AGS 3 Name: _____ Period: ____ Date: _____

Notes 3.4 – Multiplying Polynomials

Warmup – Flashback to multiplying in elementary school… no calculators

1. $2571 \cdot 34 =$

$$\begin{array}{r} 2571 \\ \times \quad 34 \\ \hline 10284 \\ 77130 \\ \hline 87{,}414 \end{array}$$

2. $8329 \cdot 371 =$

$$\begin{array}{r} {\scriptstyle 2} \\ 8329 \\ \times \quad 371 \\ \hline 8329 \\ 583030 \\ 2498700 \\ \hline 3{,}090{,}059 \end{array}$$

Investigation

When adding polynomials we applied basic addition rules, will the same be true for multiplication?

Try multiplying $(x-2)(x+5)$, what do you get?

$$x^2+3x-10$$

$$\begin{array}{r} x-2 \\ \cdot \quad x+5 \\ \hline 5x-10 \\ x^2-2x \quad 0 \\ \hline x^2+3x-10 \end{array}$$

There are two common methods used to multiply polynomials, you can use either to successfully multiply two polynomials.

Method 1: The Box $(x+2)(x^2-3x+5)$

	x^2	$-3x$	$+5$
x	x^3	$-3x^2$	$+5x$
$+2$	$+2x^2$	$-6x$	$+10$

orientation does not matter $\Longleftrightarrow$

	x	$+2$
x^2	x^3	$+2x^2$
$-3x$	$-3x^2$	$-6x$
$+5$	$+5x$	$+10$

$$x^3-x^2-x+10$$

Combine like terms by adding

Method 2: FOIL or SuperFOIL $(x-3)(x^2+4x-2)$

uses the distributive property multiple times

$(x-3)(x^2+4x-2)$

$x^3+4x^2-2x-3x^2-12x+6$

then combine like terms

$\boxed{x^3+x^2-14x+6}$

How can you check if your answers is correct?

Graph your answer & the original factored form

Practice the method of your choice.

a. $(x+5)(x^2-x-3)$

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

$\boxed{x^3+4x^2-8x-15}$

b. $(x-2)(2x^2+6x+1)$

$2x^3+6x^2+x-4x^2-12x-2$

$\boxed{2x^3+2x^2-11x-2}$

How can we find the product when there are more than two factors?

Multiply twice or more

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

$(x+2)(x-2) \rightarrow x^2-2x+2x-4 \rightarrow \boxed{x^2-4}$

$(x^2-4)(x+3) \rightarrow \boxed{x^3+3x^2-4x-12}$

How can we multiply polynomials in the form $(a-b)^3$?

expand it out to get rid of exponent

$(a-b)(a-b)(a-b)$

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

$(a^2-2ab+b^2)(a-b) \rightarrow a^3-a^2b-2a^2b+2ab^2+ab^2-b^3$

$$\boxed{a^3-3a^2b+3ab^2-b^3}$$

Practice on these problems.

c. $(x+3)^3$

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

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

$x^3+3x^2+6x^2+18x+9x+27$

$$\boxed{x^3+9x^2+27x+27}$$

d. $(x-1)^4$

$(x-1)(x-1)(x-1)(x-1)$

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

	x^2	$-2x$	$+1$
x^2	x^4	$-2x^3$	$+x^2$
$-2x$	$-2x^3$	$+4x^2$	$-2x$
$+1$	x^2	$-2x$	$+1$

$$\boxed{x^4-4x^3+6x^2-4x+1}$$

Putting it all together.

e. $(2x^2-3x+1)(x-2)^2$

$(2x^2-3x+1)(x-2)(x-2)$

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

	$2x^2$	$-3x$	$+1$
x^2	$2x^4$	$-3x^3$	$+x^2$
$-4x$	$-8x^3$	$+12x^2$	$-4x$
4	$8x^2$	$-12x$	$+4$

$$\boxed{2x^4-11x^3+21x^2-16x+4}$$