Special Products

For Multiplying Polynomials

Note: a & b below represent terms, not just numbers.

The **FOIL**(**F**irst **O**uter **I**nner **L**ast) Method is used when multiplying two binomials.

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

- **F**irsts are a * c
- **O**uters are a * d
- **I**nners are b * c
- **L**asts are b * d
- **F** + **O** + **I** + **L** → **FOIL**

We can check this by applying the rules for Multiplying Polynomials.

(a + b)(c + d)	Distribute
a(c + d) + b(c + d)	Distribute AGAIN!
ac + ad + bc + bd	If we were working with a specific problem we could now Simplify.

Examples:

(3x + 2)(x – 1)

- **F**irsts are 3x & x → $3x^2$
- **O**uters are 3x & – 1 → – 3x
- **I**nners are 2 & x → 2x
- **L**asts are 2 & – 1 → – 2

Now we can just add them together

$3x^2 + -3x + 2x - 2$ → $3x^2 + -x - 2$ or $3x^2 - x - 2$

(4x – 1)(2x – 2)

$8x^2 - 8x - 2x + 2$	**F** + **O** + **I** + **L**
$8x^2 - 10x + 2$	**FOIL**

Squaring a Binomial = Perfect Square Trinomial(factoring section)

$(a + b)^2 = a^2 + 2ab + b^2$

$(a - b)^2 = a^2 - 2ab + b^2$

We can check both of these formulae by applying the FOIL Method from above.

$(a + b)^2 \rightarrow (a + b)(a + b) \rightarrow a^2 + ab + ab + b^2 \rightarrow a^2 + 2ab + b^2$

$(a - b)^2 \rightarrow (a - b)(a - b) \rightarrow a^2 - ab - ab + (-b)^2 \rightarrow a^2 - 2ab + b^2$

Examples:

$(3x + 7)^2 \rightarrow (3x)^2 + 2(3x)(7) + (7)^2 \rightarrow 9x^2 + 42x + 49$

$(5y - 3)^2 \rightarrow (5y)^2 - 2(5y)(3) + (3)^2 \rightarrow 25y^2 - 30y + 9$

Product of a Sum & Difference (Product of Conjugates) = Difference of Two Squares (Factoring Section)

$(a + b)(a - b) = a^2 - b^2$ a – b is the ***conjugate*** of a + b, since the values are the same but the sign in between is opposite.

Again, we can check this with the FOIL Method.

$(a + b)(a - b) \rightarrow a^2 - ab + ab - b^2 \rightarrow a^2 - b^2$

Example:

$(2x + 3)(2x - 3) \rightarrow (2x)^2 - (3)^2 \rightarrow 4x^2 - 9$