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Lesson 6: Factor Fixin'

Solidify Understanding

Jump Start

Find all the pairs of factors for the following numbers.

a. 42

b. 72

c. 54

d. 110

Learning Focus

Multiply two binomials using diagrams.

Factor a trinomial using diagrams.

How can we use diagrams to write equivalent expressions for a rectangle?

Open Up the Math

Launch, Explore, Discuss

Optima Prime has a quilt shop that makes and sells squares of fabric for quilting. At first, Optima's Quilts only made square blocks for quilters and Optima spent her time making perfect squares. Customer service representatives were trained to ask for the length of the side of the block, x, that was being ordered, and they would let the customer know the area of the block to be quilted using the formula $A(x) = x^2$.

Optima found that many customers that came into the store were making designs that required a combination of squares and rectangles. So, Optima's Quilts decided to produce several new lines of rectangular quilt blocks. Each new line is described in terms of how the rectangular block has been modified from the original square block. For example, one line of quilt blocks consists of starting with a square block and extending one side length by 5 inches and the other side length by 2 inches to form a new rectangular block. The design department knows that the area of this new block can be represented by the equation: $A(x) = (x + 5)(x + 2)$, but they do not feel that this equation gives the customer a real sense of how much bigger this new block is (e.g., how much more area it has) when compared to the original square blocks.

1. Can you find a different expression to represent the area of this new rectangular block? You will

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need to convince the customers that your formula is correct using a diagram.

Here are some additional new lines of blocks that Optima's Quilts has introduced. Find two different algebraic expressions to represent each rectangle, and illustrate with a diagram why your representations are correct.

2. The original square block was extended 3 inches on one side and 4 inches on the other.

3. The original square block was extended 4 inches on only one side.

4. The original square block was extended 5 inches on each side.

5. The original square block was extended 2 inches on one side and 6 inches on the other.

Customers start ordering custom-made block designs by requesting how much additional area they want beyond the original area of x^2. Once an order is taken for a certain type of block, customer service needs to have specific instructions on how to make the new design for the manufacturing

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team. The instructions need to explain how to extend the sides of a square block to create the new line of rectangular blocks.

The customer service department has placed the following orders on your desk. For each, describe how to make the new blocks by extending the sides of a square block with an initial side length of x. Your instructions should include diagrams and algebraic descriptions of the area of the rectangles, using expressions representing the lengths of the sides.

6. $x^2 + 5x + 3x + 15$

7. $x^2 + 4x + 6x + 24$

8. $x^2 + 9x + 2x + 18$

9. $x^2 + 5x + x + 5$

Some of the orders are written using an even more simplified algebraic method. Figure out what these entries mean by finding the sides of the rectangles that have this area. Use the sides of the rectangle to write equivalent expressions for the area.

10. $x^2 + 11x + 10$

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11. $x^2 + 7x + 10$

12. $x^2 + 9x + 8$

13. $x^2 + 6x + 8$

14. $x^2 + 8x + 12$

15. $x^2 + 7x + 12$

16. $x^2 + 13x + 12$

17. What relationships or patterns do you notice when you find the sides of the rectangles for a given area of this type?

18. A customer called and asked for a rectangle with area given by $x^2 + 7x + 9$. The customer service representative said that the shop couldn't make that rectangle. Do you agree or disagree? How can you tell if a rectangle can be constructed from a given area?

Ready for More?

Here are a few challenging expressions to factor, maybe without a diagram. See what you can figure out!

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a. $x^2 + 17x + 42$

b. $x^2 + 27x + 72$

c. $x^2 + 21x + 54$

d. $x^2 + 27x + 110$

Takeaways

Multiplying binomials using the distributive property:

Diagram:

Algebraically:

Factoring a trinomial in the form:

Vocabulary

- **binomial**
- **difference of two squares**
- factor
- **factoring a quadratic**
- **trinomial**

Bold terms are new in this lesson.

Lesson Summary

In this lesson, we used area model diagrams to multiply binomials and factor trinomials. We identified a relationship between the numbers in the factors and the numbers in the equivalent trinomial that helps us to find the factors more easily.

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Retrieval

Multiply using the Distributive Property.

1. $3x(x-7)$

2. $x(x-3)$

3. $-5x(x+4)$

4. $2x(x+1)$

5. Solve the system of equations using a method of your choice.

$$\begin{cases} 4x-3y=12 \\ -2x+y=-8 \end{cases}$$