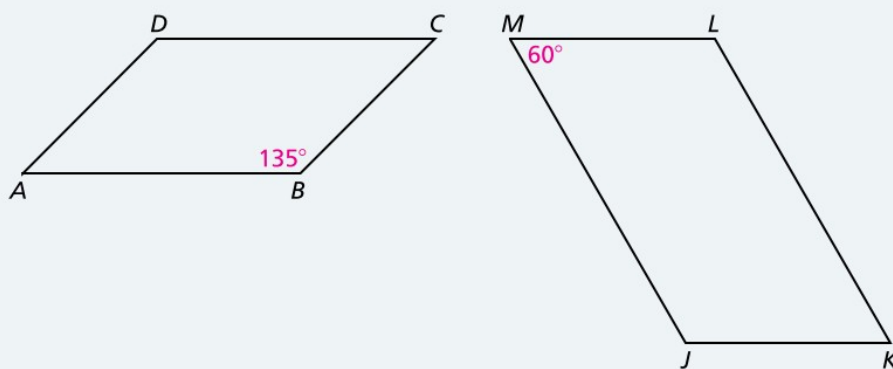


A **parallelogram** is a quadrilateral in which the pairs of opposite sides are parallel. The shape of a parallelogram is largely set by the angles at which those pairs of sides meet. A parallelogram with four right angles is a **rectangle**.

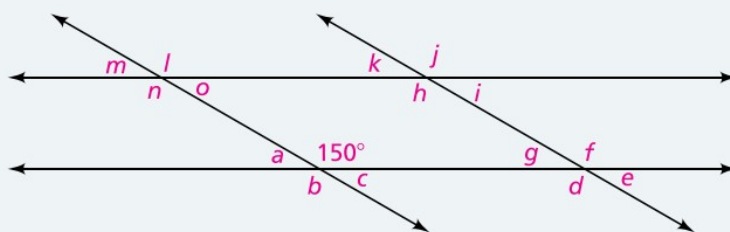


### Problem 3.4

- A** There are nine parallelograms in the Shapes Set from Problem 1.1.
1. What pattern seems to relate the measures of opposite angles in any parallelogram?
  2. What pattern seems to relate the measures of consecutive angles in any parallelogram?
  3. Suppose your conjectures in parts (1) and (2) are true. What are the measures of the angles in parallelograms  $ABCD$  and  $JKLM$  below?



- B** Suppose your conjectures from Question A are true. The lines below form a parallelogram.

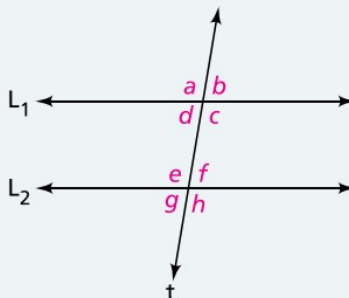


Find the measures of all labeled angles in this diagram. Be prepared to justify each answer.

### Problem 3.4 *continued*

**C** A line that intersects two other lines is called a **transversal**.

- From your work in Questions A and B, what can you say about the measures of the eight angles formed by a transversal and two parallel lines?

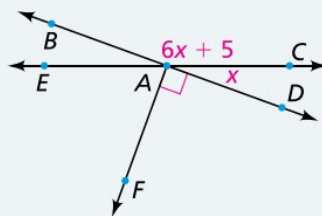


- Suppose the measure of angle  $f$  is  $80^\circ$ . What are the measures of the other labeled angles?

**D** You probably noticed that when two lines intersect four angles are formed. The opposite pairs of angles are called **vertical angles**. For example, in Question C, angles  $f$  and  $g$  are vertical angles.

- Name the other pairs of vertical angles in the figure of Question C.
- Name the pairs of supplementary angles in that figure.
- What is true about the measures of any vertical angle pair? Explain how you know.

**E** Use what you know about complementary, supplementary, and vertical angles. Write an equation and then find the value of  $x$  and the size of each angle in this figure.



**A C E** Homework starts on page 76.