# 2.01 Products of Binomials ("F OI L") and Trinomials

*Basic Algebra: One Step at a Time*. Pages 123-126: F OI L Example;
Page 131-132: #58, 61, 63.

Extra Problems: #35, 57

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F = First times First
O = Outer times Outer
I = Inner times Inner
L = Last times Last

## Products of Binomials "F OI L"

F O I L

**Example 1.** $(x + 4)(x + 3) = x^2 + 3x + 4x + 12$

$= x^2 + 7x + 12$

F O I L

**Example 2.** $(x + 6)(x + 4) = x^2 + 4x + 6x + 24$

$= x^2 + 10x + 24$

P. 131 #58. $(2x^2-3x-6)(x^2-5x-4)$

Solution: This is a trinomial times a trinomial!! You must multiply the first term in the first parentheses times the second parentheses, the second term times the second parentheses, and the third term times the second parentheses, as indicated in the color coordinated scheme below:

$$\begin{array}{l}(2x^2-3x-6)(x^2-5x-4)\\ 2x^2(x^2-5x-4)\\ \quad -3x(x^2-5x-4)\\ \qquad -6(x^2-5x-4)\\ 2x^4-10x^3-\ 8x^2\\ \quad -3x^3+15x^2+12x\\ \qquad -6x^2+30x+24\\ \hline 2x^4-13x^3+\ x^2\ +42x+24\end{array}$$

P. 132 #61. $(x+3)^3$

Solution: Of course you realize this means: $(x+3)(x+3)(x+3)$.

In math, everything is "binary." That is, if you have three numbers to be multiplied, you must multiply two together first, and then multiply that product times the third number. It does not matter in what order you perform the multiplications. It might be convenient to multiply the second two together (by F O I L) first, like this:

$$(x+3)(x+3)(x+3)$$

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

Now, you can treat this as a product of a binomial times a trinomial, as the following colors indicate. Multiply the first times everything in the second parentheses, the second times everything in the second parentheses.

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

First: $x(x^2+6x+9)$ = $x^3+6x^2+9x$

Second: $+3(x^2+6x+9)$ $\underline{\quad +3x^2+18x+27}$

Finally, combine like terms : = $x^3+9x^2+27x+27$

**P. 132 #63.** $(x-5)^3$

**Solution: Of course you realize this means:** $(x-5)(x-5)(x-5)$ **.**

**In math, everything is "binary." That is, if you have three numbers to be multiplied, you must multiply two together first, and then multiply that product times the third number. It does not matter in what order you perform the multiplications. It might be convenient to multiply the second two together (by F O I L) first, like this:**

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

$$(x-5)(x^2-10x+25)$$

**Now, you can treat this as a product of a binomial times a trinomial, as the following colors indicate. Multiply the first times everything in the second parentheses, then the second times everything in the second parentheses.**

$$(x-5)(x^2-10x+25)$$

**First:** $x(x^2-10x+25)$ **=** $x^3-10x^2+25x$

**Second:** $-5(x^2-10x+25)$ $\underline{\quad -5x^2+50x-125}$

**Finally, combine like terms :** **=** $x^3-15x^2+75x-125$

## Extra Problems: #35, 57

**35.** $\frac{2}{3}a^4(6a^5 - 12a^3 - \frac{5}{8})$

**By Distributive Property,**

$$\frac{2}{3}a^4 \bullet 6a^5 - \frac{2}{3}a^4 \bullet 12a^3 - \frac{2}{3}a^4 \bullet \frac{5}{8}$$

**Remember that when you multiply with the same exponent, you must ADD exponents:**

$$\frac{2}{3} \bullet 6a^4a^5 - \frac{2}{3} \bullet 12a^4a^3 - \frac{2}{3} \bullet \frac{5}{8}\ a^4$$

$$\frac{2}{3} \bullet 6a^9 - \frac{2}{3} \bullet 12a^7 - \frac{2}{3} \bullet \frac{5}{8}\ a^4$$

**Reduce the fractions:**

$$\frac{2}{\cancel{3}} \bullet \cancel{6}\,2a^9 - \frac{2}{\cancel{3}} \bullet \cancel{12}\,4a^7 - \frac{\cancel{2}}{3} \bullet \frac{5}{\cancel{8}\,4}\ a^4$$

$$4a^9 - 8a^7 - \frac{5}{12}\ a^4$$

**57.** $(x^2 - x + 5)(x + 1)$

**I think it's easier to multiply a binomial times a trinomial, so let's begin by reversing the order of multiplication by the commutative property:**

$$(x + 1)\ (x^2 - x + 5)$$

**Now, from the binomial, multiply the $x$ times each term in the second parentheses, then multiply the $+1$ times each term in the second parentheses .**

$$(x + 1)\ (x^2 - x + 5)$$

$$\begin{array}{rl} & x^3 - x^2 + 5x \\ & \underline{\quad +1x^2 - 1x + 5} \\ = & x^3 \qquad\quad + 4x + 5 \end{array}$$