Lesson 12: Area and Perimeter

Desired Outcomes

- Students will investigate area and perimeter using manipulatives.
- Students will make and test conjectures about area and perimeter.
- Students will analyze data represented in a table.

Teacher Information

Students use manipulatives to explore the relationships between the area and the perimeter of growing rectangles. After determining the area and perimeter of several rectangles, students make conjectures about the relationships between area and perimeter of rectangular and non-rectangular figures.

Students then test one of the conjectures and collect data to display in a table in their Bright Idea Geometry Journals. Students draw conclusions about their findings and share their ideas with classmates.

Teacher Preparation

- Display the chart with the title "Making and Testing Conjectures" from Lesson 11.
- Prepare a set of eight magnetic squares from the collection of two-dimensional shapes for the class discussion and a set for each group of four students.
- Copy a sheet of grid paper for each student.
- Copy Home Connection 12 for each student.
- Assemble for distribution: folding magnetic whiteboards, magnetic squares, grid paper, and Home Connection 12.
- Provide access to crayons, drawing paper, glue, and scissors, which are not provided in the kit.

Materials

For the class

Chart with the title "Making and Testing Conjectures" from Lesson 11

Bright Idea Marker w/Eraser

1 black marker w/eraser

1 set of 8 magnetic squares

1 folding magnetic whiteboard

For each group of four students

1 set of 8 magnetic squares

1 folding magnetic whiteboard

For each student

1 copy of grid paper

Copy of Home Connection 12

Needed but not supplied

Crayons

Drawing paper

Glue

Scissors

Vocabulary

Analyze: To examine the parts.

Area: A measure of the size of a surface in square units.

Conjecture: A mathematical statement that has yet to be proved or disproved.

Perimeter: The distance around a figure.

Square: A rectangle with four equal sides and four equal angles.

Verify: To prove.

Procedure for the Lesson

Engage

Area and Perimeter

1. Display a magnetic square on the blank side of a whiteboard. Explain that the square can be considered one unit. Ask,

   What is the area of the square in square units?

   What is the perimeter of the square in units?

2. Add another square, forming a rectangle. Ask,

   In what ways is the area of a figure determined?

   In what ways is the perimeter of a figure determined?

3. Add another square to the rectangle, forming a longer rectangle. Ask,

   Does there appear to be a relationship between the area and the perimeter of the growing rectangle?

4. Display the chart with the title "Making and Testing Conjectures." Give each group an opportunity to share ideas about the relationships between areas and perimeters. After the students have shared their ideas in their group, have each group develop a conjecture about areas and perimeters. Add the conjectures to the chart.

Conjectures about the relationships of areas and perimeters:

The perimeter is always larger than the area.

The perimeter is more than double the area.

There is a pattern to the relationship between the area and the perimeter when the shape is a rectangle.

There is not a pattern to the relationship when the shape is not a rectangle.

Investigate

Testing Conjectures

1. Distribute a set of squares and a folding magnetic whiteboard to each group of students. Have them predict the area and perimeter of the next rectangle of four squares before building the rectangle on the whiteboard.

2. Draw a table on the chart and enter the data for the first four rectangles.

Rectangles

Number of Squares	Area	Perimeter
1 	1 square unit	4 units
2 	2 square units	6 units
3 	3 square units	8 units
4 	4 square units	10 units

Conjecture: There is a pattern to the relationship between the area and the perimeter when the shape is a rectangle.

3. Lead a discussion about the relationships between the area and the perimeter in the rectangles. Ask,

   What relationships appear to be developing between the areas and the perimeters?

   What conclusions can you draw about patterns in the data?

   Is the conjecture true or false? Explain.

4. On the chart, summarize the conclusions that were drawn about the conjecture.

Conclusion: There is a pattern to the relationship between the areas and perimeters of rectangles that are one unit wide. The perimeter is double the area + 2.

The conjecture is true so far. We do not know if it will be true for other shapes of rectangles.

5. Explain that each group will investigate a different shape and test the second conjecture "There is not a pattern to the relationship when the shape is not a rectangle." Remind students that sometimes conjectures need to be revised, and sometimes there is not enough information to prove them.

6. Show the students a sheet of grid paper. Demonstrate an L-shape by outlining three squares that are in an L-shape. Explain that students will decide in what way the shape will grow, although it must keep the L-shape. Outline a second L-shape with one more square.

7. Explain that the students will make growing shapes and draw a table similar to the one on the chart on their drawing paper in which to display the data about areas and perimeters. Tell them to make five shapes starting with the smallest possible, depending on the number of squares needed for the first shape, and add one square to each new shape. The shapes can be cut out of the grid paper, colored, and glued to the drawing paper.

8. Assign a shape to each group of students. Several groups may work with the same shape. Shapes that work well for this investigation include the L-shape, T-shape, and U-shape.

9. After each group has been assigned a shape, distribute the grid paper and the drawing paper to each student. Make scissors, crayons, and glue available to the students.

10. As the students work, monitor discussions and ask questions, such as the following: *What strategy are you using to determine the area and the perimeter of your shapes? In what way is your pattern like the rectangle pattern? In what way is it different?*

11. After the students have worked on making their shapes and entering the data in a table on the drawing paper, tell them to write a conclusion about the conjecture.

12. Direct the students to share their conclusions with the other students in their group. After they share in their group, they may want to make changes before sharing with the whole group.

Reflect

More Conjectures

1. Lead a discussion to share the conclusions drawn about the non-rectangular shapes. Ask,

   Was the conjecture about non-rectangular shapes a true statement? Explain.

   What relationships, if any, were found between the areas and the perimeters of the non-rectangles?

2. Display the chart with the conjectures. Ask,

   Are there any other conjectures that can be added to the chart about areas and perimeters of two-dimensional figures?

   What conjecture can be made about squares?

3. Have the students work with their groups to develop at least one conjecture to add to the chart.

Other conjectures about perimeter and area:

Squares will have a different relationship between area and perimeter than other rectangles.

Rectangles that are more than one square wide will have a different relationship between the areas and the perimeters than the rectangles that are only one square wide.

The areas and perimeters of the classrooms in our hall follow a pattern.

Apply

Making Connections

The following activities can be used with whole groups, small groups, or individuals, depending on the needs of your students. The activities connect to past and future learning.

Testing Conjectures

As students investigate and test other conjectures listed on the chart, have them share their findings with the class.

Other Shapes

Direct each group of students to develop another shape to test to analyze whether the relationship between areas and perimeters found in the lesson continues to work. Have them share their findings with the class.

Home Connection 12

Distribute Home Connection 12 to each student. Instruct the students to use the squares to make further tests with other shapes. Tell them to be prepared to share their findings with the class.

Teacher Reflection

What did I learn about my students as they made and tested conjectures about area and perimeter?

What did my students learn about area and perimeter from each other?

Assessment

- Are students able to investigate area and perimeter using manipulatives?
- Are students able to make and test conjectures about area and perimeter?
- Are students able to analyze data represented in a table?

Information can be gathered from

Class Discussion

Teacher Observation

Individual and Group Questioning

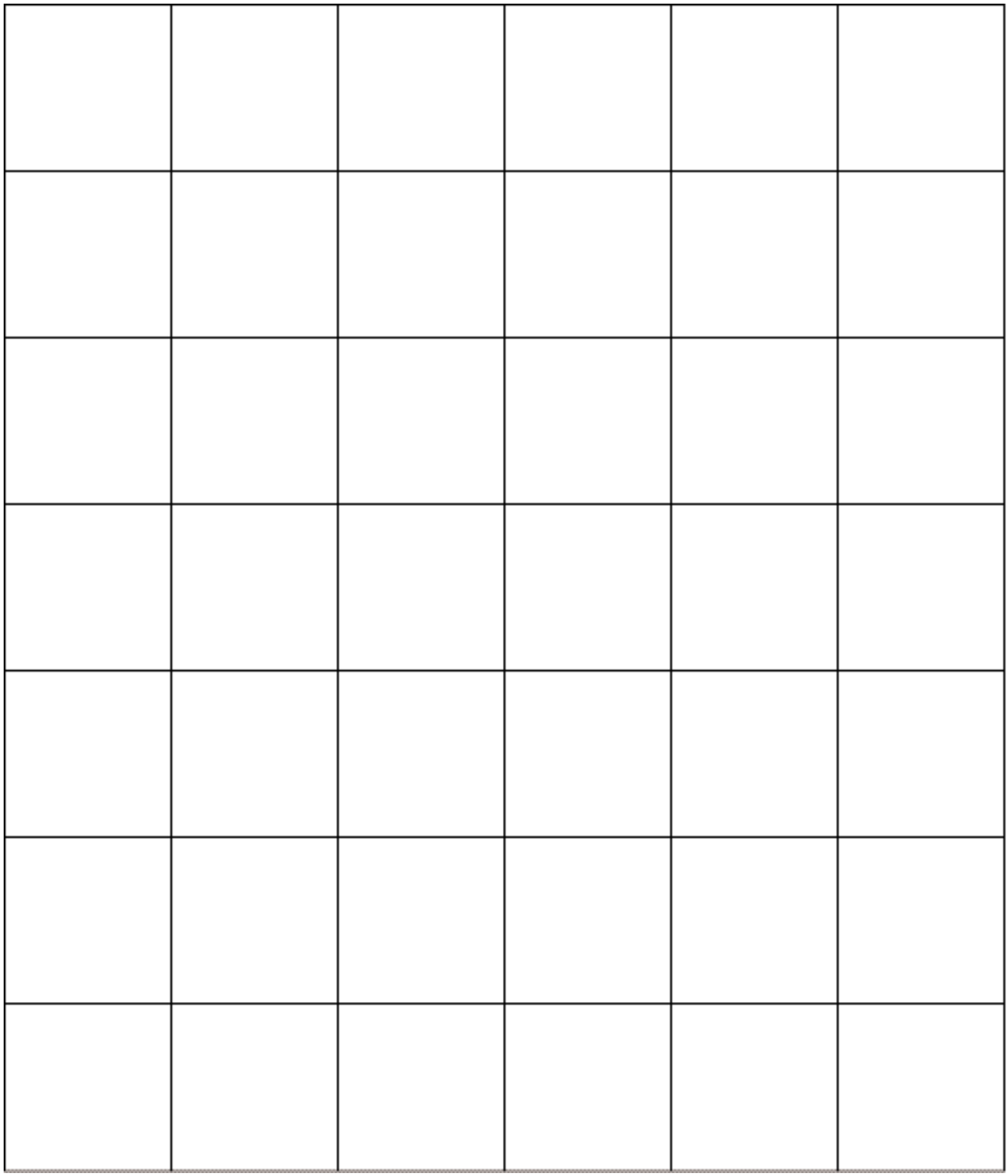
Area and Perimeter

Testing Conjectures

More Conjectures

Making Connections

Grid Paper



Home Connection 12

In math class we found a relationship between the areas and the perimeters of rectangles that are one unit wide. The relationship shows that the perimeter is double the area + 2.

Cut apart the squares below to test other rectangles and other shapes to see if the same relationship exists. Be prepared to share your findings with the class.