

# Algebra,

*Been there – Done that*

## Polynomials Multiplication by FOIL

### Mathematical Systems

Bill Hanlon

Algebra, Been there –Done that is a newsletter that links algebra to previously learned concepts and skills or outside experiences

You multiply polynomials the same way you multiplied in the third and fourth grades.

All too often students do not realize a rule or procedure they are learning is nothing more than a shortcut. For that reason, math is like magic for many students. If we take the time to develop the patterns, students would not be so easily befuddled.

Polynomials are multiplied the very same way students learned to multiply in third and fourth grades. Unfortunately, they don't realize it. They hear this shortcut called FOIL, and they become FOILed.

#### FOIL

In grade school, students are taught to line up the numbers vertically. In algebra, students typically multiply horizontally. Let's look at multiplying two 2-digit numbers and compare that to multiplying two binomials

**First**  
**Outer**  
**Inner**  
**Last**

$$\begin{array}{r} 32 \\ \times 21 \\ \hline 64 \\ 672 \end{array} \longrightarrow \begin{array}{r} x+3 \\ \times x+1 \\ \hline x^2+3x \\ x^2+4x+3 \end{array}$$

FOIL comes from a pattern that allows you to multiply binomials in your head.

Notice the same procedure is used.

If students were to look at a number of examples, they may be able to see a pattern develop that would allow them to multiply binomials in their head.

$$(x+3)(x+1) = x^2 + 4x + 3$$

$$(x+5)(x+2) = x^2 + 7x + 10$$

$$(x+4)(x+5) = x^2 + 9x + 20$$

FOIL can also be used to multiply numbers in our head

$$\begin{array}{r} 21 \\ \times 32 \\ \hline 672 \end{array}$$

Look at the numbers in the problems, look at the numbers in the answers. Do you see a pattern? That recognition would lead us to the shortcut called FOIL, First, Outer, Inner, Last.

What do you think  $(x+3)(x+2)$  would be equal? If you said  $x^2 + 5x + 6$ , then you saw the pattern.

To find the middle term you multiply the inners and outers by crisscrossing;  $3 \times 1$  and  $2 \times 2$  and adding.

That same pattern would allow us to multiply numbers in our head. Imagine FOIL being used in computation.

$$21 \times 32 = (20+1)(30+2) \rightarrow 600 + (40 + 30) + 2$$

$$52 \times 41 = (50+2)(40+1) \rightarrow 2000 + (50 + 80) + 2$$

672