LESSON 1

Objective

Compare the areas of parallelograms and rectangles.

Common Core State Standards

- **6.G.1** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

Geometry

Area of a Parallelogram

In this activity, students reason about the area of a parallelogram by visualizing its relationship to a corresponding rectangle. Without a formula, the area of a rectangle can be found by counting the number of square units that fill it. But since a parallelogram does not have right angles, it cannot be filled with whole squares. An area formula is needed. The area formula for parallelograms is a general form of the formula for rectangles.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *How did the shapes of the parking spaces change on the geoboard when you shifted the bottoms to the right?*
- **Ask:** *How can you reason that the new shapes have the same area as the original shapes?*
- Explain how the area formula remains essentially the same except that the length of the rectangle is replaced by the height of the parallelogram.

Solve It

Reread the problem with students. Have students write a paragraph that describes how the area formula for a parallelogram is a general form of the area formula for a rectangle.

More Ideas

For other ways to teach about areas of parallelograms—

- Using the square and two small triangle Tangrams, demonstrate how a rectangle can be made into a parallelogram having the same height and base length, and discuss why the areas are the same.
- Students can use 4 AngLegs® pieces to form a rectangle, then push on opposite corners to slant the rectangle and form a parallelogram. Ask students to compare the area of the rectangle with the area of the parallelogram. The area of the parallelogram is less because the height has decreased.

Formative Assessment

Have students try the following problem.

A parallelogram has an area of 20 square inches and a base length of 4 inches. What is the height?

A. 4 inches

B. 5 inches

C. 6 inches

D. 10 inches

Try It! 20 Minutes | Pairs

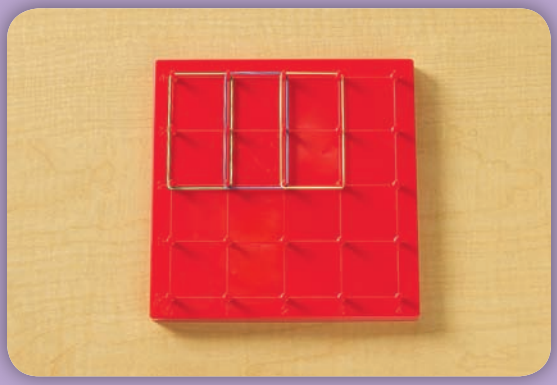
Here is a problem about areas of parallelograms.

Doug wants to install three parking spaces on part of a rectangular section of land in front of his store. The land is 18 feet deep by 36 feet wide. Doug considers installing perpendicular spaces that are 9 feet wide. He also considers angled spaces. Does Doug's choice of layout affect the amount of paving that he needs for the parking spaces?

Introduce the problem. Then have students do the activity to solve the problem. Distribute Geoboards, rubber bands, grid paper, and colored pencils to students.

Materials

- Geoboards (1 per pair)
- rubber bands (6 per pair)
- 10 x 10 Grid (BLM 9; 1 per pair)
- colored pencils (2 colors per pair)



1. Say: *Using the upper half of a geoboard to represent the section of land, model three perpendicular parking spaces.* If necessary, guide students to realize that each space should be depicted using a 2-by-1 rectangle.

2. Say: *Draw a 2-by-4 rectangle on a grid to represent the section of land. Draw and shade three rectangles to represent the three perpendicular parking spaces.* **Ask:** *What is the area of each rectangle? What is the area of the three rectangles added together?* Have students write their answers.

3. Say: *On the geoboard, shift the bottom of each rectangle to the right by one unit to create a model of three angled parking spaces.* **Ask:** *What is the area of each parallelogram and all three parallelograms together?* Have students draw the model on their grid. Guide them to see that a triangular area has been uncovered on the left but that an equal area has been added on the right.

⚠ Look Out!

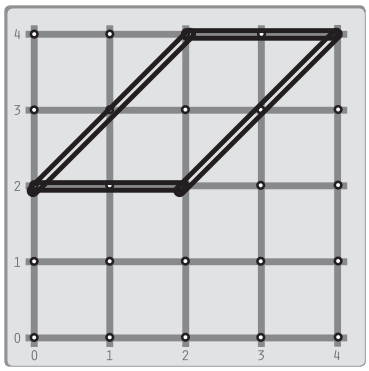
Point out to students that only one side length (called the base) is used to find the area of a parallelogram. The other measurement used is the height of the parallelogram, which is not a side length. Note that any of the four sides of a parallelogram can be called a base and the base is perpendicular to the height. The base and height are multiplied to find the area. With a rectangle, both the base and height (or length and width) happen to be sides of the rectangle.

Answer Key

Use a Geoboard to model each parallelogram. Find its area.

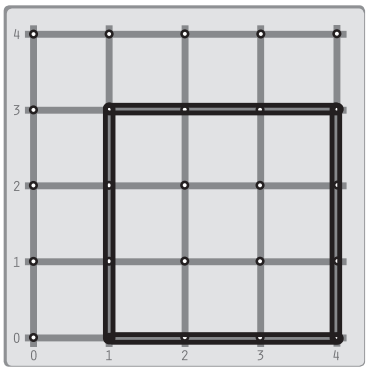
(Check students' work.)

1.



4 square units

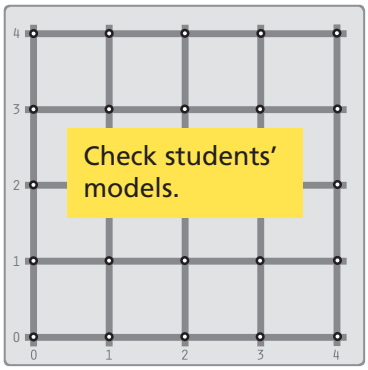
2.



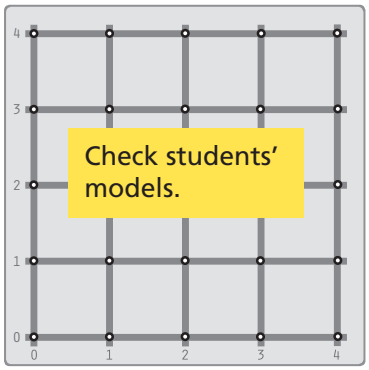
9 square units

Using a Geoboard, model a parallelogram with the given area. Sketch the shape.

3. 16 units^2

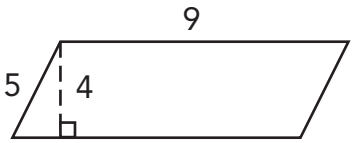


4. 12 units^2



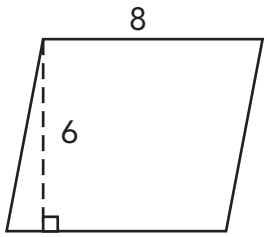
Find the area of each parallelogram.

5.



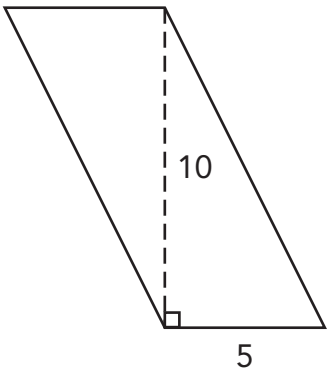
36 units^2

6.



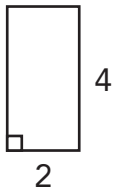
48 units^2

7.



50 units^2

8.



8 units^2

Answer Key

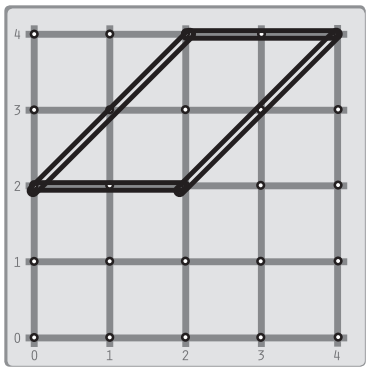
Challenge! How is finding the area of a parallelogram different from finding the area of a rectangle? How is it similar? Draw a picture to help.

Challenge: (Sample) The height of a parallelogram may or may not be one of the sides. The height of a rectangle is always one of the sides. To find the area of both, you multiply the base by the height. In a rectangle, the base and height are named the length and width.

Name _____

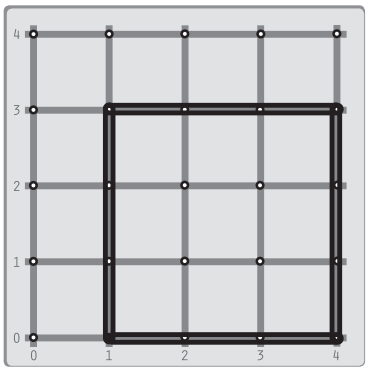
Use a Geoboard to model each parallelogram. Find its area.

1.



_____ square units

2.



_____ square units

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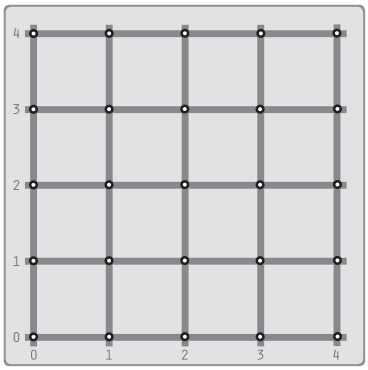
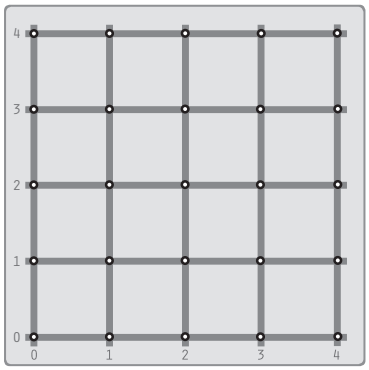
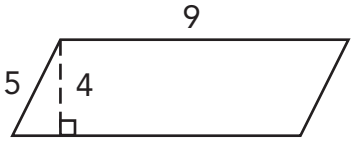


4. 12 units^2



Find the area of each parallelogram.

5.



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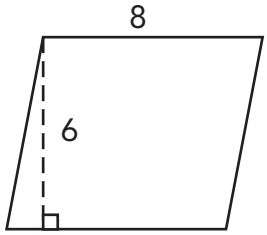
6.



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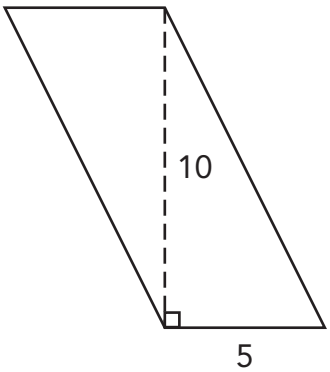
7.



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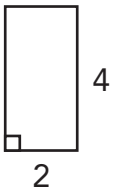
8.



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Name _____

Challenge! How is finding the area of a parallelogram different from finding the area of a rectangle? How is it similar? Draw a picture to help.

Name _____