

The FOIL Method

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WHAT'S COVERED

In this lesson, you will learn how to multiply two binomials by using the FOIL method. Specifically, this lesson will cover:

1. The Distributive Rule
2. The FOIL Method
3. Practice Using FOIL

1. The Distributive Rule

Before we introduce the FOIL method, it is helpful to review the distributive rule, because the two are similar processes. The distributive rule is used when a quantity is being multiplied by a sum.



FORMULA TO KNOW

Distributive Property

$$a(b+c) = ab+ac$$

⇒ **EXAMPLE** $3(5+9)$ can be evaluated using distribution.

$3(5+9)$ The 3 on the outside is multiplied into each term in the parentheses

$(3 \cdot 5) + (3 \cdot 9)$ Find each sum

$15 + 27$ Evaluate

42 Our Solution

We can confirm this by evaluating $3(5+9)$ using the order of operations: $3(5+9) = 3(14) = 42$.

2. The FOIL Method

Earlier, we saw how distribution can help us evaluate expressions in the form $a(b+c)$, by distributing a into $b+c$ to get $ab+ac$. How could we distribute something like $(4+3)(5+1)$?

We can evaluate such expressions through distribution, but the process works in a slightly different way. What really happens is that we distribute twice: first, we distribute 4 into 5 and 1, then we distribute 3 into 5 and 1. Take a look at how this distribution works:

⇒ EXAMPLE

$$\begin{array}{ll} (4+3)(5+1) & \text{Distribute 4 into } (5+1) \\ 4 \cdot 5 + 4 \cdot 1 & \text{Distribute 3 into } (5+1) \\ 3 \cdot 5 + 3 \cdot 1 & \text{Evaluate and combine all parts} \\ 20 + 4 + 15 + 3 & \text{Add} \\ 42 & \text{Our Solution} \end{array}$$

Taking a look at the distributions, we can say that in our first step, we multiplied the first terms of each factor. 4 is the first term in $(4+3)$ and 5 is the first term in $(5+1)$, to get 20. Our next step was to multiply the two outer terms. 4 and 1 are the outermost terms in our expression, and when multiplied, we get 4. In the next step, we multiplied the two inner terms, 3 and 5, to get 15. Finally, we multiplied the last terms in each factor: 3 is the last term in $(4+3)$ and 1 is the last term in $(5+1)$. When multiplied together, this equaled 3. Put them all together and we got $20+4+15+3=42$.

In short, we multiplied the first term in each factor, then the outside two terms, then the inside two terms, and then the last term in each factor. This is known as the **FOIL** method: First, Outside, Inside, Last.

 HINT

Using FOIL to evaluate numerical expressions may seem odd, but FOIL is an extremely useful method when working with quadratics and algebraic expressions. Practicing without variables will help us see the properties and relationship to distribution, which will make FOILING algebraic expressions much easier!

 TERM TO KNOW

FOIL

An acronym to remember the steps for distributing factors in binomial multiplication: first, outside, inside, last.

3. Practice Using FOIL

Let's take a look at some more examples of using FOIL to evaluate expressions. As we work through these examples, pay attention to the sign of the numbers. We bring positive and negatives with us when distributing!

⇒ EXAMPLE

$(5-2)(4+7)$ Distribute 5 into $(4+7)$
 First: $5 \cdot 4$, Outside: $5 \cdot 7$ Distribute -2 into $(4+7)$
 Inside: $-2 \cdot 4$, Last: $-2 \cdot 7$ Combine all parts
 $20 + 35 + (-8) + (-14)$ Change to subtraction
 $20 + 35 - 8 - 14$ Evaluate
 33 Our Solution

⇒ EXAMPLE

$(6-3)(8-5)$ Distribute 6 into $(8-5)$
 First: $6 \cdot 8$, Outside: $6 \cdot -5$ Distribute -3 into $(8-5)$
 Inside: $-3 \cdot 8$, Last: $-3 \cdot -5$ Combine all parts
 $48 + (-30) + (-24) + 15$ Change to subtraction
 $48 - 30 - 24 + 15$ Evaluate
 9 Our Solution



SUMMARY

The **distributive rule** is used for the **FOIL method** when you're multiplying groups of terms in the form $(a+b)(c+d)$. Remember, these are called binomials. If we're multiplying $(a+b)$ times $(c+d)$, we are multiplying two binomials. When we **practice using FOIL**, the acronym can help us remember the steps for doing that distributing. It is important to remember that FOIL stands for First, Outer, Inner, and Last.

Source: ADAPTED FROM "BEGINNING AND INTERMEDIATE ALGEBRA" BY TYLER WALLACE, AN OPEN SOURCE TEXTBOOK AVAILABLE AT www.wallace.ccfaculty.org/book/book.html. License: Creative Commons Attribution 3.0 Unported License



TERMS TO KNOW

FOIL

An acronym to remember the steps for distributing factors in binomial multiplication: first, outside, inside, last.



FORMULAS TO KNOW

FOIL Method

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