2.6 Factor Fixin'

A Develop Understanding Task

Start on LESSON 2.6

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* has 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 expression: $A(x) = (x + 5)(x + 2)$, but they do not feel that this expression 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 need to convince your customers that your formula is correct using a diagram.

$x^2 + 2x + 5x + 10$

$x(x+2)\quad 5(x+2)$

$(x+5)(x+2)$

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.

$(x+3)(x+4)$

$x^2+4x+3x+12$

$x(x+4)+3(x+4)$

$(x+3)(x+4)$

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 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, written descriptions and algebraic descriptions of the area of the rectangles in using expressions representing the lengths of the sides.

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

8x

$x(x+5)$ $3(x+5)$

$(x+3)(x+5)$

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

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

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

Some of the orders are written in an even more simplified algebraic code. 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.

2.6 LESSON

Start here

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

$11 = 1 + 10$ ✓

$(x+1)(x+10)$

10 → 1, 10 → 2, 5

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

$(x+2)(x+5)$

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

$(x+1)(x+8)$

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

$(x+4)(x+2)$

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

$(x+2)(x+6)$

$x^2 + 6x + 2x + 12$

$8 = 1 + 12$ ✓

$8 = 2 + 6$ ✓

$8 = 3 + 4$

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

$(x+3)(x+4)$

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

$(x+12)(x+1)$

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?

SECONDARY MATH II // MODULE 2
STRUCTURES OF EXPRESSIONS - 2.6

2.6

READY, SET, GO! Name Period Date

READY

Topic: Creating Binomial Quadratics

Multiply. (Use the distributive property, write in standard form.)

1. $x(4x-7)$ 2. $5x(3x+8)$ 3. $3x(3x-2)$

$4x^2-7x$ 0

4. The answers to problems 1, 2, & 3 are quadratics that can be represented in standard form $ax^2 + bx + c$. Which coefficient, **a**, **b**, or **c** equals 0 for all of the exercises above?

c, is always zero.

Factor the following. (Write the expressions as the product of two linear factors.)

5. x^2+4x 6. $7x^2-21x$ 7. $12x^2+60x$ 8. $8x^2+20x$

$x(x+4)$ $7x(x-3)$

Multiply.

9. $(x+9)(x-9)$ 10. $(x+2)(x-2)$ 11. $(6x+5)(6x-5)$ 12. $(7x+1)(7x-1)$

13. The answers to problems 9, 10, 11, &12 are quadratics that can be represented in standard form $ax^2 + bx + c$. Which coefficient, **a**, **b**, or **c** equals 0 for all of the exercises above?

SET

Topic: Factoring Trinomials

Factor the following quadratic expressions into two binomials.

14. $x^2 + 14x + 45$ (x+5)(x+9)

15. $x^2 + 18x + 45$

16. $x^2 + 46x + 45$

45
1 45
3 15
5 9

17. $x^2 + 11x + 24$

18. $x^2 + 10x + 24$

19. $x^2 + 14x + 24$

20. $x^2 + 12x + 36$

21. $x^2 + 13x + 36$

22. $x^2 + 20x + 36$

23. $x^2 - 15x - 100$

24. $x^2 + 20x + 100$

25. $x^2 + 29x + 100$

26. Look back at each "row" of factored expressions in problems 14 to 25 above. Explain how it is possible that the coefficient ***(b)*** of the middle term can be different numbers in each problem when the "outside" coefficients ***(a)*** and ***(c)*** are the same. (Recall the standard form of a quadratic is $ax^2 + bx + c$.)

GO

Topic: Taking the square root of perfect squares.

Only some of the expressions inside the radical sign are perfect squares. Identify which ones are perfect squares and take the square root. Leave the ones that are not perfect squares under the radical sign. Do not attempt to simplify them. (Hint: Check your answers by squaring them. You should be able to get what you started with, if you are right.)

27. $\sqrt{(17xyz)^2}$

28. $\sqrt{(3x-7)^2}$

29. $\sqrt{121a^2b^6}$

$11 \cdot a \cdot b^3$

$b^3 \cdot b^3$

30. $\sqrt{x^2+8x+16}$

31. $\sqrt{x^2+14x+49}$

$x+7$

32. $\sqrt{x^2+14x-49}$

can't not be factored.

33. $\sqrt{x^2+10x+100}$

34. $\sqrt{x^2+20x+100}$

35. $\sqrt{x^2-20x+100}$