LESSON 7.3

Squares of Sums

You will need:

the Lab Gear 

1. Exploration

a. Model the square $(x + 1)^2$ with the Lab Gear. Then add blocks to create the square $(x + 2)^2$. What blocks did you need to add to the first square to get the second? Now add blocks to create the square $(x + 3)^2$. What blocks did you add this time? Continue to make the square grow, keeping an organized record of what blocks you add each time. Write a paragraph about any patterns you notice.

b. If a and b are whole numbers, what blocks would you need to add to $(x + a)^2$ to get $(x + a + 1)^2$? To get $(x + a + b)^2$?

MISSING TERMS

2. a. Use the Lab Gear to build a square using 10 x-blocks and any other blocks that you want (except more x-blocks). Sketch the square.

b. What is the area of the square?

c. What are its dimensions?

d. Is this the only such square you could build? (That is, is your answer *unique*?) If it isn't, try to find another possibility. If you can't build another square, explain why.

3. Repeat problem 2, using 16 one-blocks and any other blocks that you want (except more yellow blocks).

4. Repeat problem 2, using 8 xy-blocks and any other blocks that you want (except more xy-blocks).

5. Can you build a square starting with 3 x^2-blocks, if you can use any other blocks except more x^2-blocks? Explain.

6. Can you build a square starting with 15 one-blocks, if you can use any other blocks except more one-blocks? Explain.

7. Build two different squares starting with 4 x^2-blocks, using any other blocks except more x^2-blocks. Are there more solutions? Explain.

TERMS AND COEFFICIENTS

8. a. Use the Lab Gear to build three squares of the form $(x + b)^2$, using a different value of b each time. Sketch the squares.

b. Write the area of the square next to each sketch, combining like terms.

c. Notice how many terms are in each expression for area. Notice the coefficient of each term. Describe what you notice.

In each expression below, a binomial is squared. Distribute and combine like terms.

9. $(2y + 3)^2$ **10.** $(3x + 2)^2$

11. $(2x + 3y)^2$ **12.** $(3x + 2y)^2$

13. Refer to problems 9-12 to answer these questions.

a. How many terms are in each product, after combining like terms?

b. For each binomial, notice the coefficients of each of the terms. Then notice the coefficients in the related expression for area. Describe any relationships you notice.

c. For each binomial, notice the degree of each of the terms. Then notice the degree of each term in the related expression for area. Describe any relationships you notice.

14. **Summary** Summarize the patterns for the square of a binomial.

15. **Generalization** The patterns you found can be generalized by using letters instead of numbers for coefficients. Show how you would find the area of a square having side

a. $a + b$; b. $ax + b$;

c. $a + by$; d. $ax + by$.

16. In each expression below, a binomial is squared. Distribute and combine like terms.

a. $(m + n)^2$ b. $(11m + 2)^2$

c. $(5y + 6x)^2$ d. $(1 + 9y)^2$

RECOGNIZING PERFECT SQUARES

$x^2 + 14x + 49$ is called a *perfect square trinomial.* It is the square of the binomial $(x + 7)$, as you can see by writing it in a multiplication table.

	x	7
x	x^2	$7x$
7	$7x$	49

17. Which of the following are perfect square trinomials? For each one, write the binomial it is the square of.

a. $x^2 + 16x + 16$

b. $x^2 + 4x + 4$

c. $x^2 + 10x + 25$

d. $x^2 + 10xy + 25y^2$

18. All of these are perfect square trinomials. Write each one as the square of a binomial. Sketches may help.

a. $4x^2 + 20xy + 25y^2$

b. $36y^2 + 12xy + x^2$

c. $y^2 + 18y + 81$

d. $25x^2 + 10xy + y^2$

19. None of these expressions is a perfect square trinomial. In each one, change just one of the terms to convert the whole expression into the square of a binomial.

a. $4x^2 + 12x + 10$

b. $2x^2 + 8x + 16$

c. $36x^2 + 30x + 25$

d. $1.44x^2 + 1.6x + 2.25$

20. **Summary** Explain how to recognize a perfect square trinomial. You may use sketches, but be sure to discuss *coefficients, terms,* and *degree.*

21. Look at each perfect square trinomial in this lesson. For each one, find the sum of the coefficients. What do you notice? Explain.

PREVIEW *HOW MANY TERMS?*

22. **Exploration** Two of the following problems are impossible. Solve the other three. Find a pair of binomials such that their product has:

a. three terms

b. four terms

c. five terms

d. one term

e. two terms

REVIEW *LAB GEAR MULTIPLICATION*

For each of these problems, 23-25:

a. Use the corner piece to show the multiplication.

b. Check that the resulting figure includes an *uncovered rectangle* of the required dimensions.

c. Write a *length times width equals area* equation.

23. $(y + 2)(y + 2)$ **24.** $(y + 2)(y - 2)$

25. $(y - 2)(y - 2)$

26. Which of the uncovered rectangles in problems 23, 24, and 25 are squares?

DISCOVERY *CONSTRAINED NUMBERS*

27. What are m and n if they are whole numbers and

a. $89 = 12m + n$, with $n < 12$;

b. $123 = 45m + n$, with $n < 45$;

c. $2345 = 67m + n$, with $n < 67$.

28. If N and m are whole numbers, and $N = 7m + n$, find several values of N such that $n = 2$.