

Quadratics 3a - Multiplying Factors Together

Standards: A-APR.1, 8.EE.A.1

Math Practices: Look for and make use of structure

GLOs: #1 - Self Directed Learner

Learning Target(s):

-How do you multiply binomials?

Recall that one of our goals in algebra is to solve equations, and solving quadratic equations in factored form is straightforward. Many times, however, quadratic equations are not given in factored form. By learning how to factor, we can rewrite these equations in factored form to make them easier to solve. First, however, let's review how to multiply factors together. Recall the following definitions:

- A **monomial** is a single term consisting of a number, a variable, or the product of a number and one or more variables. $3, x, 5x, -7xy$
- A **binomial** is a sum of two monomials. $3x+4$
- A **polynomial** is a sum of one or more monomials $3, 2y-9, 2x^3-4x^2+17x-1$

We start with the case of multiplying a **monomial** with a **polynomial**. In this case, we use the **Distributive Property**.

Distributive Property:

For any monomials a , b , and c : $a(b+c) = ab+ac$

Example 1: Multiply

$$\text{a) } 5x(2x-3)$$

$$5x \cdot 2x + 5x \cdot -3$$

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

$$\boxed{10x^2 - 15x}$$

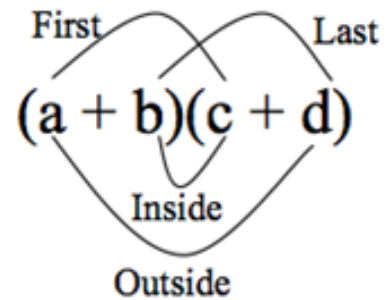
$$\text{b) } 7x(4x-5)$$

$$7x \cdot 4x + 7x \cdot -5$$

$$28x^2 + -35x$$

$$\boxed{28x^2 - 35x}$$

For multiplying two binomials, many students are usually familiar with the **FOIL method**:



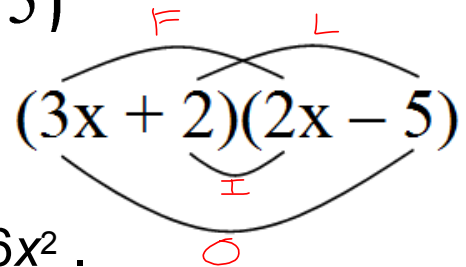
FOIL Method

- **F**irst – multiply the first terms of each binomial
- **O**utside – multiply the two outside terms
- **I**nside – multiply the two inside terms
- **L**ast – multiply the last terms of each binomial

Combine like terms to get the final result.

$$(a + b)(c + d) = ac + ad + bc + bd$$

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



First: Multiply $3x$ and $2x$ to get $6x^2$.

Outside: Multiply $3x$ and -5 to get $-15x$.

Inside: Multiply 2 and $2x$ to get $4x$.

Last: Multiply 2 and -5 to get -10 .

Combine like terms to get:

$$(3x + 2)(2x - 5) = 6x^2 - 15x + 4x - 10$$

$$= 6x^2 - 11x - 10$$

Another visual method is the **Box (or Table) Method** as seen below.

	a	+ b
c	ac	+ bc
+ d	+ ad	+bd

We can do the same problem from Example 2 using this method.

•	$3x$	$+2$
$2x$	$6x^2$	$4x$
-5	$-15x$	-10

Create a 3 x 3 table. In the top row, write the terms from the first binomial, a single term in each box. In the left column, write the terms for the second binomial, a single term in each box. Note here that -5 is used, because of the subtraction in $2x - 5$.

Next, complete the table like you would with an elementary school multiplication table. That is, $2x$ multiplied by $3x$ gives us $6x^2$; $2x$ multiplied by 2 gives us $4x$, etc.

Notice that the products in the table are the exact same results that we got in Example 2 through the FOIL method. Simply combine like terms to get the final answer.

Practice: Multiply using either FOIL or Box Method

a) $(x + 3)(x + 2)$

FOIL

$$x^2 + 2x + 3x + 6$$

$$x^2 + 5x + 6$$

	x	$+3$
x	x^2	$+3x$
$+2$	$+2x$	$+6$

$$x^2 + 5x + 6$$

b) $(3x - 2)(x + 8)$

FOIL

$$3x^2 + 24x - 2x - 16$$

$$3x^2 + 22x - 16$$

	$3x$	-2
x	$3x^2$	$-2x$
$+8$	$+24x$	-16

$$3x^2 + 22x - 16$$

c) $(3x - 5)^2$

$$(3x - 5)(3x - 5)$$

$$9x^2 - 15x - 15x + 25$$

$$9x^2 - 30x + 25$$

	$3x$	-5
$3x$	$9x^2$	$-15x$
-5	$-15x$	$+25$

$$9x^2 - 30x + 25$$

Entrance Pass:

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