

Squares Covering Rectangles

ID: 12218

Time required

45 minutes

Activity Overview

In this activity, students discover the relationship between a change in the dimensions of a rectangle and the change in the corresponding area.

Topic: Problem Solving

- *Understand measurable attributes of objects and the units, systems, and processes of measurement*
- *Understand relationships among units and convert from one unit to another within the same system*

Teacher Preparation and Notes

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it. If you would like to send the images to students, it will be helpful for students to know how to retrieve pictures.*
- *For Problem 3, students should be familiar with the greatest common factor. The **gcd()** feature will be used to find a common side in two figures.*
- **To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter “12218” in the quick search box.**

Associated Materials

- *MGAct19_Rectangles_worksheet_TI73.doc*
- *MGAct19_Nav01_TI73.act*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

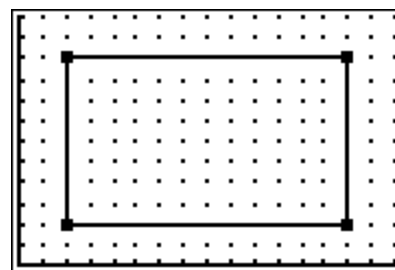
- *Dimension and Area (TI-73 Explorer with TI-Navigator) — 6687*
- *Area Formulas App (TI-73 Explorer) — 6814*
- *Geoboard and Area (TI-73 Explorer with TI-Navigator) — 6690*

Problem 1 – Wide and Long

Questions 1-3

In the first set of exercises, students can either count the squares or count the length of the sides and multiply. They could also draw squares by connecting the dots and then count the squares to find the area.

Students may have difficulty keeping the dots straight on the last problem. Suggest that they use a ruler to run down or across the figure to help with counting.



Questions 4-7

Students should recognize the pattern between the relationship of the side lengths to the area. However, they may need to see more patterns. In that case, you can use the original lists $\{1, 7, 7, 1\}$ $\{1, 1, 5, 5\}$ to create the rectangle and adjust the window to change the scale. In some cases, the change in scale will cause vertices to not land on a “dot”. This will make it difficult to count the squares. Carefully select the points used as vertices and the scale factors used to change the dimensions of the sides.

Problem 2 – Making Predictions

Questions 8-10

In this problem set, students should use the pattern identified in Problem 1 to find the unknown areas without a figure. Students may want to draw a figure to determine what each side is multiplied by to get the new dimensions.

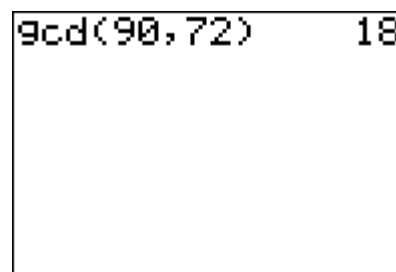
Problem 3 – Finding the Missing Sides

Questions 11-15

In this problem set, students bring several different ideas together to solve problems. First, they should realize that if the figures share a side, one dimension will be the same for both figures.

Next, students should realize that the shared side is a factor of both areas. The greatest common factor, or **gcd**(on the TI-73, will determine what the largest possible side is that the two figures can share.

To find the greatest common factor, press **MATH** and select gcd(. Then enter the first number, , the second number, and **ENTER**.



Solutions – student worksheetProblem 1

1. Length, 3; width 2; area 6 sq units
2. Length, 6; width 4; area 24 sq units
3. Length, 12; width 8; area 96 sq units
4. The sides are double and the area is 4 times larger.
5. The sides are double and the area is 4 times larger.
6. The sides are four times and the area is 16 times larger.
7. Because each side is 2 times larger, you multiply the original area by 2 twice. (for each side)
Or, you multiply the original area by 2^2 , or 4.

Problem 2

8. multiply both sides by 12 inches per foot, or multiply the area by 12^2 . 2,160 sq inches
9. The area will quadruple, from 54 sq ft to 216 sq ft.
10. 1,728 sq inches; multiply 12 sq ft by 12 inches per side.

Problem 3

11. Figure 1: 18 in \times 5 in; Figure 2: 18 in \times 4 in
12. Figure 1: 5 ft \times 5 ft; Figure 2: 5 ft. \times 3 ft.
13. Figure 1: 28 yds \times 5 yds; Figure 2: 28 yds \times 3
14. Figure 1: 20 cm \times 5 cm; Figure 2: 20 cm \times 4 cm
15. Figure 1: 25 ft \times 9 ft; Figure 2: 25 ft \times 3 ft.

Extension – TI-Navigator™

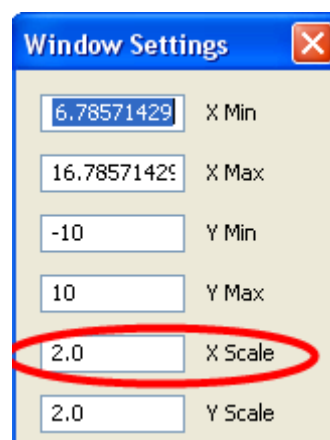
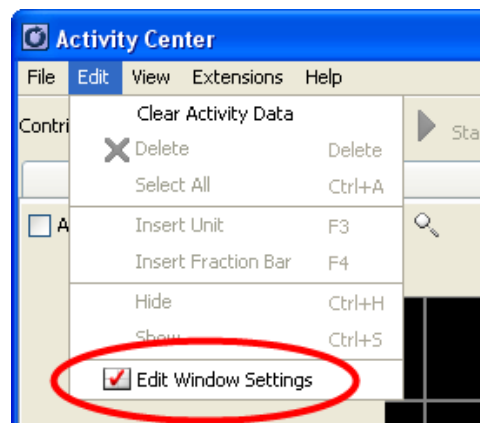
1. Load the *MGAct19_Nav01_TI73.act* activity settings file into Activity Center. This sets up Activity Center to display a grid with a rectangle superimposed on it.

Instruct students to determine the area of the rectangle in square units. Start the activity and have students enter the number 1 under **RECT** and its corresponding area under **AREA**.

Pause the activity and click on the **Edit Window Settings** icon. Change X Scale and Y Scale to 2. Resume the activity and ask students to once again determine the area of the same rectangle with different units. Students should enter the number 2 under **RECT** and its corresponding area under **AREA**.

Pause the activity again and click on the Edit Window Settings icon. Change X Scale and Y Scale to 1. Resume the activity and ask students to once again determine the area of the same rectangle with these new units.

Students should enter the number 3 under **RECT** and its corresponding area under **AREA**. Have students send their data for all three rectangles.



2. Stop the activity and click on the List tab to display student data. Verify that students found Rectangle 1 to have an area of 24 square units, Rectangle 2 to have an area of 96 square units, and Rectangle 3 to have an area of 384 square units.

Using **Quick Poll** (with Open Response), ask students by what factor the area increased when the length of the measurement unit in the first rectangle was decreased by a factor of 2 to give the measurement unit for the second rectangle. They should respond that the number of square units increased by a factor of 4 (since $96 \div 24 = 4$).

Using **Quick Poll** again, ask students by what factor the number of square units increased from the first rectangle to the third rectangle when the measurement unit was decreased by a factor of 4. They should realize that it changed by a factor of 16 (since $384 \div 24 = 16$).

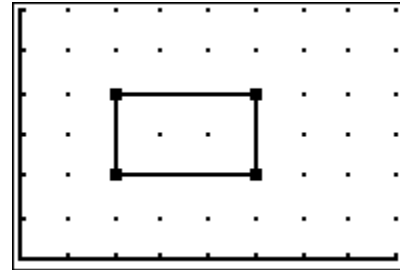
3. Use **Quick Poll** to assess student understanding of the relationship between changing the dimensions and the changes in the area. Throughout the lesson, ask related questions to the type of problem just worked.

Problem 1 – Wide and Long

Find the dimensions and area of each figure.

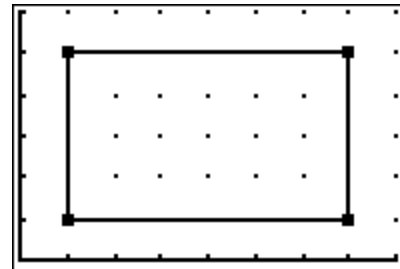
1. Length: _____ Width: _____

Area: _____



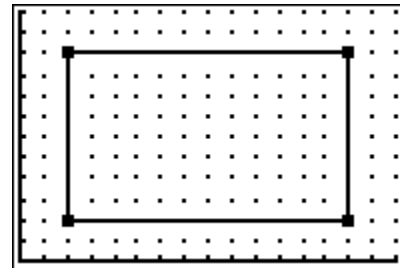
2. Length: _____ Width: _____

Area: _____



3. Length: _____ Width: _____

Area: _____



4. How do the dimensions of Rectangle 1 compare to Rectangle 2? The area?

5. How do the dimensions of Rectangle 2 compare to Rectangle 3? The area?

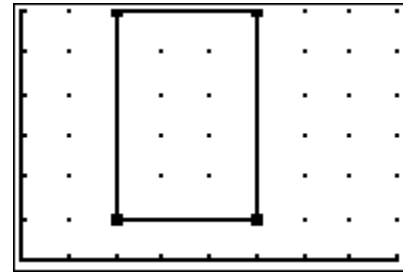
6. How do the dimensions of Rectangle 3 compare to Rectangle 1? The area?

7. What happens to the area of a figure when the length and width double? Why is this true? _____

Problem 2 – Making Predictions

Given the relationship you found in Problem 1, find the area of the unknown figure. Draw a figure to help show your answer.

8. A rug has an area of 15 square feet. What is the area of the rug measured in square inches?



9. Joseph is building a new storage building. He thinks the current size, 9' x 6' does not have enough area inside. What will the area be if he doubles the length of the sides?

10. Shelia created a blanket that is 3 feet by 4 feet. Her mom asked what the area is in square inches instead of feet.

Problem 3 – Finding the Missing Sides

Find the missing sides in each problem. The figures should share the largest side possible.

11. Figure 1: 90 sq inches _____ × _____
 Figure 2: 72 sq inches _____ × _____

Use the **gcd()** feature to find the largest possible side the two figures share. Press **MATH** **ENTER**, then enter **9** **0** **,** **7** **2** **)** and press **ENTER** to evaluate.

12. Figure 1: 25 sq feet _____ × _____
 Figure 2: 15 sq feet _____ × _____

13. Figure 1: 140 sq yds _____ × _____
 Figure 2: 84 sq yds _____ × _____

14. Figure 1: 100 sq cm _____ × _____
 Figure 2: 80 sq cm _____ × _____

15. Figure 1: 225 sq feet _____ × _____
 Figure 2: 75 sq feet _____ × _____