

## Lesson 1.5 • Classifying Parallelograms

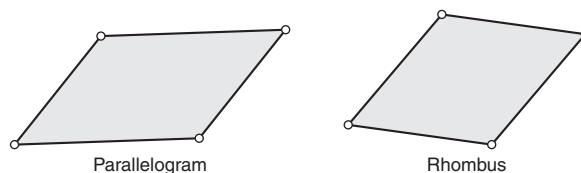
## Demo

In this demonstration you'll manipulate four specially constructed quadrilaterals: a parallelogram, a rhombus, a rectangle, and a square. You'll see how they behave and how they are related to one another.

### Sketch

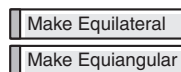
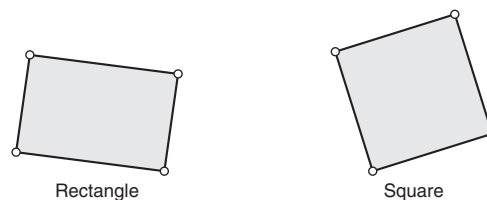
**Step 1** Open the sketch [Parallelograms.gsp](#).

**Step 2** Choose the **Arrow** tool and drag different vertices of each shape. Play for a minute to get a feel for how each point controls the shape.



### Investigate

1. Which of the four shapes is the most flexible? Explain.
2. Which of the four shapes is the least flexible? Explain.
3. Write a sentence or two about the flexibility of the other two shapes. Is one more flexible than the other? Explain.
4. All four shapes are parallelograms, but the rectangle, rhombus, and square have additional properties. What property do all four parallelograms have in common?



### Sketch

**Step 3** While watching the four shapes, press the *Make Equilateral* button. You should see one or more of the shapes change. If you don't, try dragging different points to change each shape, then press the *Make Equilateral* button again. Once each shape is equilateral, don't change it until you've answered the following questions.

### Investigate

5. Which shapes changed when you pressed *Make Equilateral*?
6. Which shapes didn't change when you pressed *Make Equilateral*? Explain.
7. What shape does the parallelogram look like when it's equilateral?
8. What shape does the rectangle look like when it's equilateral?

(continued)

## Lesson 1.5 • Classifying Parallelograms (continued)

### Sketch

**Step 4** Drag different points to change each shape.

**Step 5** While watching the four shapes, press the *Make Equiangular* button. Once each shape is equiangular, don't change it until you've answered the following questions.

### Investigate

9. Which shapes changed when you pressed *Make Equiangular*?
10. Which shapes didn't change when you pressed *Make Equiangular*? Explain.
11. What shape does the parallelogram look like when it's equiangular?
12. What shape does the rhombus look like when it's equiangular?

### Sketch

**Step 6** Drag different points to change each shape.

**Step 7** Press both the *Make Equiangular* button and the *Make Equilateral* button, in either order.

### Investigate

13. What shape do all the parallelograms look like when they are both equiangular and equilateral?

Drag points and press the buttons as needed to answer the following questions.

14. Write a definition for *parallelogram*.
15. Write a definition for *rhombus*.
16. Write a definition for *rectangle*.
17. Write a definition for *square*.
18. Is a rectangle always, sometimes, or never a rhombus? Explain.
19. Is a square always, sometimes, or never a rectangle? Explain.
20. Is a parallelogram always, sometimes, or never a square? Explain.

**21.** This is a concept map showing the relationships among the different types of parallelograms. This type of concept map is known as a *Venn diagram*. Fill in the missing names.

