7.1 Adding and Subtracting Polynomials

Learning Target:

- I can perform operations and use special patterns with polynomials

Success Criteria:

- I can find the degree of monomials.
- I can classify polynomials.
- I can add and subtract polynomials.
- I can solve real-life problems.

I can find the degree of monomials.

A monomial is a number, a variable, or the product of a number and one or more variables with a whole number exponent.

ex: 4, x, $2x^4$, xy^6

The degree of a monomial is the sum of the exponents of the variables. The degree of a nonzero constant term is 0. Zero does not have a degree.

#

Monomial	Degree
10	0
$3x$	1
$\frac{1}{2}ab^2$	$1 + 2 = 3$
$-1.8m^5$	5

Not a monomial	Reason
$5 + x$	A sum is not a monomial.
$\frac{2}{n}$	A monomial cannot have a variable in the denominator.
4^a	A monomial cannot have a variable exponent.
x^{-1}	The variable must have a whole number exponent.

Examples: Find the degree of each monomial

1. $7n^3$
   3
2. $\frac{1}{3}x^5$
   5
3. w^2y^5
   7

You try:

1. $-3x^4$
   4
2. $7c^3d^2$
   5
3. -20.5
   0

7.1 Adding and Subtracting Polynomials

I can classify polynomials.

A polynomial is a monomial or a sum of monomials. Each monomial is called a "term"

Name	# of Terms	Example
Monomial	1	$10x^2$
Binomial	2	$3x^4 - 4x$
Trinomial	3	$2x^2+3x-5$
Polynomial	more than 3	

The degree of a polynomial is the largest greatest degree of its terms. A polynomial in one variable is in standard form when the exponents of the terms decrease from left to right. The coefficient of the first term is called the leading coefficient. largest degree to smallest degree

Examples: Write the polynomials in standard form, identify the degree and leading coefficient, and classify the polynomial by the number of terms.

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

$3x^2-2x+4$

deg: 2

LC: 3

trinomial

2. $2.8x + x^3$

$x^3+2.8x$

deg: 3

LC: 1

binomial

You try:

1. $4 - 9z$

$-9z+4$

deg: 1

LC: -9

binomial

2. $q^2 - q^3 - 6q$

$-q^3+q^2-6q$

deg: 3

LC: -1

trinomial

7.1 Adding and Subtracting Polynomials

I can add and subtract polynomials.

Examples: Simplify the expression.

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

$p^2+p+3+-4p^2-p+3$

$\boxed{-3p^2+6}$

2) $(b-10)+(4b-3)$

$b-10+4b-3$

$\boxed{5b-13}$

3) $(2x^3-5x^2+x)+(2x^2+x^3-1)$

$\cancel{2x^3}-\cancel{5x^2}+x+\cancel{2x^2}+\cancel{x^3}-1$

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

4) $(8w+3)-1(9w+6)$

$8w+3-9w-6$

$\boxed{-w-3}$

5) $(5b^2-6b-9)-1(-2b^2+8b-1)$

$5b^2-6b-9+2b^2-8b+1$

$\boxed{7b^2-14b-8}$

You try:

1) $(-12v+3)+(8v-7)$

$-12v+3+8v-7$

$\boxed{-4v-4}$

2) $(3j^2-7j+1)+(-6j^2-4j+9)$

$\cancel{3j^2}-\cancel{7j}+1-\cancel{6j^2}-\cancel{4j}+9$

$\boxed{-3j^2-11j+10}$

3) $(2w^2-7w+3)+(2w^2+8w)$

$2w^2-7w+3+2w^2+8w$

$\boxed{4w^2+w+3}$

4) $(p-5)-1(4p-7)$

$p-5-4p+7$

$\boxed{-3p+2}$

5) $(3y^2-6y+9)-1(6y^2-7y-2)$

$\cancel{3y^2}-\cancel{6y}+\cancel{9}-\cancel{6y^2}+\cancel{7y}+\cancel{2}$

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

6) $(x^2-4xy+9y^2)+(-8x^2+6xy-y^2)$

$\cancel{x^2}-\cancel{4xy}+\cancel{9y^2}-\cancel{8x^2}+\cancel{6xy}-\cancel{y^2}$

$\boxed{-7x^2+2xy+8y^2}$

7.1 Adding and Subtracting Polynomials

I can solve real-life problems.

Example: The number of economy-size cars rented in *w* weeks is represented by $152 + 3w$. The number of full-size cars rented in *w* weeks is represented by $99 + 2w$. Write a polynomial that represents how many more economy cars are rented in *w* weeks than full-size cars.

$(152+3w)-(99+2w)$

$152+3w-99-2w$

$\boxed{53+w}$

You try: The cost (in dollars) of making *b* bracelets is represented by $4 + 5b$. The cost (in dollars) of making *b* necklaces is represented by $8b + 6$. Write a polynomial that represents how much more it costs to make *b* necklaces than *b* bracelets.

$(8b+6)-(4+5b)$

$8b+6-4-5b$

$\boxed{3b+2}$

7.2 Multiplying Polynomials

Learning Target:

- I can perform operations and use special patterns with polynomials

Success Criteria:

- I can multiply binomials.
- I can use the FOIL method.
- I can multiply binomials and trinomials.

I can multiply binomials.

<table>
<tr><th colspan="2">$(x + 4)(x + 1)$</th></tr>
<tr><td>Multiplying binomials using the DISTRIBUTIVE method</td><td>$\overgroup{x(x+1)}+\overgroup{4(x+1)}$
$x^2+x+4x+4$
x^2+5x+4</td></tr>
<tr><td>Multiplying binomials using a TABLE</td><td><table><tr><td></td><td>x</td><td>1</td></tr><tr><td>x</td><td>x^2</td><td>x</td></tr><tr><td>4</td><td>4x</td><td>4</td></tr></table>x^2+5x+4</td></tr>
<tr><td>Multiplying binomials using the FOIL method
Success Criteria: FOIL method</td><td>F: Firsts
O: Outer
I: Inner
L: Lasts
$(x+4)(x+1)$
F: $x \cdot x = x^2$
O: $x \cdot 1 = x$
I: $4 \cdot x = 4x$
L: $4 \cdot 1 = 4$
x^2+5x+4</td></tr>
</table>

Use any method to multiply $(r - 5)(2r^2 - 1)$

$$\overgroup{r(2r^2-1)}-\overgroup{5(2r^2-1)}$$

$$2r^3-r-10r^2+5$$

$$2r^3-10r^2-r+5$$

7.2 Multiplying Polynomials

You try: (continued on next page!)

Use any method to multiply $(m-3)(m+7)$

	m	$+7$
m	m^2	$7m$
-3	$-3m$	-21

$\boxed{m^2+4m-21}$

Use any method to multiply $(2u+\frac{1}{2})(u-\frac{3}{2})$

$F: 2u \cdot u = 2u^2$

$O: 2u \cdot -\frac{3}{2} = -3u$

$I: \frac{1}{2} \cdot u = \frac{1}{2}u$

$L: \frac{1}{2} \cdot -\frac{3}{2} = \frac{-3}{4}$

$\boxed{2u^2-2.5u-0.75}$

OR

$\boxed{2u^2-\frac{5}{2}u-\frac{3}{4}}$

I can multiply a binomial and a trinomial.

To multiply a binomial and trinomial we must use either distributive or a table.

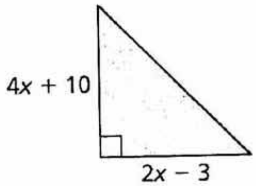
<table>
<tr><th colspan="2">Example: $(x+1)(x^2+5x+8)$</th></tr>
<tr><td>Multiplying binomials using the DISTRIBUTIVE method</td><td>$x(x^2+5x+8)+1(x^2+5x+8)$
$x^3+5x^2+8x+x^2+5x+8$
$\boxed{x^3+6x^2+13x+8}$</td></tr>
<tr><td>Multiplying binomials using a TABLE</td><td><table><tr><td></td><td>x^2</td><td>$5x$</td><td>8</td></tr><tr><td>x</td><td>x^3</td><td>$5x^2$</td><td>$8x$</td></tr><tr><td>1</td><td>x^2</td><td>$5x$</td><td>8</td></tr></table>$\boxed{x^3+6x^2+13x+8}$</td></tr>
</table>

7.2 Multiplying Polynomials

You try: $(r-3)(r^2-2r+4)$	
Multiplying binomials using the DISTRIBUTIVE method	$r(r^2-2r+4)-3(r^2-2r+4)$ $\cancel{r^3}-\cancel{2r^2}+\cancel{4r}-\cancel{3r^2}+\cancel{6r}-12$ $\boxed{r^3-5r^2+10r-12}$
Multiplying binomials using a TABLE	$\begin{array}{c\|c\|c\|c} & r^2 & -2r & 4 \\ \hline r & r^3 & -2r^2 & 4r \\ \hline -3 & -3r^2 & +6r & -12 \end{array}$ $\boxed{r^3-5r^2+10r-12}$

Mathematical Connections

Example: Write a polynomial that represents the area of the shaded region



$A=\frac{1}{2}bh$

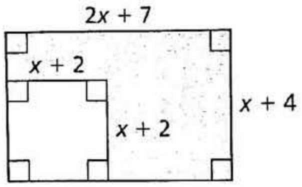
$A=\frac{1}{2}(2x-3)(4x+10)$

$A=(x-\frac{3}{2})(4x+10)$

$\boxed{A=4x^2+4x-15}$

$$\begin{array}{c|c|c} & 4x & 10 \\ \hline x & 4x^2 & 10x \\ \hline -\frac{3}{2} & -6x & -15 \end{array}$$

You try:



Big: $(2x+7)(x+4)$

$$\begin{array}{c|c|c} & x & 4 \\ \hline 2x & 2x^2 & 8x \\ \hline 7 & 7x & 28 \end{array}$$

$2x^2+15x+28$

Small: $(x+2)(x+2)$

$$\begin{array}{c|c|c} & x & 2 \\ \hline x & x^2 & 2x \\ \hline 2 & 2x & 4 \end{array}$$

x^2+4x+4

$(2x^2+15x+28)-(x^2+4x+4)$

Closure: What I learned today was... $\boxed{x^2+11x+24}$

7.3 Special Products of Polynomials

Learning Target:

- I can perform operations and use special patterns with polynomials

Success Criteria:

- I can use the square of a binomial pattern.
- I can use the sum and difference pattern.
- I can use special product patterns to solve real-life problems.

I can use the square of a binomial pattern.

Investigation:

How can we rewrite the following 'square of a binomial'? Then just multiply using the method of your choice!

$(x+7)^2 =$ $x^2+14x+49$

$(x+7)(x+7)$

$x^2+7x+7x+49$

$(7x-3)^2 =$ $49x^2-42x+9$

$(7x-3)(7x-3)$

$49x^2-21x-21x+9$

Do you notice a pattern?

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

~~a^2+b^2~~

$(3m+n)^2 =$ $9m^2+6mn+n^2$

$a=3m$
$b=n$

$(3m)^2+2(3m)(n)+(n)^2$

$(-7t+4)^2 =$ $49t^2-56t+16$

$a=-7t$
$b=4$

$(-7t)^2+2(-7t)(4)+4^2$

7.3 Special Products of Polynomials

I can use the sum and difference pattern.

Investigation:

Multiply the following polynomials.

1) $(x+10)(x-10)$

$x^2 - \cancel{10x} + \cancel{10x} - 100$

$x^2 - 100$

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

$4x^2 + \cancel{2x} - \cancel{2x} - 1$

$4x^2 - 1$

Do you notice a pattern? $a^2 - b^2$

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

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

$a = x$

$b = 3y$

$\boxed{x^2 - 9y^2}$

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

$a = 3x$

$b = 2$

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

$\boxed{9x^2 - 4}$

You try:

Try these using the Square of a Binomial and the Sum and Difference pattern instead of multiplying:

1) $(x-7)^2$

$(x-7)(x-7)$

$a = x$

$b = -7$

$x^2 + 2(x)(-7) + (-7)^2$

$\boxed{x^2 - 14x + 49}$

2) $(t-7)(t+7)$

$a = t$

$b = 7$

$t^2 - 7^2$

$\boxed{t^2 - 49}$

3) $(8+3a)(8-3a)$

$a = 8$

$b = 3a$

$8^2 - (3a)^2$

$\boxed{64 - 9a^2}$

4) $(2x+5)^2$

$(2x+5)(2x+5)$

$a = 2x$

$b = 5$

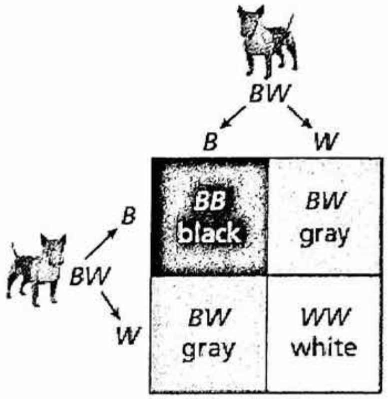
$(2x)^2 + 2(2x)(5) + 5^2$

$\boxed{4x^2 + 20x + 25}$

7.3 Special Products of Polynomials

I can use special products to solve real- life problems.

Example: Each of two dogs has one black gene (B) and one white gene (W). The Punnett square shows the possible gene combinations of an offspring and the resulting colors.



a) What percent of the possible gene combinations result in black?

25% $\frac{1}{4}$

b) Show how you could use polynomial to model the possible gene combinations of the offspring.

$(.5B+.5W) = 50\%$ Black, 50% white (from each parent)

$(.5B+.5W)^2 = (.5B+.5W)(.5B+.5W)$

$a = .5B$

$b = .5W$

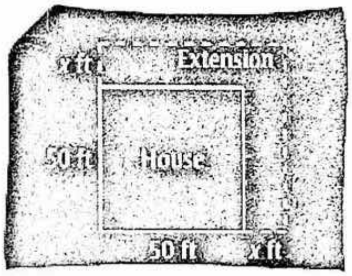
$(.5B)^2+2(.5B)(.5W)+(.5W)^2$

$0.25B^2+0.5BW+0.25W^2$

25% black, 50% gray, 25% white

You try: A contractor extends a house on two sides.

a) The area of the house after the renovation is represented by $(x + 50)^2$. Find this product.



$(x+50)^2$

$a = x$

$b = 50$

$x^2+2x\cdot50+50^2$

$\boxed{x^2+100x+2500}$

b) Use the polynomial in part (a) to find the area when $x = 15$. What is the area of the extension?

$15^2+100(15)+2500$

$225+1500+2500$

$\boxed{4225\ ft^2}$ total house

extension = new - old

$4225-2500$

$\boxed{1725\ ft^2 \text{ extension}}$