Lesson 5.3 Multiplying Polynomials

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MCA
Lesson 5....

Exponents and Polynomials

5.3 Multiplying Polynomials: Special Products

What You Will Learn

▶ Find products with monomial multipliers.

- ▸ Find products with monomial multipliers.

- ▸ Multiplying binomials using the Distributive Property and the FOIL Method.

- ▸ Multiply polynomials using a horizontal or vertical format.

- ▸ Identify and use special binomial products.

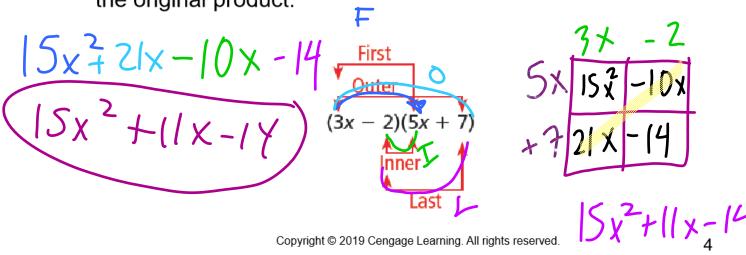## Example 1 – Finding Products with Monomial Multipliers

Find each product.

a. $(3x - 7)(-2x)$ $-6x^2 + 14x$

b. $3x^2(5x - x^3 + 2)$ $15x^3 - 3x^5 + 6x^2$
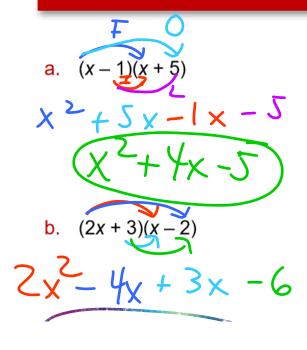
c. $(-x)(2x^2 - 3x)$

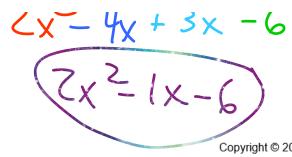$-2x^3 + 3x^2$

Multiplying Binomials

You can write the product of two binomials in just one step.

This is called the **FOIL Method.** Note that the words first, outer, inner, and last refer to the positions of the terms in the original product.

$$15x^2 + 21x - 10x - 14$$

$$\boxed{15x^2 + 11x - 14}$$

F

First

Outer

$(3x - 2)(5x + 7)$

Inner I

Last L

$$5x \boxed{\begin{array}{c} 3x \quad -2 \\ \hline 15x^2 \mid -10x \\ \hline +7 \mid 21x \mid -14 \end{array}}$$

$$15x^2 + 11x - 14$$

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Example 2 – Multiplying Binomials with the Distributive Property

F   O

a. $(x - 1)(x + 5)$

I L

$$x^2 + 5x - 1x - 5$$

$$\boxed{x^2 + 4x - 5}$$

b. $(2x + 3)(x - 2)$

$$2x^2 - 4x + 3x - 6$$

$$<x^2 - 4x + 3x - 6$$

$$\boxed{2x^2 - 1x - 6}$$

Example 3 – Multiplying Binomials using the FOIL Method

a. $(x + 4)(x - 4) =$

$$x^2 - 4x + 4x - 16$$

$$\boxed{x^2 - 16}$$

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

$$6x^2 + 3x + 10x + 5$$

$$\boxed{6x^2 + 13x + 5}$$

Example 5 – Simplifying a Polynomial Expression

Simplify the expression and write the result in standard form.

$$(4x + 5)^2 \quad = \quad (4x + 5)(4x + 5)$$

F   O

$(|x+5)$ $(|4x+5)$

I L

$$16x^2 + 20x + 20x + 25$$

$$16x^2 + 40x + 25$$

Example 6 – Simplifying a Polynomial Expression

Simplify the expression and write the result in standard form.

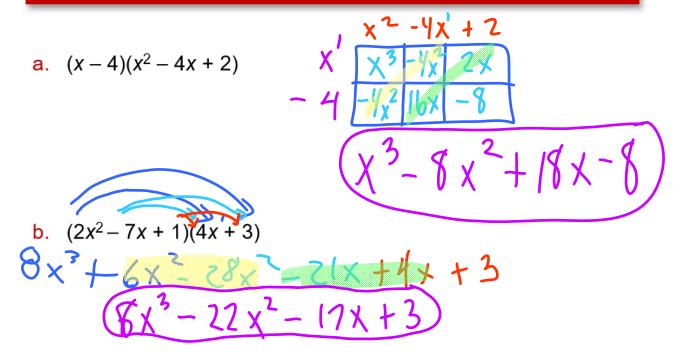F O

$$(3x^2 - 2)(4x + 7) - (4x)^2$$

I L

Solution:

$$12x^3 + 21x^2 - 8x - 14 - 16x^2$$

$$12x^3 + 5x^2 - 8x - 14$$

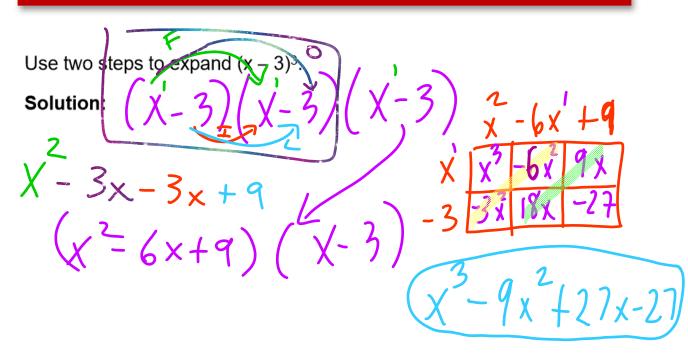## Example 7 – Multiplying Polynomials (Horizontal Format)

Example 7 – Multiplying Polynomials (Horizontal Format)

a. $(x - 4)(x^2 - 4x + 2)$

$x^2 - 4x + 2$

	x^2	$-4x$	2
x	x^3	$-4x^2$	$2x$
-4	$-4x^2$	$16x$	-8

$$x^3 - 8x^2 + 18x - 8$$

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

$8x^3 + 6x^2 - 28x - 21x + 4x + 3$

$$8x^3 - 22x^2 - 17x + 3$$

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Example 10 – Raising a Polynomial to a Power

Use two steps to expand $(x - 3)^3$.

Solution: $(x - 3)(x - 3)(x - 3)$

$x^2 - 3x - 3x + 9$

$(x^2 - 6x + 9)(x - 3)$

$x^2 - 6x + 9$

	x^2	$-6x$	9
x	x^3	$-6x^2$	$9x$
-3	$-3x^2$	$18x$	-27

$$x^3 - 9x^2 + 27x - 27$$

Special Products

Special Products

Let *a* and *b* be real numbers, variables, or algebraic expressions.

Special Product	*Example*

Sum and Difference of Two Terms:

$(a + b)(a - b) = a^2 - b^2$ $(2x - 5)(2x + 5) = 4x^2 - 25$

Square of a Binomial:

$(a + b)^2 = a^2 + 2ab + b^2$ $(3x + 4)^2 = 9x^2 + 24x + 16$

$(a - b)^2 = a^2 - 2ab + b^2$ $(x - 7)^2 = x^2 - 14x + 49$