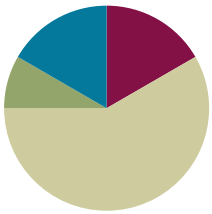
# Lesson 21

## Objective: Construct rectangles with a given perimeter using unit squares and determine their areas.

### Suggested Lesson Structure



| | |
|---|---|
| Fluency Practice | (10 minutes) |
| Application Problem | (5 minutes) |
| Concept Development | (35 minutes) |
| Student Debrief | (10 minutes) |
| **Total Time** | **(60 minutes)** |

## Fluency Practice (10 minutes)

- Sprint: Multiply or Divide by 3 **3.OA.7** (10 minutes)

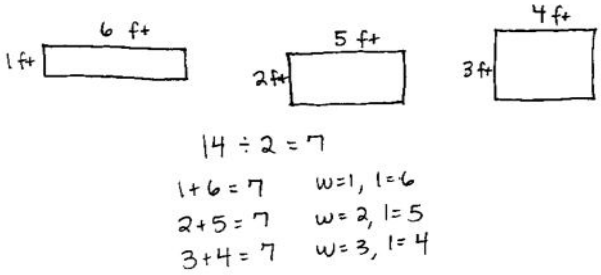
### Sprint: Multiply or Divide by 3 (10 minutes)

Materials: (S) Multiply or Divide by 3 Sprint

Note: This Sprint builds fluency with multiplication and division facts using units of 3.

## Application Problem (5 minutes)

Mrs. Zeck will use 14 feet of tape to mark a rectangle on the gym wall. Draw several rectangles that Mrs. Zeck could make with her tape. Label the width and length of each rectangle.




**NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:**

Scaffold the Application Problem for students working below grade level. One solution path (shown here) is to find half of the perimeter and list all addend pairs with a sum of 7. Set individualized goals for effort and persistence, perhaps by providing a checklist of problem-solving self-talk, such as, "What information do I know?"

Note: This problem reviews Lesson 20. If time allows, invite students to discuss which rectangular target they would want to try to hit by throwing a ball from the opposite side of the gym.

## Concept Development (35 minutes)

Materials: (S) Centimeter grid paper (Template), Problem Set, personal white board

T: Read the first sentence of Problem 1 on the Problem Set.

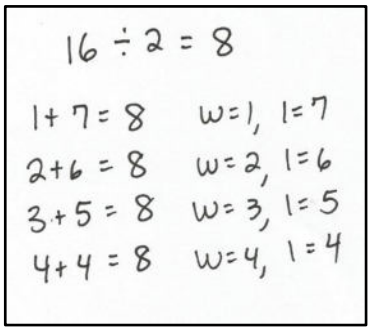
S: (Read: On your centimeter grid paper, shade and label as many rectangles as you can with a perimeter of 16 centimeters.)

T: Tell a partner the strategy you will use to find rectangles with a perimeter of 16 centimeters.

MP.5

S: I'll start by finding half of the perimeter, which is 8. Then, I'll write addition sentences that equal 8. The numbers in these addition sentences are the widths and lengths of the rectangles.

T: Work with a partner to find the widths and lengths for rectangles with a perimeter of 16 centimeters. (Sample student work is shown to the right.)




T: Share your work with another pair of students. If your answers are different, figure out why, and come to an agreement.

S: (Share with another pair and make adjustments.)

T: How many different rectangles did you find with a perimeter of 16 centimeters?

S: 4 rectangles!

T: Talk to a partner: Are any of your rectangles squares? How do you know?

S: Yes. The rectangle with a width of 4 and a length of 4 is a square. → That's right because all the side lengths are equal.

T: Shade each rectangle on your centimeter grid paper, and label the side lengths. Darken the perimeters of the rectangles so they stand out on the grid.

S: (Shade rectangles on the centimeter grid paper.)

When students finish shading, facilitate a class discussion using the following suggested questions.

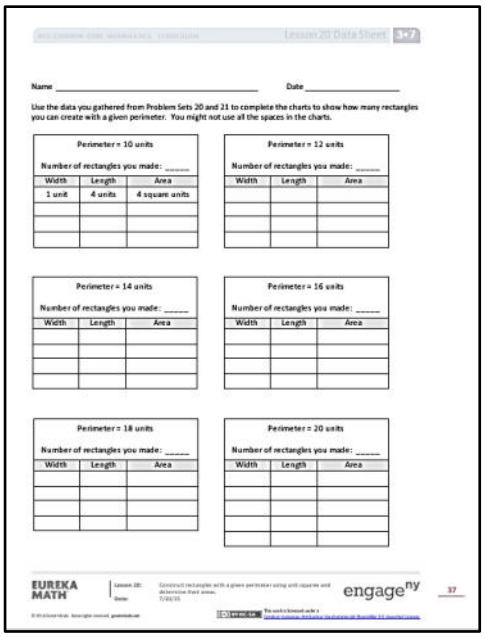
- How can you be sure that all of the rectangles have a perimeter of 16 centimeters?
- Do you think the rectangles all have the same area? Why or why not?
- Which rectangle do you think has the smallest area? The greatest area? Why?

After the discussion, ask students to finish Problem 1, which includes sketching each rectangle, labeling the side lengths, and finding the areas. Repeat the process for Problem 2 on the Problem Set, releasing students to work independently as they are ready.

## Problem Set (10 minutes)

Students should do their personal best to complete Problems 3 and 4 on the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

To prepare for Lesson 22, students should add their data from today's lesson to the sheet shown to the right. (A master copy is included at the end of this lesson.) An extra five minutes is built into the time allotted for the Concept Development to accommodate this. However, choose when the data collection might happen most smoothly for the class, perhaps at the end of the Problem Set or the Student Debrief or after completing the Exit Ticket.



Name _____ Date _____

Use the data you gathered from Problem Sets 20 and 21 to complete the charts to show how many rectangles you can create with a given perimeter. You might not use all the spaces in the charts.

Perimeter = 10 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| 1 unit | 4 units | 4 square units |
| | | |
| | | |
| | | |
| | | |

Perimeter = 12 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 14 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 16 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 18 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 20 units — Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
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| | | |
| | | |

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## Student Debrief (10 minutes)

**Lesson Objective:** Construct rectangles with a given perimeter using unit squares and determine their areas.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

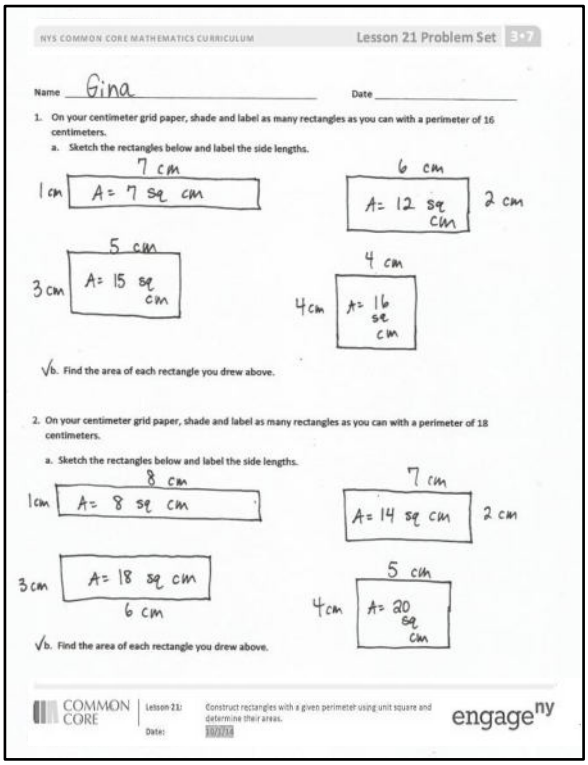
Any combination of the questions below may be used to lead the discussion.

- Compare the rectangles you drew on your grid paper for Problems 1 and 2. What patterns do you see in the side lengths?
- Look at the charts in Problem 3. Can a rectangle with a perimeter of 10 units have a greater area than a rectangle with a perimeter of 20 units? How do you know?
- Share your answers to Problem 4. Do you know for sure what Macy's and Gavin's rectangles look like? Why or why not?

- Look at the number of rectangles you made with the given perimeters in Problems 1, 2, and 3. Why do you think you can make more rectangles with some perimeters than with others?

## Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 21 Problem Set 3•7

Name Gina Date

1. On your centimeter grid paper, shade and label as many rectangles as you can with a perimeter of 16 centimeters.
   a. Sketch the rectangles below and label the side lengths.

7 cm, 1 cm, A= 7 sq cm
6 cm, 2 cm, A= 12 sq cm
5 cm, 3 cm, A= 15 sq cm
4 cm, 4 cm, A= 16 sq cm

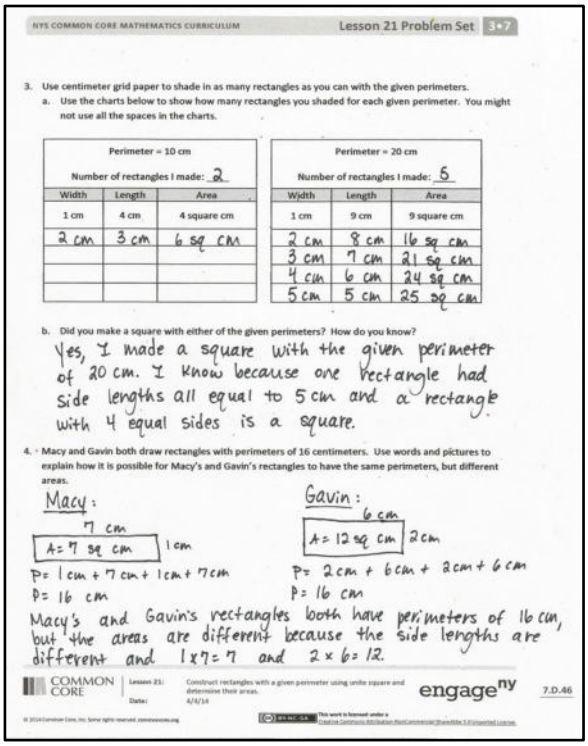
√b. Find the area of each rectangle you drew above.

2. On your centimeter grid paper, shade and label as many rectangles as you can with a perimeter of 18 centimeters.
   a. Sketch the rectangles below and label the side lengths.

8 cm, 1 cm, A= 8 sq cm
7 cm, 2 cm, A= 14 sq cm
A= 18 sq cm, 3 cm, 6 cm
5 cm, 4 cm, A= 20 sq cm

√b. Find the area of each rectangle you drew above.

COMMON CORE Lesson 21: Date: 10/7/14 Construct rectangles with a given perimeter using unit square and determine their areas. engage^ny



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 21 Problem Set 3•7

3. Use centimeter grid paper to shade in as many rectangles as you can with the given perimeters.
   a. Use the charts below to show how many rectangles you shaded for each given perimeter. You might not use all the spaces in the charts.

Perimeter = 10 cm — Number of rectangles I made: 2

| Width | Length | Area |
|---|---|---|
| 1 cm | 4 cm | 4 square cm |
| 2 cm | 3 cm | 6 sq cm |
| | | |
| | | |
| | | |

Perimeter = 20 cm — Number of rectangles I made: 5

| Width | Length | Area |
|---|---|---|
| 1 cm | 9 cm | 9 square cm |
| 2 cm | 8 cm | 16 sq cm |
| 3 cm | 7 cm | 21 sq cm |
| 4 cm | 6 cm | 24 sq cm |
| 5 cm | 5 cm | 25 sq cm |

   b. Did you make a square with either of the given perimeters? How do you know?

Yes, I made a square with the given perimeter of 20 cm. I know because one rectangle had side lengths all equal to 5 cm and a rectangle with 4 equal sides is a square.

4. Macy and Gavin both draw rectangles with perimeters of 16 centimeters. Use words and pictures to explain how it is possible for Macy's and Gavin's rectangles to have the same perimeters, but different areas.

Macy: 7 cm, A= 7 sq cm, 1 cm
P= 1 cm + 7 cm + 1 cm + 7 cm
P= 16 cm

Gavin: 6 cm, A= 12 sq cm, 2 cm
P= 2 cm + 6 cm + 2 cm + 6 cm
P= 16 cm

Macy's and Gavin's rectangles both have perimeters of 16 cm, but the areas are different because the side lengths are different and 1 x 7 = 7 and 2 x 6 = 12.

COMMON CORE Lesson 21: Date: 4/4/14 Construct rectangles with a given perimeter using unit square and determine their areas. engage^ny 7.D.46

# A

Number Correct: _____

Multiply or Divide by 3

| | | |
|---|---|---|
| 1. | 2 × 3 = | |
| 2. | 3 × 3 = | |
| 3. | 4 × 3 = | |
| 4. | 5 × 3 = | |
| 5. | 1 × 3 = | |
| 6. | 6 ÷ 3 = | |
| 7. | 9 ÷ 3 = | |
| 8. | 15 ÷ 3 = | |
| 9. | 3 ÷ 3 = | |
| 10. | 12 ÷ 3 = | |
| 11. | 6 × 3 = | |
| 12. | 7 × 3 = | |
| 13. | 8 × 3 = | |
| 14. | 9 × 3 = | |
| 15. | 10 × 3 = | |
| 16. | 24 ÷ 3 = | |
| 17. | 21 ÷ 3 = | |
| 18. | 27 ÷ 3 = | |
| 19. | 18 ÷ 3 = | |
| 20. | 30 ÷ 3 = | |
| 21. | ___ × 3 = 15 | |
| 22. | ___ × 3 = 3 | |
| 23. | ___ × 3 = 30 | |
| 24. | ___ × 3 = 6 | |
| 25. | ___ × 3 = 9 | |
| 26. | 30 ÷ 3 = | |
| 27. | 15 ÷ 3 = | |
| 28. | 3 ÷ 3 = | |
| 29. | 6 ÷ 3 = | |
| 30. | 9 ÷ 3 = | |
| 31. | ___ × 3 = 18 | |
| 32. | ___ × 3 = 21 | |
| 33. | ___ × 3 = 27 | |
| 34. | ___ × 3 = 24 | |
| 35. | 21 ÷ 3 = | |
| 36. | 27 ÷ 3 = | |
| 37. | 18 ÷ 3 = | |
| 38. | 24 ÷ 3 = | |
| 39. | 11 × 3 = | |
| 40. | 33 ÷ 3 = | |
| 41. | 12 × 3 = | |
| 42. | 36 ÷ 3 = | |
| 43. | 13 × 3 = | |
| 44. | 39 ÷ 3 = | |

# B

Number Correct: _____

Improvement: _____

Multiply or Divide by 3

| | | |
|---|---|---|
| 1. | 1 × 3 = | |
| 2. | 2 × 3 = | |
| 3. | 3 × 3 = | |
| 4. | 4 × 3 = | |
| 5. | 5 × 3 = | |
| 6. | 9 ÷ 3 = | |
| 7. | 6 ÷ 3 = | |
| 8. | 12 ÷ 3 = | |
| 9. | 3 ÷ 3 = | |
| 10. | 15 ÷ 3 = | |
| 11. | 10 × 3 = | |
| 12. | 6 × 3 = | |
| 13. | 7 × 3 = | |
| 14. | 8 × 3 = | |
| 15. | 9 × 3 = | |
| 16. | 21 ÷ 3 = | |
| 17. | 18 ÷ 3 = | |
| 18. | 24 ÷ 3 = | |
| 19. | 30 ÷ 3 = | |
| 20. | 27 ÷ 3 = | |
| 21. | ___ × 3 = 3 | |
| 22. | ___ × 3 = 15 | |
| 23. | ___ × 3 = 6 | |
| 24. | ___ × 3 = 30 | |
| 25. | ___ × 3 = 9 | |
| 26. | 6 ÷ 3 = | |
| 27. | 3 ÷ 3 = | |
| 28. | 30 ÷ 3 = | |
| 29. | 15 ÷ 3 = | |
| 30. | 9 ÷ 3 = | |
| 31. | ___ × 3 = 18 | |
| 32. | ___ × 3 = 24 | |
| 33. | ___ × 3 = 27 | |
| 34. | ___ × 3 = 21 | |
| 35. | 24 ÷ 3 = | |
| 36. | 27 ÷ 3 = | |
| 37. | 18 ÷ 3 = | |
| 38. | 21 ÷ 3 = | |
| 39. | 11 × 3 = | |
| 40. | 33 ÷ 3 = | |
| 41. | 12 × 3 = | |
| 42. | 36 ÷ 3 = | |
| 43. | 13 × 3 = | |
| 44. | 39 ÷ 3 = | |

Name _____ Date _____

1. On your centimeter grid paper, shade and label as many rectangles as you can with a perimeter of 16 centimeters.

   a. Sketch the rectangles below, and label the side lengths.

   b. Find the area of each rectangle you drew above.

2. On your centimeter grid paper, shade and label as many rectangles as you can with a perimeter of 18 centimeters.

   a. Sketch the rectangles below, and label the side lengths.

   b. Find the area of each rectangle you drew above.

3. Use centimeter grid paper to shade in as many rectangles as you can with the given perimeters.

   a. Use the charts below to show how many rectangles you shaded for each given perimeter. You might not use all the spaces in the charts.

| Perimeter = 10 cm<br>Number of rectangles I made: ____ | | |
|---|---|---|
| Width | Length | Area |
| 1 cm | 4 cm | 4 square cm |
| | | |
| | | |
| | | |
| | | |

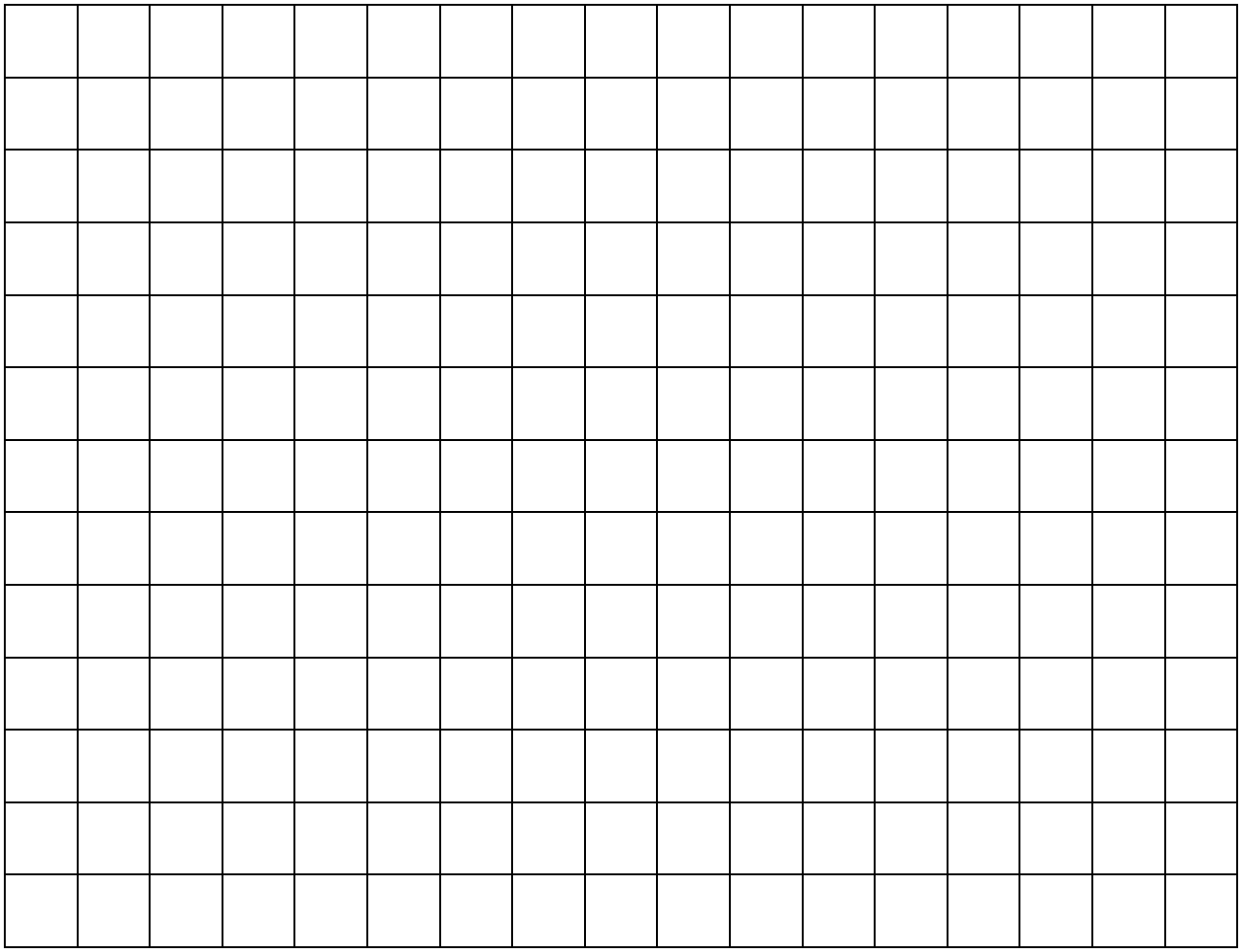
| Perimeter = 20 cm<br>Number of rectangles I made: ____ | | |
|---|---|---|
| Width | Length | Area |
| 1 cm | 9 cm | 9 square cm |
| | | |
| | | |
| | | |
| | | |

   b. Did you make a square with either of the given perimeters? How do you know?

4. Macy and Gavin both draw rectangles with perimeters of 16 centimeters. Use words and pictures to explain how it is possible for Macy's and Gavin's rectangles to have the same perimeters but different areas.

Name _____ Date _____

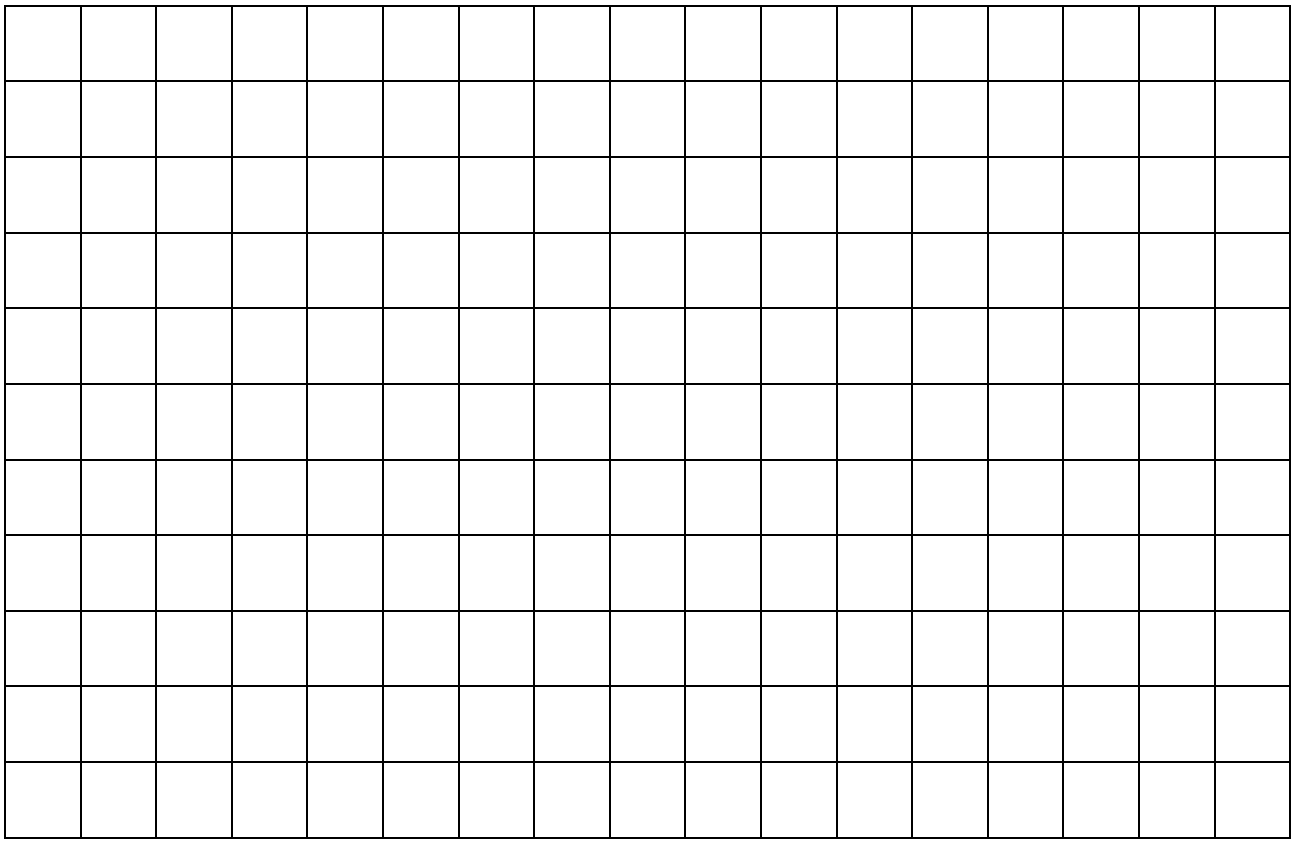
On the grid below, shade and label at least two different rectangles with a perimeter of 20 centimeters.



Name _____ Date _____

1. Margo finds as many rectangles as she can with a perimeter of 14 centimeters.

   a. Shade Margo's rectangles on the grid below. Label the length and width of each rectangle.



   b. Find the areas of the rectangles in part (a) above.

   c. The perimeters of the rectangles are the same. What do you notice about the areas?

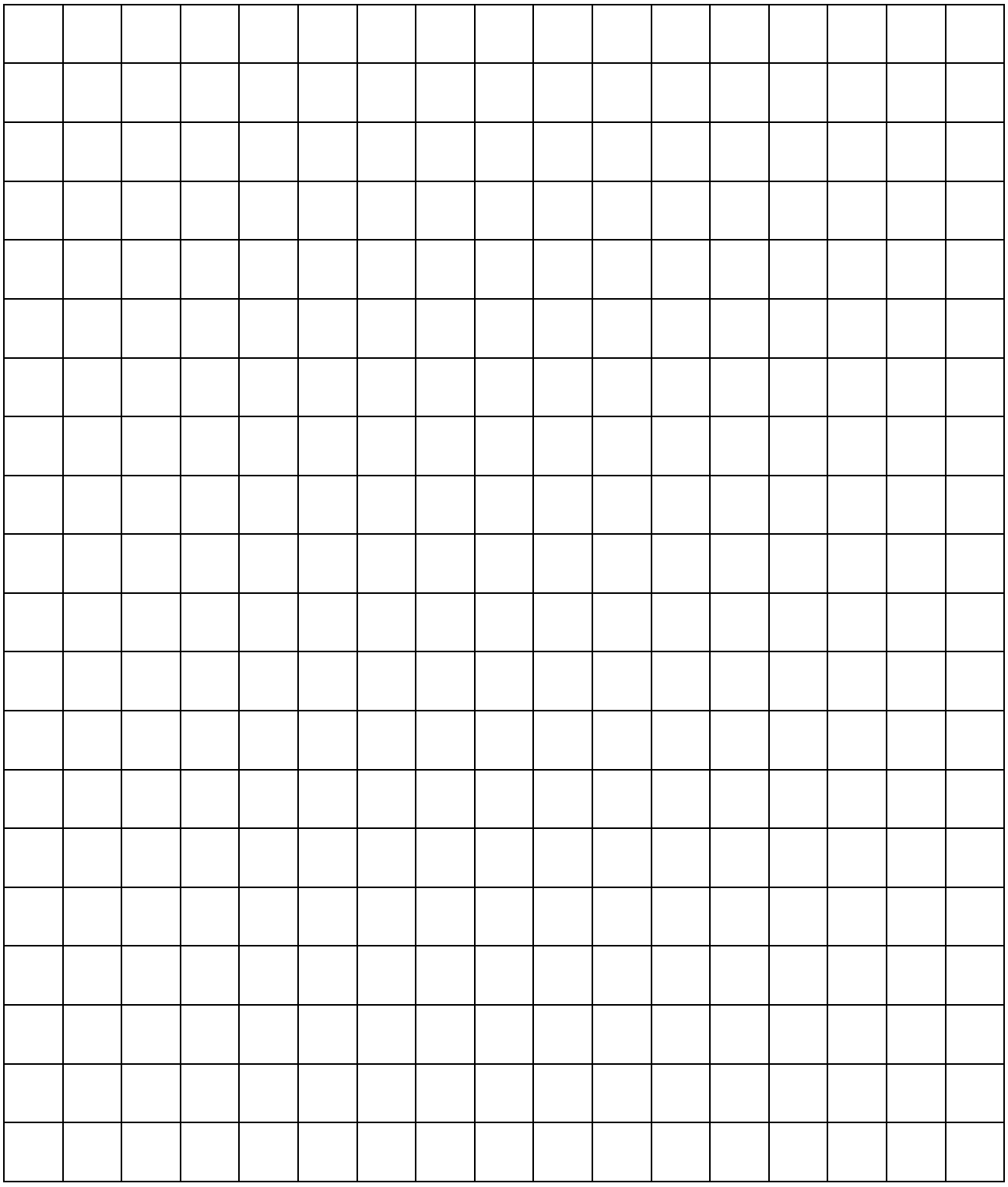
2. Tanner uses unit squares to build rectangles that have a perimeter of 18 units. He creates the chart below to record his findings.

   a. Complete Tanner's chart. You might not use all the spaces in the chart.

| Perimeter = 18 units<br>Number of rectangles I made: _____ | | |
|---|---|---|
| Width | Length | Area |
| 1 unit | 8 units | 8 square units |
| | | |
| | | |
| | | |
| | | |

   b. Explain how you found the widths and lengths in the chart above.

3. Jason and Dina both draw rectangles with perimeters of 12 centimeters, but their rectangles have different areas. Explain with words, pictures, and numbers how this is possible.



centimeter grid paper

Name _____ Date _____

Use the data you gathered from Problem Sets 20 and 21 to complete the charts to show how many rectangles you can create with a given perimeter. You might not use all the spaces in the charts.

Perimeter = 10 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| 1 unit | 4 units | 4 square units |
| | | |
| | | |
| | | |

Perimeter = 12 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 14 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 16 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Perimeter = 18 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

Perimeter = 20 units

Number of rectangles you made: _____

| Width | Length | Area |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |