Day #26: Multiplying

Now we're going to learn about multiplying factors to change the form of a quadratic.

We're going to use what's called an **AREA MODEL** to multiply. How do you find the **area of a rectangle?**

Write the expression that represents the area of each rectangle.

1. 5 / 4 — $4 \cdot 5 = 20$

2. 7 / m — $m \cdot 7 = 7m$

3. a / 3 — $3a$

4. x / x — x^2

Find the area of each box in the pair.

5. x 3 / 4 — $4x$ | 12

6. a 9 / 7 — $7a$ | 63

7. x 2 / x — x^2 | $2x$

Write the expression that represents the total length of each segment.

8. x 9 — $x + 9$

9. x 4 — $x + 4$

10. a 2 — $a + 2$

Write the area of each rectangle as the product of *length* × *width* and also as a sum of the areas of each box.

11. x 7 / 5

AREA AS PRODUCT	AREA AS SUM
$5(x+7)$	$5x+35$

12. x 12 / x

AREA AS PRODUCT	AREA AS SUM
$x(x+12)$	x^2+12x

13. a 8 / a

AREA AS PRODUCT	AREA AS SUM
$a(a+8)$	a^2+8a

Vocabulary

Polynomial:	Expression with numbers, variables, and whole # exponents.
Binomial:	Polynomial with 2 terms. (Variable & constant)

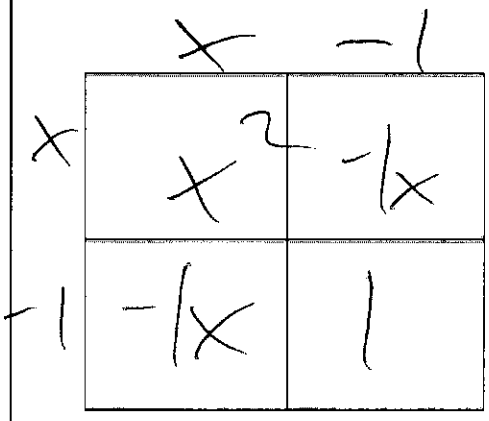
Multiplying Perfect Square Binomials

Remember the last couple classes we have learned about quadratic equations in this special form called Vertex Form: $y = a(x - h)^2 + k$. We're going to explore the "$(x - h)^2$" part and see how it can be represented another way.

Example 1: Let's say we have a perfect square where each side is (x - 1) units in length.

First...How can I represent the area as a product?

Second, let's find the area with an area model: $(x-1)(x-1)$ **Third,** write the area as a *simplified* sum:



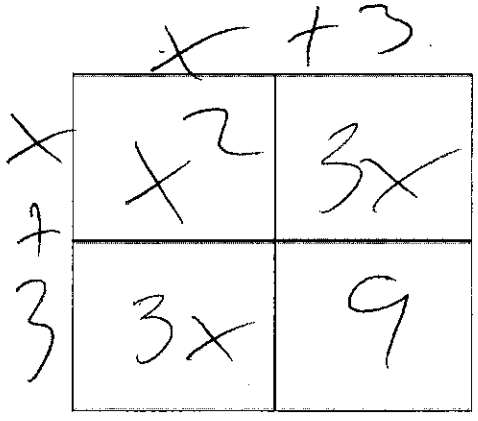
$x^2 - 2x + 1$

Example 2: Multiply out $(x + 3)^2$

First, expand out $(x + 3)^2 =$ $(x+3)(x+3)$

Second, let's find the area with an area model:

Third, write the area as a *simplified* sum:



$x^2 + 6x + 9$

You Try:

Expand out each expression and then use an area model to find the product. Then *simplify* the expression. Notice any patterns.

1. $(x + 1)^2$ =

	x	$+1$
x	x^2	$1x$
$+1$	$1x$	1

Simplified: x^2+2x+1

2. $(x - 2)^2$ =

	x	-2
x	x^2	$-2x$
-2	$-2x$	4

Simplified: x^2-4x+4

3. $(2x + 1)^2$ =

	$2x$	$+1$
$2x$	$4x^2$	$2x$
$+1$	$2x$	1

Simplified: $4x^2+4x+1$

4. **Generalize:** What would $(a + b)^2$ simplify to when you multiply it out?

$a^2+2ab+b^2$

Rectangles

5. $(3x + 2)(x - 1)$

	$3x$	2
x	$3x^2$	$2x$
-1	$-3x$	-2

$3x^2-x-2$

6. $(3x - 2)(2x - 1)$

	$3x$	-2
$2x$	$6x^2$	$-2x$
-1	$-3x$	2

$6x^2-7x+2$

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

	$4x$	-1
$2x$	$8x^2$	$-2x$
3	$12x$	-3

$8x^2+10x-3$

For the problems below, draw your own appropriate area model.

7. $3(x^2 + 5x + 7)$

	x^2	$5x$	7
3	$3x^2$	$15x$	21

$3x^2+15x+21$

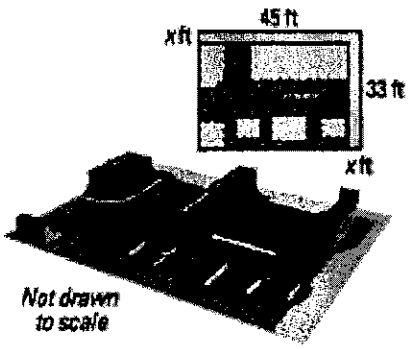
8. $(x + 5)(x^2 + 6x - 7)$

	x^2	$6x$	-7
x	x^3	$6x^2$	$-7x$
5	$5x^2$	$30x$	-35

$x^3+11x^2+23x-35$

Solve real-world problems:

1. You are designing a rectangular skateboard park on a lot that is on the corner of a city block. The park will have a walkway along two sides. The dimensions of the lot and the walkway are shown in the diagram.



a. Write a polynomial that represents the area of the skateboard park.

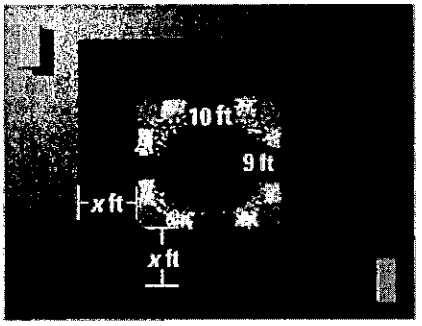
$(x+45)(x+33)$

b. What is the area of the park if the walkway is 3 feet wide?

$(3+45)(3+33)$

$(48)(36) = 1728\,ft^2$

2. You are planning to build a brick walkway that surrounds a rectangular garden, as shown. The width of the walkway around the garden is the same on every side.



a. Write a polynomial that represents the combined area of the garden and the walkway.

$(2x+10)(2x+9)$

b. Find the combined area when the width of the walkway is 4 feet.

$(2(4)+10)(2(4)+9)$

$(18)(17) = 306\,ft^2$

3. The dimensions of a rectangle are **x + 3** and **x + 2**. Which expression represents the area of the rectangle?

a) $x^2 + 6$ b) $x^2 + 5x + 6$ c) $x^2 + 6x + 6$ d) $x^2 + 6x$

Explain how you chose your solution to **problem 3.**

Because $3+2=5$ & $3 \cdot 2 = 6$