Chapter

5 Area and Perimeter

Dear Student,

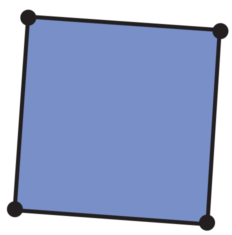
You already know various units for measuring different kinds of things. If you want to know how long a fence is, you might measure its length in feet and inches.

What units could you use to measure how much water it takes to fill up your bathtub?

What units could you use to measure how much paint is needed to cover a wall?

Would you use the same units to measure the distance around a baseball field?

In this chapter, you'll be measuring with square units of various sizes, like this one:



What could you measure with this unit?

Mathematically yours,

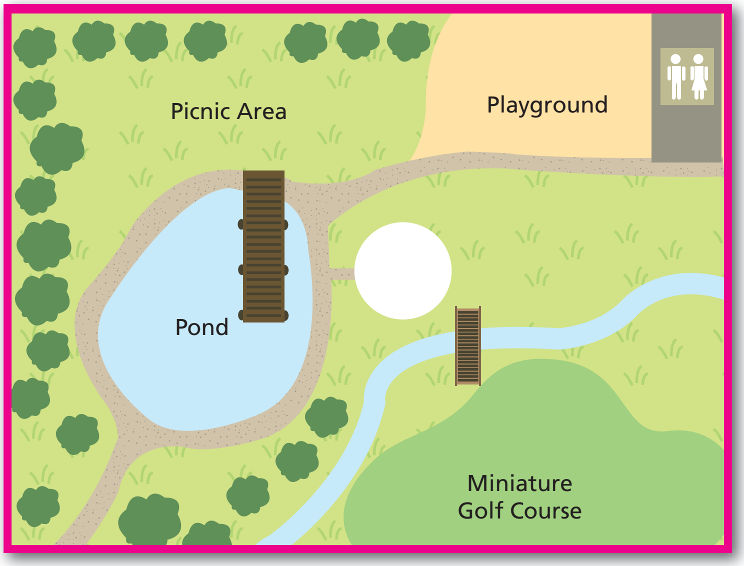
The authors of ***Think Math!***

THE WORLD ALMANAC FOR KIDS

Reading and Analyzing Maps

FACT • ACTIVITY 1

Pictures from satellite cameras above the earth can show your neighborhood. Images can show things as small as 2 meters, such as a bicycle in a park. A map also represents a view from above. The map at the right shows a neighborhood park.



Use the map and a centimeter ruler to answer Problems 1–5.

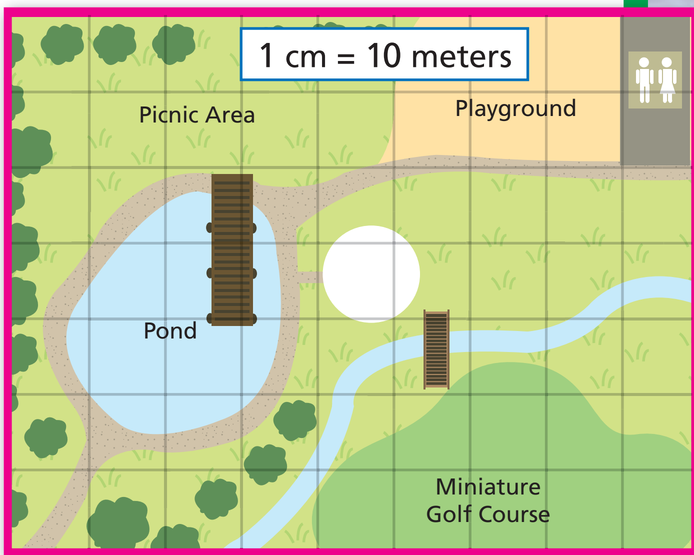
1. Find the dock and the bridge on the map. About how many times longer is the dock than the bridge?
2. To the nearest centimeter, how long is the dock on the map?
3. If each centimeter represents 10 meters, about how long is the actual dock?
4. Measure the perimeter of the gazebo with string. To the nearest centimeter, how many centimeters of string did you use?
5. If each centimeter on the map represents 10 meters, about how many meters is the distance around the gazebo?

FACT·ACTIVITY 2

Maps have "legends" that show what measure on the map represents what distance. This map shows that 1 centimeter represents 10 meters. This map also has a grid that helps you estimate measurements.

Look at the park again. Now it is covered by a grid.

1. About how many square meters is the gazebo? Explain.
2. Estimate the area of the pond.
3. Compare the area of the playground to the area of the miniature golf course.
4. Estimate the perimeter of the playground and rest room building. Explain how you found your answer.
5. If each square represents 100 square meters, about how many square meters does the playground cover?



CHAPTER PROJECT

You and your classmates are organizing a club to raise awareness of the need to keep the local park clean. One of your jobs is to create a design that will represent your club.

- Design an emblem for a patch that can be sewn or ironed onto a shirt. The emblem must be no bigger than 28 square centimeters.
- Draw your emblem on centimeter grid paper. Estimate the area of your design.
- Put the club name or motto on the design.

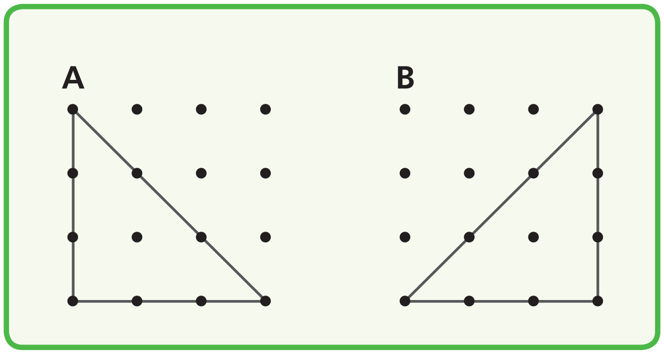
ALMANAC Fact

The first satellite photos of earth were taken in 1960. They were used to look at weather patterns.

Chapter 5
Lesson 2

EXPLORE
Comparing Areas

For each pair of figures, decide whether the two figures are congruent, and find the area of each figure. On a separate sheet of paper write *true* or *false* and the area of each figure.

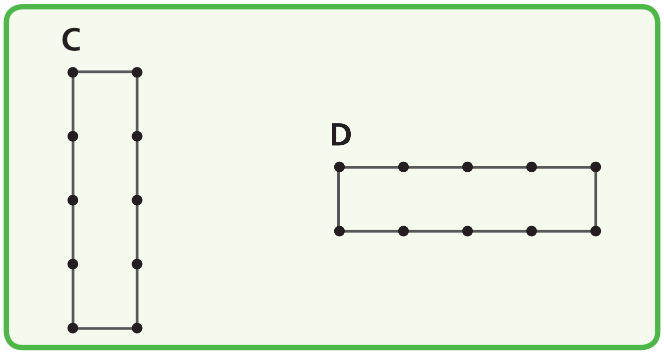


A is congruent to **B.**

True or False

Area of **A:** square units

Area of **B:** square units

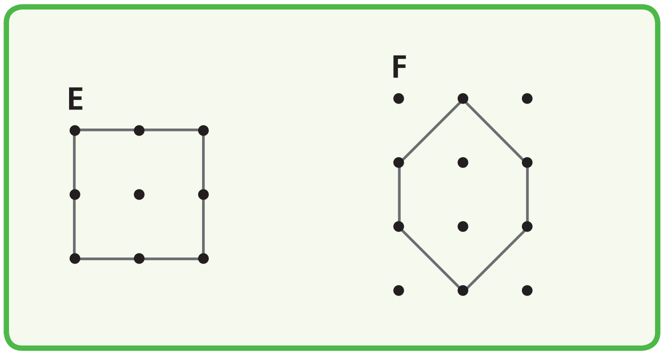


C is congruent to **D.**

True or False

Area of **C:** square units

Area of **D:** square units

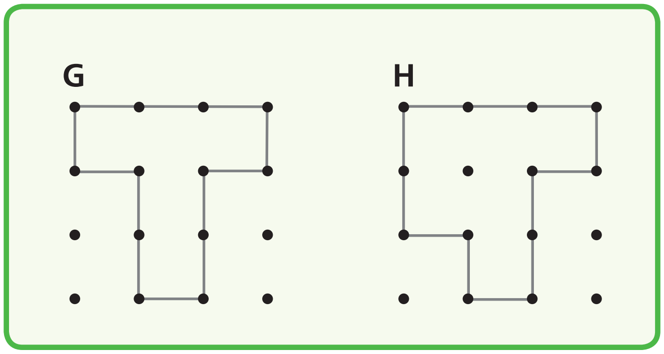


E is congruent to **F.**

True or False

Area of **E:** square units

Area of **F:** square units



G is congruent to **H.**

True or False

Area of **G:** square units

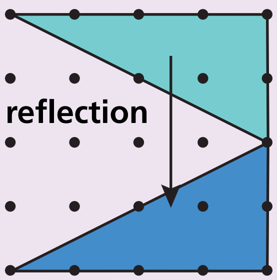
Area of **H:** square units

Chapter 5

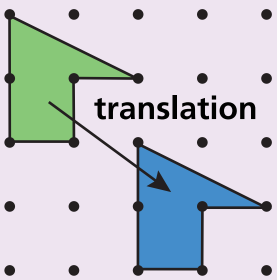
Lesson 2

REVIEW MODEL
Using Transformations to Find Areas

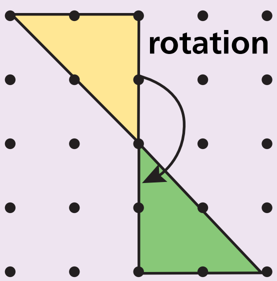
If two figures are congruent, they must have the same area. The figures will always be congruent if one figure is a reflection, a translation, or a rotation of the other.



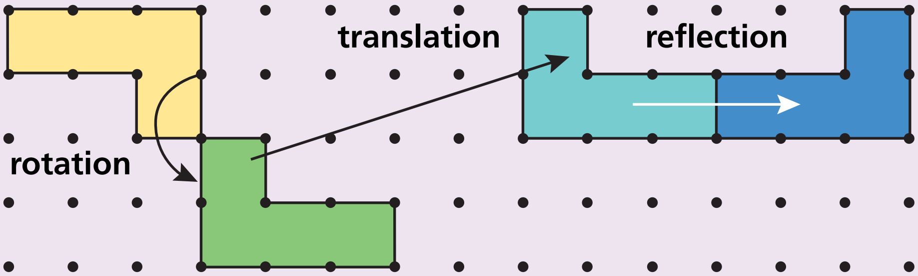
The triangles have the same area.



The figures have the same area.



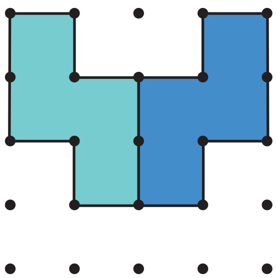
The triangles have the same area.

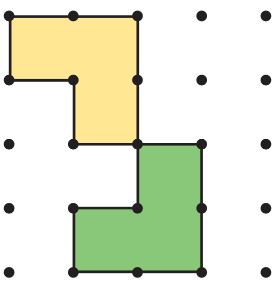


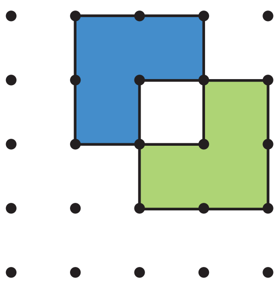
All four figures have the same area.

Check for Understanding

Determine if a translation, rotation, or reflection was used to move one figure onto the other. Write your answers on a separate sheet of paper.

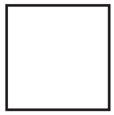
1. 

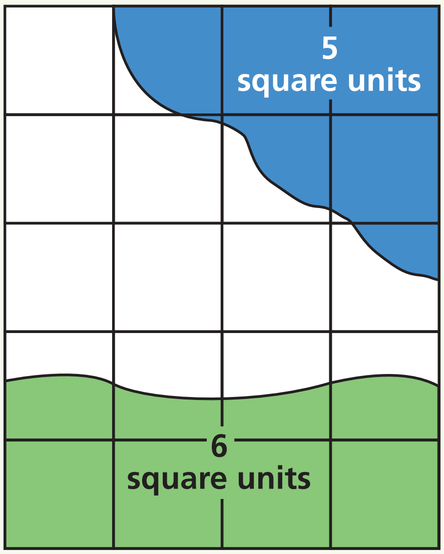
2. 

3. 

Chapter 5
Lesson 3

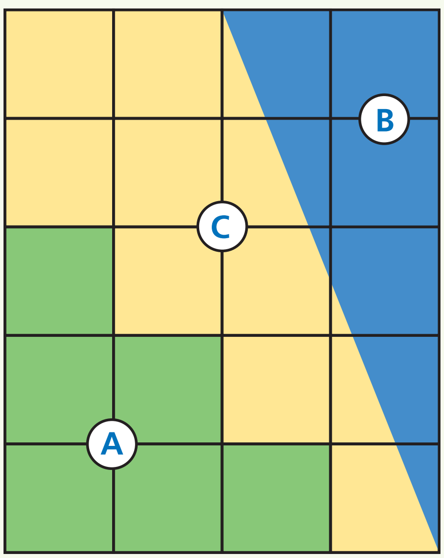
EXPLORE
Finding the Area of a Strange Shape

On this page, one unit of area is this big: 
Write your answers on a separate sheet of paper.



If the area of the blue part is 5 square units and the area of the green part is 6 square units:

1. What is the area of the **white part?**



2. What is the area of **A?**

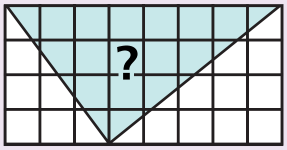
3. What is the area of **B?**

4. What is the area of **C?**

REVIEW MODEL
Finding Areas of Triangles

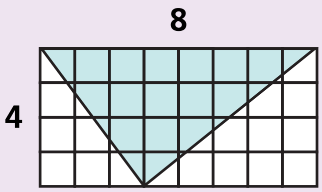
You can use what you know about finding the area of a rectangle to find the area of a triangle.

What is the area of the shaded triangle?



Step 1

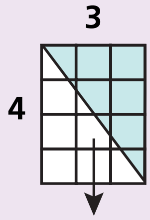
Find the area of the rectangle.



$4 \times 8 = 32$

Step 2

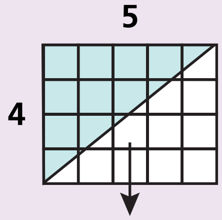
Find the area of the unshaded triangle on the left.



$(4 \times 3) \div 2 = 6$

Step 3

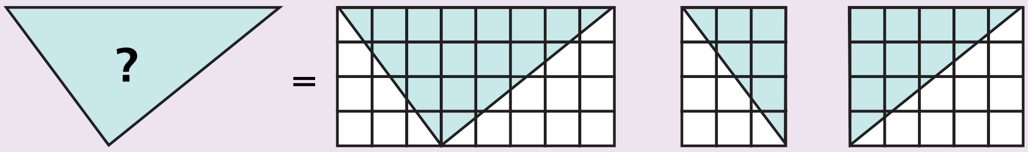
Find the area of the unshaded triangle on the right.



$(4 \times 5) \div 2 = 10$

Step 4

Subtract the areas of the unshaded triangles from the area of the rectangle.

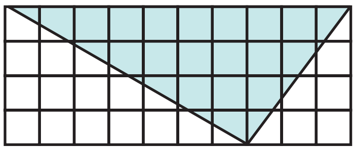


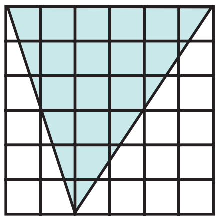
$32 \quad - \quad 6 \quad - \quad 10 \quad = \quad 16$

The area of the shaded triangle is 16 square units.

Check for Understanding

Find the area of the shaded triangle. Write your answers on a separate sheet of paper.

1. 

2. 

Chapter 5
Lesson 7

EXPLORE
Making Rectangles Whose Perimeter is 20 cm

1 On a piece of centimeter grid paper, draw as many different rectangles as you can, following these rules:

- ☑ **The perimeter is 20 cm.**
- ☑ **The length of each side must be a whole number of centimeters.**
- ☑ **Congruent rectangles all count as the same rectangle.**

2 Find the area of each of your rectangles. (One square of grid paper equals one square centimeter.) Write your answers on a separate sheet of paper.

3 Do you think you've made all the rectangles that can be made following these rules? How could you check?

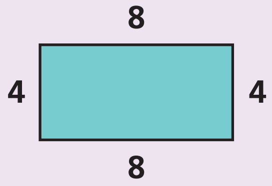
Chapter 5

Lesson 7

REVIEW MODEL
Comparing Areas and Perimeters

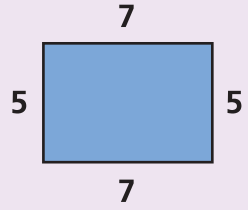
Area measures the region *inside* a figure. Perimeter measures the distance around the *outside* of the figure.

Two figures can have the **same** perimeter but **different** areas.



Perimeter = 8 + 4 + 8 + 4 = 24 units

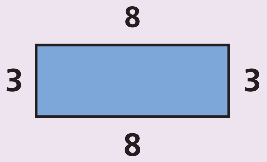
Area = 8 × 4 = 32 square units



Perimeter = 7 + 5 + 7 + 5 = 24 units

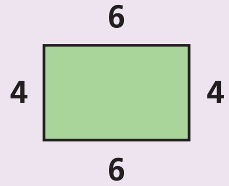
Area = 7 × 5 = 35 square units

Two figures can have the **same** area but **different** perimeters.



Area = 8 × 3 = 24 square units

Perimeter = 8 + 3 + 8 + 3 = 22 units



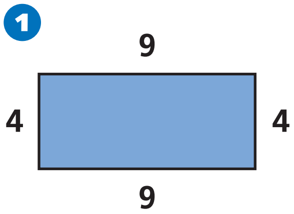
Area = 6 × 4 = 24 square units

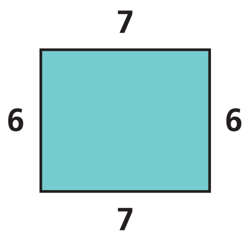
Perimeter = 6 + 4 + 6 + 4 = 20 units

Check for Understanding

Tell if the areas are the same or different. Then tell if the perimeters are the same or different. Write your answers on a separate sheet of paper.

1





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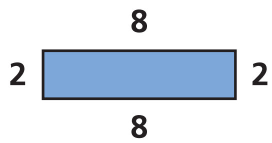
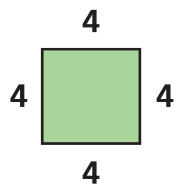
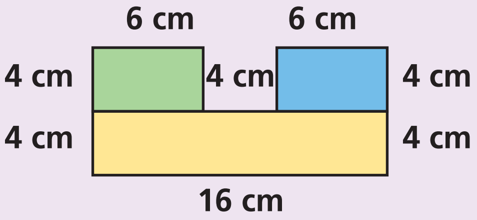




REVIEW MODEL
Problem Solving Strategy
Solve a Simpler Problem

Tony is making large block letters for a class project. His letter U is shown at the right. What is the area of the paper he will need to make the letter?



Strategy: **Solve a Simpler Problem**

Read to Understand

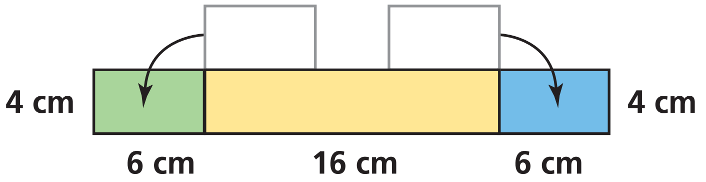
What do you know from reading the problem?
the dimensions of a figure in the shape of the letter U
What do you need to find out?
the area of the paper needed to make the letter

Plan

How can you solve this problem?
You could find the areas of the three rectangles that form the figure, and then find their sum. But you could also look for a simpler way to solve the problem.

Solve

How can a simpler problem help you find the answer?



The green and blue rectangles are the same height as the yellow rectangle. So you could place them beside the yellow rectangle to form a long rectangle 4 cm tall and $(6 + 16 + 6)$ centimeters $= 28$ centimeters long.

The area of the new rectangle is the same as the area of the letter U. The area is $4 \times 28 = 112$ square centimeters.

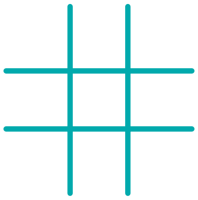
Check

Look back at the original problem. Does your answer make sense?
If I want to check my answer, I can calculate the areas of the three rectangles individually, and add them to see if I get a sum of 112 square centimeters

Problem Solving Practice

Use the strategy *solve a simpler problem* to solve.

1. If you draw 2 horizontal and 2 vertical lines, you can make a 9-space tic-tac-toe diagram. If you used 7 horizontal and 7 vertical lines, how many spaces would the diagram have?



2. A bell rang 12 times. Each ring lasted 5 seconds. There were 2 seconds between rings. How long did the ringing last?

Problem Solving Strategies

- ✔ Act It Out
- ✔ Draw a Picture
- ✔ Guess and Check
- ✔ Look for a Pattern
- ✔ Make a Graph
- ✔ Make a Model
- ✔ Make an Organized List
- ✔ Make a Table
- ✔ **Solve a Simpler Problem**
- ✔ Use Logical Reasoning
- ✔ Work Backward
- ✔ Write an Equation

Mixed Strategy Practice

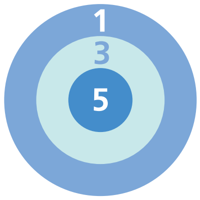
Use any strategy to solve. Explain.

3. Greg, Juan, and Valerie found a box of tennis balls. Greg took half the balls. Juan took half of the balls that were left. Valerie took the remaining 3 balls. How many tennis balls were in the box at the beginning?

4. Tiffany and Ted live on the same street. Each of their house numbers has two digits. The sum of the digits of each number is 14. Both numbers are even. What are the house numbers?

5. A snail is at the bottom of a well that is 30 feet deep. Each day the snail crawls up 3 feet. Each night it slips back 2 feet. How long will it take the snail to crawl out of the well?

6. Three darts hit the dartboard. How many scores are possible?



7. Marcus earned \$80 in two days. The second day he earned \$10 more than he earned the first day. How much did he earn each day?

8. A square has a perimeter of 32 centimeters. What is the area of the square?

Chapter 5 Vocabulary

Choose the best vocabulary term from Word List A for each sentence.

1. Two figures that have the same size and shape are __?__.
2. The distance around a shape is its __?__.
3. The top of a card table could have an area of 1 square __?__.
4. Area is measured in __?__.
5. You can use a stamp to __?__ the area of a post card in square centimeters.
6. The number of congruent squares that fit inside a shape is its __?__.
7. A(n) __?__ is not as long as an inch.
8. To find the area of a rectangle, multiply its length by its __?__.

Word List A

- area
- centimeter
- congruent
- estimate
- length
- meter
- perimeter
- square units
- width

Complete each analogy. Use the best term from Word List B.

9. Inch is to perimeter as square inch is to __?__.
10. Penny is to dollar as __?__ is to meter.

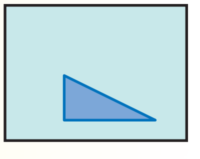
Word List B

- area
- centimeter
- length

Talk Math

Discuss with a partner what you have just learned about area and perimeter. Use the vocabulary terms *length, width,* and *area.*

11. Explain how you could estimate the area of a desktop.
12. Explain how you could find the area of the rectangle without including the area of the small triangle.



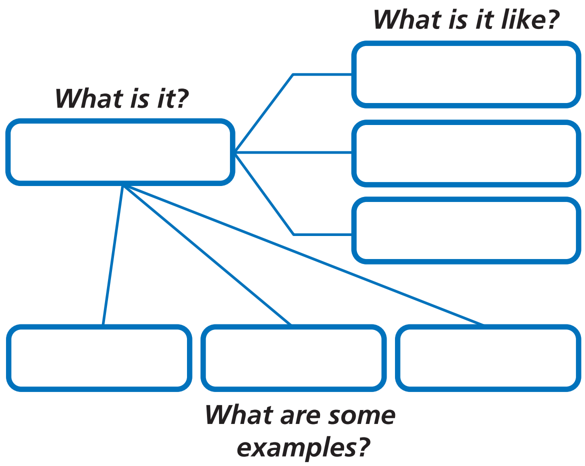
Word Definition Map

14 **Create a Word Definition Map for the word *estimate.***

A What is it?

B What is it like?

C What are some examples?



Analysis Chart

15 **Create an analysis chart for the words *centimeter, meter, inch,* and *foot.* Use what you know and what you have learned about units of measure.**

What's in a Word?

METER The original meaning of the word *meter* is "measure." A parking *meter* measures the time a car is parked. A *meter* in poetry is the rhythm of the syllables. A *meter* in music is the number of beats in each musical measure. In each of these examples, *meter* has something to do with "measure."

In mathematics, the *meter* is the basic unit of measure in the metric measurement system. Since the prefix *centi-* means "hundredth," a centimeter is one hundredth of a meter. The prefix *peri-* means "around," so a *perimeter* is the measure around a shape.

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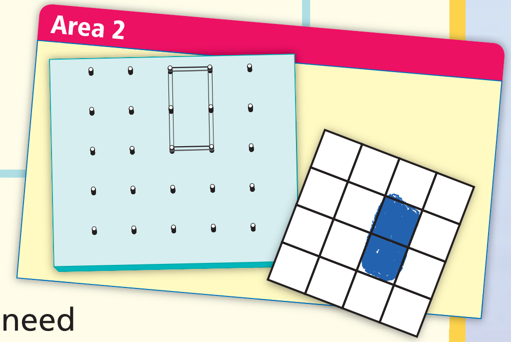
GAME

Area 2

Game Purpose
To practice drawing figures with a given area

Materials
- Activity Master 38: *Grid Paper*
- Geoboards (if available)

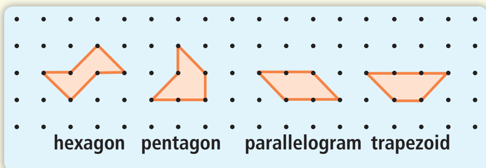


How To Play The Game

1. Play this game with a group. Each player will need several copies of Activity Master 38. Players can also use a geoboard and rubber bands to practice making figures.

2. The first player tries to draw a figure with an area of 2 square units. The group checks to see whether the area is 2 square units. If it is, the player scores 1 point.

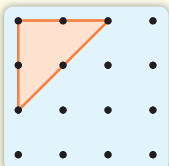
3. Players take turns drawing figures with an area of 2 square units. To score 1 point, a player must draw a different figure from the ones that have already been drawn.
Here are some possible figures:

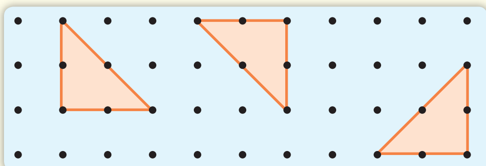


4. A figure that is a flip, slide, or turn of another figure is not a different figure. So, the player does not get a point.

Example:

Dorian draws this figure. Then these figures cannot score points:





5. The player with the most points is the winner.

GAME

Area Claim

Game Purpose
To practice transforming figures

Materials
- AM39: *Area Claim*, AM40: *Area Claim: Figure Cards*, AM41: *Area Claim: Transformation Cards*

How To Play The Game

1. This game can be played with 2 or more players. You need 4 copies of Activity Master 40. Cut out the Figure and Transformation Cards. Mix up the Figure and Transformation Cards. Place them face down in separate piles.

2. Player 1 takes one card from each pile and matches his or her figure card to the same figure on the *Area Claim* grid.
   - Look at the Transformation Card. Draw a copy of the figure. Don't overlap any other figure.
   - Claim the area by writing your initials in the new figure.
   - Put the used cards aside in separate piles.

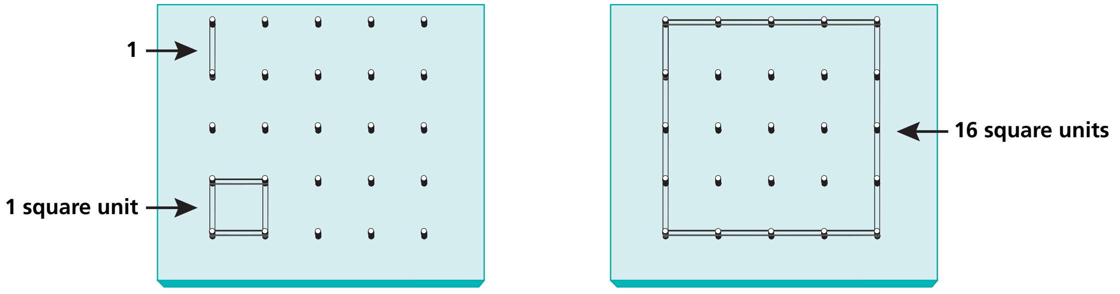
3. Players take turns adding new figures to the grid.
   - You may only start from a figure printed on the grid or from a figure with your initials.
   - If the cards run out, mix up the used cards, and keep playing until you go through both piles of cards twice.
   - If you cannot find space to draw a new figure, your turn ends.

4. The game ends when there is no room to draw any new figures. Score 1 point for every square unit covered by a figure with your initials. The player with the most points wins.

CHALLENGE

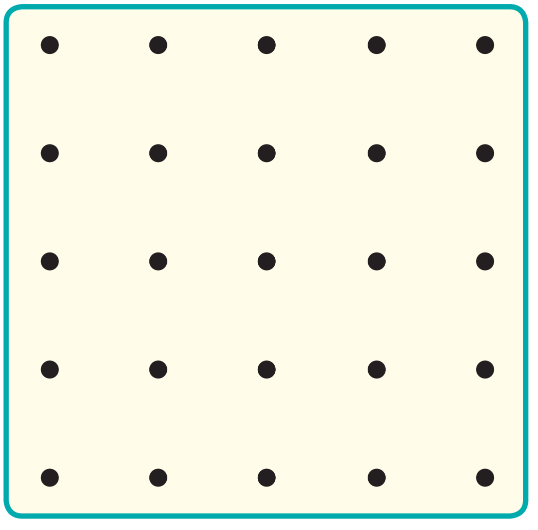
On a geoboard, the shortest line you can make is 1 unit, so the smallest square has an area of 1 square unit.

The largest square you can make will fill the geoboard and have an area of 16 square units.



How many squares with different areas between 1 square unit and 16 square units can you make?

Use a geoboard. Or you can trace copies of the board below and draw all the squares with different areas you can make.



Hint: You will not be able to find squares for every number between 1 and 16.