LESSON 6.12

Geoboard Squares

You will need:

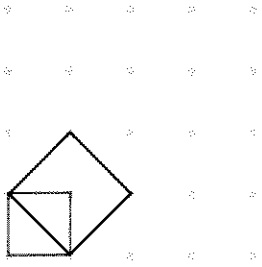
- geoboards 
- dot paper 

1. **Exploration** There are 33 different geoboard squares. Find as many of them as you can. (For this exercise, squares that have the same size are considered the same.) Sketch each square on dot paper.

FIND THE AREA

2. There are 10 geoboard squares having horizontal and vertical sides. What are their areas?

3. Make a 1-by-1 square in the bottom left of your geoboard. Make a square that has this square's diagonal — (0, 1) to (1, 0) — for a side. What is the area of the new square?



4. Repeat problem 3, starting with larger and larger squares in the bottom left. What is the area of each new square?

5. Explain why only five squares can be found this way.

6. Make a square having (0, 1) to (2, 0) as a side.

a. Explain how you found the other vertices of the square.

b. Find the area. Explain how you did it.

7. Make squares having (0, 1) to (x, 0) as a side. Use $x = 3, 4, \ldots 9$. Find the area of each one.

8. Explain why you cannot find a geoboard square having (0, 1) to (10, 0) as one side.

9. Make a square having (0, 2) to (3, 0) as one side.

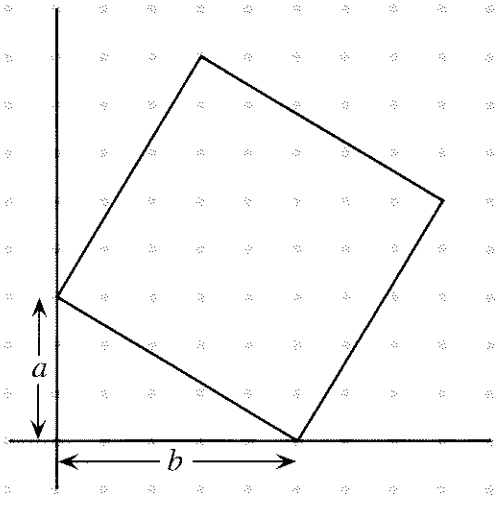
a. Sketch the square.

b. Make and sketch the smallest square having horizontal and vertical sides that entirely covers the original square. What is the area of this square?

c. What is the total area of the four triangles that surround the original square?

d. What is the area of the original square?

10. **Generalization** On dot paper, sketch a pair of x- and y-axes.



a. Copy the above figure.

b. Sketch the smallest square having horizontal and vertical sides that entirely covers the original square. What are its sides in terms of a and b? What is its area in terms of a and b?

c. What is the area of one of the triangles that surround the original square in terms of a and b? What is the total area of the four triangles in terms of a and b?

d. What is the area of the original square in terms of a and b?

11. Summary How does one find the area of a geoboard square? For examples, use the squares having the following as one side.

a. (0, 3) to (4, 0)

b. (2, 4) to (7, 1)

FIND THE SIDE

12. How long is the side of a square if the area is

a. 64? b. 81?

c. 289? d. 0.0121?

13. How long is the side of a square if the area is 70? Give an approximate answer. (Hint: You may be able to use some of the results from problem 12.)

14. Use trial and error on a calculator to answer problem 13 to the closest one-thousandth.

15. Summary Use examples to explain.

a. How does one find the area of a square, if given the side?

b. How does one find the side of a square, if given the area?

DISCOVERY *CHUNKING*

16. Solve: $3(x + 3) + 5 = 4(x + 3)$

It is easier to solve this equation by first solving for $(x + 3)$, and then finding x, instead of distributing. This is called *chunking*, since in this method the quantity $(x + 3)$ is thought of as one chunk.

17. Solve $3y + 5 = 4y$, then use the fact that $y = x + 3$ to solve for x. Explain what you did, and how this problem is related to problem 16.

18. Create an equation that would be easier to solve by chunking than by distributing. Solve it.

19. Solve a classmate's chunking equation.

DISCOVERY *INEQUALITY RULES*

Like most students, Mary and Martin enjoy discussing inequalities during their lunch period.

20. Martin said, "I noticed something cool. If $5/x$ is less than 5, then $x/5$ is more than $1/5$." Mary said, "I don't understand. In the first place, I can't think of a value of x that would make $5/x$ greater than 5."

a. Give Mary at least two values of x that will make $5/x$ greater than 5.

b. Is Martin's statement correct? Give examples to explain your answer.

21. Martin said, "If $a < b$, then by taking the reciprocals of both sides, I get $1/a > 1/b$. Notice that I changed the direction of the inequality." Mary answered, "Sorry, but you're wrong." Who is right? Explain, with examples.

22. Martin said, "If $a < b$, then by taking the opposites of both sides, I get $-a > -b$. Notice that I changed the direction of the inequality." Mary answered, "When will you give up making up rules off the top of your head! You're wrong again!" Who is right? Explain, with examples.

REVIEW SOLVING INEQUALITIES

Solve these inequalities. Remember that you must find *all the values* of x that make the inequality true. Show your work, and check your answers.

23. $x - 1 > 5$

24. $x + 1 > 5$

25. $2x - 6 > 5x + 3$

26. $2x - 6 < 5x + 3$

27. $3(x + 1) > 6$

28. $2 - 3(x + 1) > 6$

DISCOVERY CAN TARA MAKE A B?

Some auto insurance policies have a "good student" policy for high school students. If a student maintains a *B* average, he or she can qualify for a discount on insurance rates.

Tara doesn't like writing assignments because they take time outside of school, when she would rather be driving her car. However, she does well on quizzes. She needs a *B* in algebra. Her scores are:

Writing Assignments: 45 55

Quizzes: 100 50 90 85 90 95

Tara hopes that the teacher will count quizzes heavily in the average so that she can make a *B*.

29. Is it possible for Tara to make a *B*? If so, how much would the teacher have to weight her quizzes? If not, explain why not.