8.1 Notes: Adding and Subtracting Polynomials

Lesson Objectives

1) Define terms used for polynomials
2) Add and subtract polynomials

Key Vocabulary

Monomial	**Binomial**
Trinomial	**Polynomial** **Note: All the exponents must be whole (positive) numbers!**
Degree of a polynomial	**Leading Coefficient**
Descending order	**Like Terms**

Adding polynomials

For Examples #1 – 2: Find each sum (simplify):

1) $(4x^3 + x^2 - 5) + (7x + x^3 - 3x^2)$ **You Try!** 2) $(x^2 + x + 8) + (x^2 - x - 1)$

Subtracting polynomials

Remember to multiply each term in the polynomial by – 1 when you write the subtraction as addition.

For Examples 3 – 4: Find the difference (simplify).

3) $(4z^2 - 3) - (-2z^2 + 5z - 1)$ **You Try!** 4) $(3x^2 + 6x - 4) - (x^2 - x - 7)$

You try! Example 5) Simplify the expression: $(3x^2 + 5) - (x^2 + 2) + (-3x + 1)$

Reminder: Using the Distributive Property

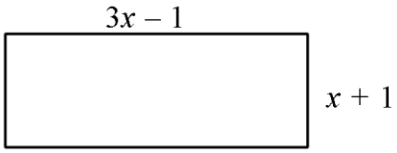
For #6 – 8: Simplify each expression. **You Try #7 and #8!**

6) $3x^3(2x^3 - x^2 - 7x - 3)$

7) $-x^2(x - 6)$

8) $\frac{1}{2}y^3(6xy^2 + 8xy - 4)$

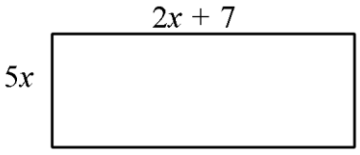
Example 9) Find the perimeter of the rectangle shown.
Perimeter = sum of all four sides



Example 10) Find $h(x) = f(x) + g(x)$ if $f(x) = (7x^2 - 3x + 2)$ and $g(x) = (5x - 2)$.

Example 11) Find $h(x) = f(x) - g(x)$ if $f(x) = (-2x^3 - 4x + 2)$ and $g(x) = (5x^3 + 5x^2 - 2x)$

Example 12) Write a polynomial expression to represent the area of the rectangle shown.
Area = (length)(width)



8.2 Notes: Multiplying Polynomials

Lesson Objectives

1) Multiply binomials
2) Square binomials
3) Multiply a binomial and a polynomial

Multiplying binomials	

Examples 1 – 4: Multiply the binomials. **You Try #3 – 4!**

1) $(x+3)(x+4)$

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

3) Multiply: $(3x+7)(x-8)$

4) Multiply: $(x^2-4)(x-x^2)$

Brain Challenge! **Can you multiply these binomials without showing work? Look for patterns!**

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

6) $(a+3)(a+4)$

7) $(b+9)(b+3)$

8) $(y-2)(y+6)$

9) $(d-7)(d-1)$

10) $(x-3)(x+3)$

Example 11: Find $h(x) = f(x) \cdot g(x)$ if $f(x) = (2x+7)$ and $g(x) = (x-9)$.

Squaring binomials	

Examples 12 – 13: Simplify each expression. **You Try #13!**

12) $(x+4)^2$ 13) $(x-7)^2$

Examples 14 – 15: Simplify each expression. **You Try #13!**

14) $(3x+4)^2$ 15) $(5x-1)^2$

Challenge! #16: Simplify the expression: $(m+7)(m-3) + (m-4)(m+5)$

Example 17 – 19: Find each product. Challenge: See if you can do these without work. 😊

17) $(x-5)(x+5)$ 18) $(y-3)(y+3)$ 19) $(2a-7)(2a+7)$

Conjugates:

What happens when you multiply two conjugates (see examples 17 – 19)?

Example 20) Write two binomials that are conjugates and whose product equals $x^2 - 4$.

Examples 21 – 24: Multiply the polynomials.

21) $(2a-5)(a^2-6a-3)$

22) $(5p-2)(3p^2-2p+1)$

You Try #23 – 24!

23) $(3x-2)(4x^2-5x+1)$

24) $(2a^2+3a-2)(a-4)$

Challenge! **#25:** Simplify $2(-4a+9)^2+5$

8.3: Factoring Out the Greatest Common Factor (GCF)

Lesson Objectives

1) Find the GCF for a polynomial expression
2) Factor the GCF out of a polynomial

Exploration: What are the **factors** of each number below?

6 15 18

What is the greatest common factor of all three numbers?

Expand each expression to show all factors. Then find the greatest common factor for all three of the expressions.

$8x^3$ $-4x^2$ $6x^3$

Greatest Common Factor (GCF)	
Factoring out the GCF	

Examples 1 – 6: Factor each expression by taking out the GCF.

1) $5x + 20$ 2) $8x - 4x^2$ 3) $16x^2y + 40xy + 8xy^2$

You Try #4 – 6!

4) $6m^2 - 30m^3$ 5) $12ab + 32b$ 6) $8ax^3 + ax^2 - 3ax$

Factoring out the GCF if the first term is negative	

Examples 7 – 12: Factor each expression by taking out the GCF.

7) $-4nm - 2n^2$ 8) $-5wx^3 + 10wx^2$ 9) $-a^3 + 4a^2 - 8a$

You Try #10 – 12!

10) $-6y + 15y^3$ 11) $-9dm^3 + dm^2$ 12) $-b^2 - 4b + 1$

13) One factor of $-7x^3y - 21x^2y^2$ is $(-7x^2y)$. What is the other factor?

14) Factor: $15x^3 - 7y^4 - 2z$

When a polynomial expression does not have any factors besides 1 and itself, we say that the expression is _____.

REVIEW #15 – 17: Find each product. Try to do these in your head.

15) $(x + 2)(x + 3)$ 16) $(y + 4)(y + 7)$ 17) $(h - 3)(h + 5)$

Challenge! **What are the factors of each trinomial? (Try to work backwards to figure this out!)**

18) $x^2 + 6x + 8$ 19) $x^2 + 7x + 10$

8.4 Notes: Intro to Factoring Trinomials and Binomials

Lesson Objectives

1) Factor a trinomial into two binomials
2) Factor a difference of two squares
3) Determine if a polynomial is prime (unable to be factored).

Work in groups to multiply (expand) the following expressions: Challenge: Try this without work!

$(x + 5)(x - 3)$ $(x + 2)(x + 8)$ $(x + 4)(x - 4)$

Factoring a Trinomial in the form $x^2 + bx + c$	

Example 1: Factor $x^2 + 10x + 16$ **Check by multiplying your answer:**

Examples 2 – 7: Factor each expression.

2) $x^2 + 10x + 9$ 3) $a^2 + 6a + 9$ 4) $x^2 + 7x + 12$

You try #5 – 7!

5) $x^2 + 5x + 6$ 6) $y^2 + 5y + 4$ 7) $x^2 + 2x + 1$

Examples 9 – 14: Factor each trinomial. You might have to use some negative values at times.

9) $x^2 + 4x - 12$ 10) $w^2 - 10w + 25$ 11) $a^2 - a - 30$

You try #12 – 14! Factor each trinomial.

12) $x^2 - 8x - 24$ 13) $b^2 + 7b - 18$ 14) $y^2 - 3y + 2$

Reminder: What are conjugates?

Multiply each expression below. (Try to do this without work!)

$(x - 5)(x + 5)$ $(x + 11)(x - 11)$

Factoring a Difference of Two Perfect Squares $\boldsymbol{a^2 - b^2}$	

For #15 – 22: Factor each expression.

15) $x^2 - 25$ 16) $a^2 - 49b^2$ 17) $36 - y^{10}$ 18) $x^6 - 100$

You try #19 – 22!

17) $g^2 - 4$ 18) $1 - b^2$ 19) $k^8 - 81j^2$ 20) $n^{10} - 9$

Consider: $\boldsymbol{a^2 + 25}$. Try to factor this expression. Multiply out any answers you get to check your ideas.

If an expression does not factor at all, then it is _____.

8.5: More Factoring Trinomials and Binomials

Lesson Objectives

1) **Factor a trinomial of the form $ax^2 + bx + c$**
2) **Review other factoring techniques.**

Exploration: **Simplify each expression. Try to do these without showing work!**

$a)$ $(3x - 1)(x + 4)$ $b)$ $(5x + 2)(3x - 7)$

Factoring a Trinomial in the form $ax^2 + bx + c$	

Example 1: Factor $2x^2 + 11x + 5$ **Check your solution by using multiplication:**

For Examples 2 – 7: Factor each expression.

2) $3n^2 + 4n + 1$ 3) $9y^2 + 6y + 1$ 4) $2x^2 + 19x + 9$

You Try # 5 – 7!

5) $2y^2 + 15y + 7$ 6) $3a^2 + 8a + 4$ 7) $15x^2 + 13x + 2$

Examples 8 – 13: Factor each expression. You might have to use some negative values or extra variables!

8) $3x^2 - x - 2$ 9) $6d^2 - 23d + 7$ 10) $8b^2 + 14ab - 15a^2$

You Try #11 – 13!

11) $3a^2 - 10a - 8$ 12) $15y^2 - 13y + 2$ 13) $2m^2 + mn - 21n^2$

Reminder: Factoring Difference of Perfect Squares

$\boldsymbol{a^2 - b^2}$

Examples 14 – 19: Factor each expression.

14) $25x^2 - 4$ 15) $49b^4 - 9d^2$ 16) $36a^2 - b^6$

You try #17 – 19!

17) $121h^2 - 4g^8$ 18) $25 - 16k^2$ 19) $49x^2 - 1$

Reminder! Factoring out the GCF:

Examples 20 – 22: Factor out the GCF for each expression.

20) $6x^2 - 8x$ 21) $-a^5 - 9a^6$ 22) $-4x^3y + 4x^2y$

Challenge! Factor the trinomial below in 2 steps. First factor out the GCF and then factor the remaining trinomial: $5x^2 + 15x + 10$

8.6 Notes: Factoring Completely

Lesson Objective

- Completely factor all polynomials (or state they are prime).

Factoring COMPLETELY	

Examples 1 – 6: Factor each polynomial completely. Always look for a GCF first!

1) $5a^2 - 405$ 2) $2x^2 - 8x - 10$ 3) $-3r^3 + 21r^2 - 30r$

You Try #4 – 6!

4) $6x^6 - 24$ 5) $5x^2 + 10x - 15$ 6) $-x^3 - x^2 + 12x$

Example 7 – 10: Factor completely. Look for a GCF first!

7) $6x^2 + 26x + 8$ 8) $-2x^3 - 5x^2y - 2xy^2$

You try!

9) $-20x^2 + 10x + 10$ 10) $30a^3 + 21a^2b + 3ab^2$

Examples 11 – 19: Factor each expression completely. Write "prime" if no factoring can be done. Not all problems will have a GCF, but some might.

11) $5x^3 - 20x$

12) $3x^2 - 13x + 12$

13) $g^2 + 16$

You try #14 – 19!

14) $-x^5 + 9x^3$

15) $-2x^3 - 20x^2 - 42x$

16) $8x^2 - 63x - 81$

17) $-a^5 - 3a^4$

18) $25x^2 + 1$

19) $-15x^2 + x + 2$