Section 8-3:

Multiplication of Binomials

Objective:

to multiply polynomials by using the distributive property, the FOIL method, the Box method, or the vertical method

There are 4 techniques you can use for multiplying polynomials.

1)Distributive Property

2)Box Method (Area Model)

3)FOIL Method

4)Vertical Method

1st Method

Distributive Property

Multiply 2 Binomials:
$(2x + 3)(5x + 8)$

Multiply $\mathbf{2x}(5x + 8) + \mathbf{3}(5x + 8)$.

$10x^2 + 16x + 15x + 24$

Combine like terms.

$\mathbf{10x^2 + 31x + 24}$

Multiply A Binomial by a Trinomial:

$(2x - 5)(x^2 - 5x + 4)$

$$\mathbf{2x}(x^2 - 5x + 4) \mathbf{- 5}(x^2 - 5x + 4)$$

$$2x^3 - 10x^2 + 8x - 5x^2 + 25x - 20$$

Group and combine like terms.

$$2x^3 - 10x^2 - 5x^2 + 8x + 25x - 20$$

$$\mathbf{2x^3 - 15x^2 + 33x - 20}$$

Got it? #1 on page 498

$(x - 6)(4x + 3)$

$$\mathbf{x}(4x + 3) - \mathbf{6}(4x + 3)$$

$$4x^2 + 3x - 24x - 18$$

Combine like terms.

$$\mathbf{4x^2 - 21x - 18}$$

2nd Method

Box Method (Area Model)

This method works for every problem!

Here's how you do it.

Multiply (3x – 5)(5x + 2)

Draw a box. Write a polynomial on the top and side of a box. It does not matter which goes where.

(Be careful with your signs!)

	3x	-5
5x		
+2		

Multiply $(3x - 5)(5x + 2)$

Combine like terms.

$15x^2 - 19x - 10$

	3x	-5
5x	$15x^2$	-25x
+2	+6x	-10

Multiply (7p - 2)(3p - 4)

Combine like terms.

$21p^2 - 34p + 8$

	7p	-2
3p	$21p^2$	-6p
-4	-28p	+8

Multiply $(2x - 5)(x^2 - 5x + 4)$

You cannot use FOIL because they are not BOTH binomials. You must use the distributive property or box method.

	x^2	$-5x$	$+4$
$2x$	$2x^3$	$-10x^2$	$+8x$
-5	$-5x^2$	$+25x$	-20

Almost done! Go to the next slide!

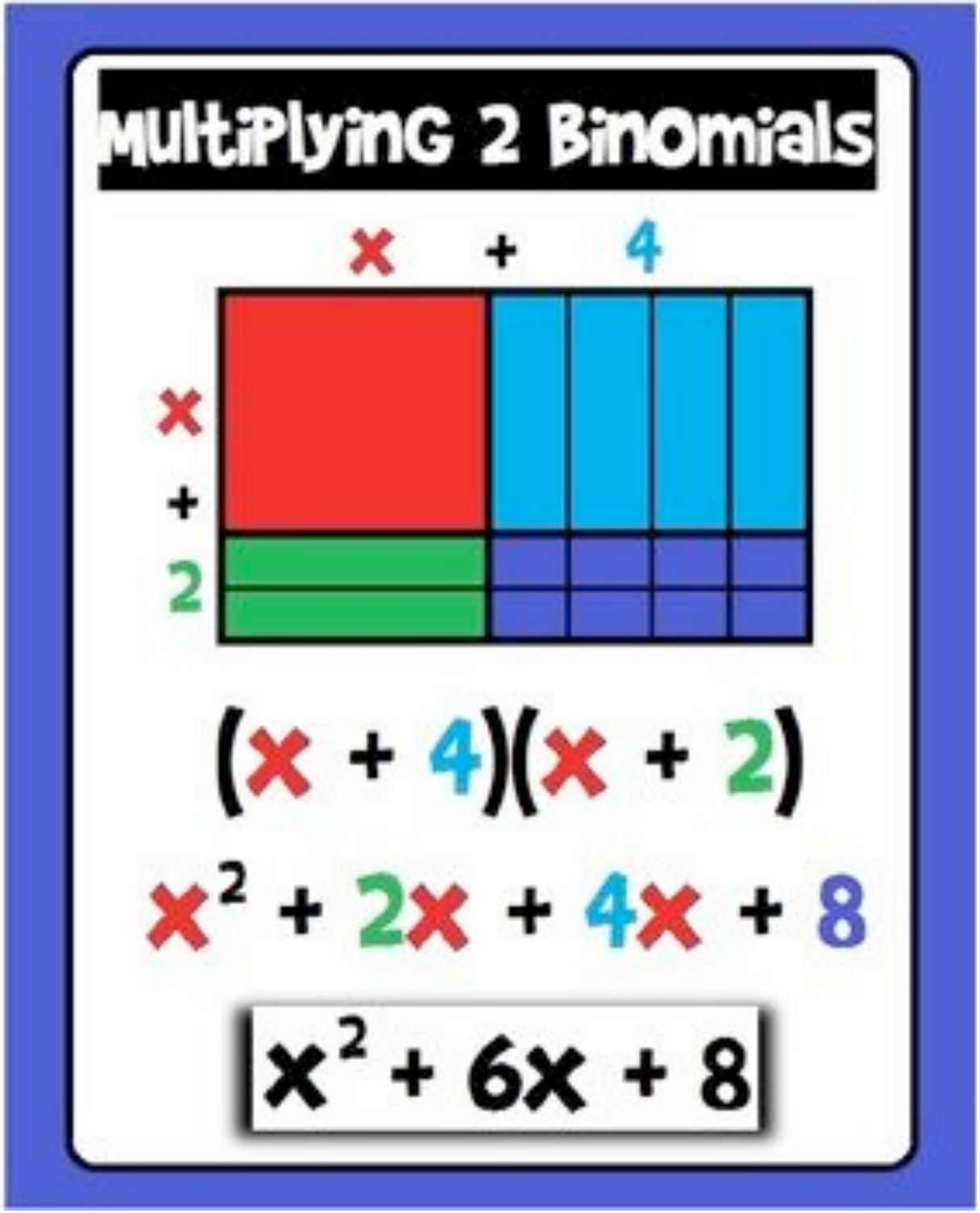
Multiply $(2x - 5)(x^2 - 5x + 4)$

Combine like terms!

	x^2	$-5x$	$+4$
$2x$	$2x^3$	$-10x^2$	$+8x$
-5	$-5x^2$	$+25x$	-20

$$2x^3 - 15x^2 + 33x - 20$$

Similar to the Box Method is the Area Model.



Got it? #2 on page 499

$(3x + 1)(x + 4)$

$$3x^2 + 13x + 4$$

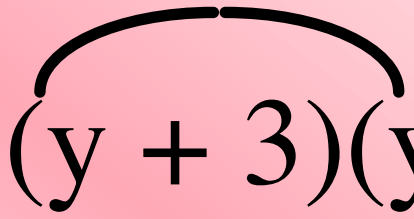
3rd Method

FOIL Method

The **FOIL** method is ONLY used when you multiply 2 binomials. It is an acronym and tells you which terms to multiply.

2) Use the **FOIL** method to multiply the following binomials:

$(y + 3)(y + 7)$



F tells you to multiply the FIRST terms of each binomial.

y^2

$(y + 3)(y + 7)$

O tells you to multiply the <u>OUTER</u> terms of each binomial.

$y^2 + 7y$

$(y + 3)(y + 7)$

I tells you to multiply the <u>INNER</u> terms of each binomial.

$y^2 + 7y$ **$+ 3y$**

$(y + 3)(y + 7)$

L tells you to multiply the LAST terms of each binomial.

$y^2 + 7y + 3y$ **+ 21**

Combine like terms.

$y^2 + 10y + 21$

Remember, FOIL reminds you to multiply the:

First terms

Outer terms

Inner terms

Last terms

Got it? #3 on page 500

A) $3x^2 + 2x - 8$

B) $4n^2 - 31n + 42$

C) $4p^3 - 10p^2 + 6p - 15$

Review Problem #4 on page 500

Got it? #4 on page 500

$4\pi x^2 + 20\pi x + 24\pi$

4th Method

Vertical Method

Vertical Method

Simplify $(4x + 2)(3x – 6)$.

$$\begin{array}{r} 4x + 2 \\ \times\ 3x - 6 \\ \hline -24x - 12 \\ 12x^2 + 6x \\ \hline 12x^2 - 18x - 12 \end{array}$$

Multiply each term by -6

Multiply each term by 3x

Got it? #5 on page 501

A)$2x^3 - 9x^2 + 10x - 3$

A)Refer back to earlier example in this Powerpoint

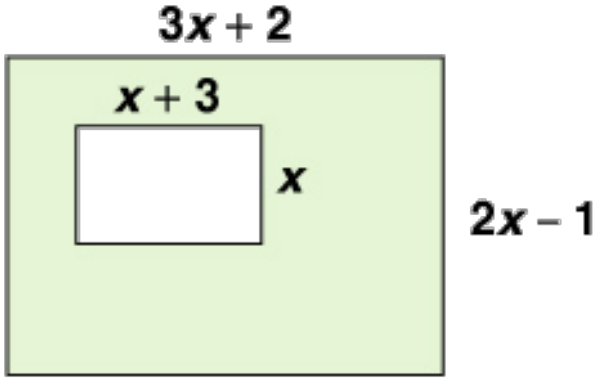
Informally check to make sure you are on the right track:

- the problem has 2 terms in the first polynomial and 3 terms in the second polynomial (2 * 3 = 6)

- Six is then the number of terms you should have BEFORE you collect like terms and get your final answer

Applying Multiplication of Polynomials

Find the area of the shaded region. Simplify.



area of outer rectangle = $(3x + 2)(2x - 1)$

area of hole = $x(x + 3)$

area of shaded region = area of outer rectangle – area of hole

$= (3x + 2)(2x - 1) - x(x + 3)$ Substitute.

$= 6x^2 - 3x + 4x - 2 \quad -x^2 - 3x$ Use FOIL to simplify $(3x + 2)(2x - 1)$ and the Distributive Property to simplify $x(x + 3)$.

$= 6x^2 - x^2 - 3x + 4x - 3x - 2$ Group like terms.

$= 5x^2 - 2x - 2$ Simplify.

Practice

1. Simplify the product using the FOIL method. $(x + 2)(x + 5)$

$x^2 + 7x + 10$

2. Simplify the product using the vertical method. $(r + 6)(r – 4)$

$r^2 + 2r – 24$

3. Simplify using the box method. $(- 7 + p)(8 + p)$

$p^2 + p – 56$

4. Use any method to simplify the products

$(a – 4)(a^2 – 2a + 1)$

$a^3 - 6a^2 + 9a - 4$

5. Simplify $(2x + 2)^2$

$4x^2 + 8x + 4$

Try This…

Multiply $(y + 4)(y – 3)$

1. $y^2 + y – 12$
2. $y^2 – y – 12$
3. $y^2 + 7y – 12$
4. $y^2 – 7y – 12$
5. $y^2 + y + 12$
6. $y^2 – y + 12$
7. $y^2 + 7y + 12$
8. $y^2 – 7y + 12$

Multiply $(y + 4)(y – 3)$

1. $y^2 + y – 12$
2. $y^2 – y – 12$
3. $y^2 + 7y – 12$
4. $y^2 – 7y – 12$
5. $y^2 + y + 12$
6. $y^2 – y + 12$
7. $y^2 + 7y + 12$
8. $y^2 – 7y + 12$

Try Another…

Multiply $(2a - 3b)(2a + 4b)$

1. $4a^2 + 14ab - 12b^2$
2. $4a^2 - 14ab - 12b^2$
3. $4a^2 + 8ab - 6ba - 12b^2$
4. $4a^2 + 2ab - 12b^2$
5. $4a^2 - 2ab - 12b^2$

Multiply $(2a - 3b)(2a + 4b)$

1. $4a^2 + 14ab - 12b^2$
2. $4a^2 - 14ab - 12b^2$
3. $4a^2 + 8ab - 6ba - 12b^2$
4. ✓ $4a^2 + 2ab - 12b^2$
5. $4a^2 - 2ab - 12b^2$

Multiply $(2x+3)(x^2+4x+5)$

1. $2x^3+ 8x^2 +10x + 3x^2 + 12x +15$
2. ✓ $2x^3+ 11x^2 + 22x+15$
3. $13x^2 + 22x+15$
4. $2x^3+ 32x+15$