UNIT 2 – FACTORING

M2 Ch 11 all

2.1 Polynomials

- Objective
  - I will be able to put polynomials in standard form and identify their degree and type. I will be able to add and subtract polynomials.
- Vocabulary

• Monomial	• GCF	• Polynomial	• Binomial
• Trinomial	• Standard Form of a Polynomial		
• Degree of a Polynomial		• Degree of a Monomial	

2.1 Polynomials

- Polynomials
  - A monomial is a real number, a variable, or their product.
    - The degree of a monomial is the sum of its exponents.
  - The addition and/or subtraction of monomials are called polynomials.
    - The degree of a polynomial equals the highest degree of its terms.
    - Standard form of a polynomials: highest degree to lowest degree.

2.1 Polynomials

- Can be named based on degree or number of terms.

Degree	Name	Degree	Name	# Terms	Name
0	Constant	3	Cubic	1	Monomial
1	Linear	4	Quartic	2	Binomial
2	Quadratic			3	Trinomial

2.1 Polynomials

- Adding/Subtracting Polynomials
  - Combine like terms (terms with the same variables and degree)
  - Adding/Subtracting Polynomials
    - Vertical Method – line up like terms; then add the coefficients.
    - Horizontal Method – group like terms; then add the coefficients.
    - If subtracting polynomials, add the opposite of each term in the polynomial being subtracted. (for either method above)

2.2 Multiplying Polynomials

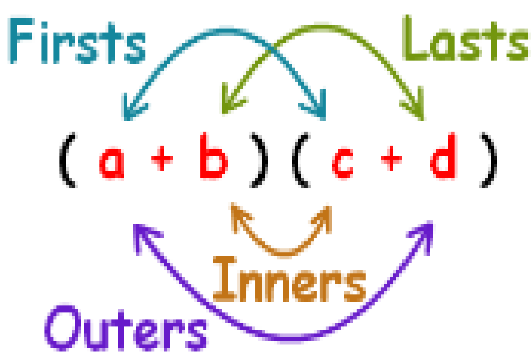
- Objective
  - I will be able to multiply polynomials using distribution, FOIL, and the vertical method.
- Vocabulary
  - None

2.2 Multiplying Polynomials

- Multiplying a Polynomial by a Monomial
  - Distribute the monomial into the polynomial by multiplying each term of the polynomial by the monomial.
  - When multiplying two monomials with like bases, add the exponents and multiply the coefficients.

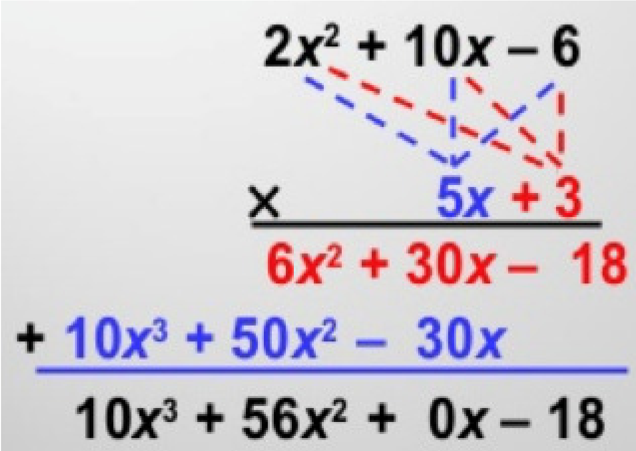
2.2 Multiplying Polynomials

- Multiplying Polynomials
  - Distributive property
    - Distribute one polynomial into the other
    - Then distribute the monomials into the polynomials.
  - FOIL
    - Works only for multiplying two binomials
    - Shortened form of distribution
    - Multiply in the order: First, Outer, Inner, Last



2.2 Multiplying Polynomials

- Vertical Method
  - Line up the two polynomials
  - Multiply the top binomial by one term at a time from the bottom polynomial.
  - Add like terms from the products.



2.3 Multiplying Special Cases

- Objective
  - I will be able to square binomials and find the product of the sum and difference of two terms.
- Vocabulary
  - None

2.3 Multiplying Special Cases

- Squaring Binomials
  - Multiplying a binomial by itself results in a special pattern in the trinomial.
  - The pattern slightly changes depending upon whether the two terms are added or subtracted.
    - $(a+b)^2 = a^2 + 2ab + b^2$
    - $(a-b)^2 = a^2 - 2ab + b^2$

2.3 Multiplying Special Cases

- The product of sum and difference
  - Both binomials have the same two terms; one is addition, the other is subtraction.
  - When multiplying in this situation, the middle term cancels out.
    - $(a+b)(a-b)=a^2-b^2$

2.4 Simple Factoring

- Objective
  - I will be able to factor out the greatest common factor from a polynomial. I will be able to factor quadratic expressions with a lead coefficient of one.
- Vocabulary
  - None

2.4 Simple Factoring

- Factoring Polynomials
  - Find the Greatest Common Factor first, then factor it out of the polynomial.
- Put quadratic expression in standard form

$$(ax^2 + bx + c)$$

  - Find factors of c that add up to b.

$$(m * n = c \ and \ m + n = b)$$

  - Write the quadratic expression in factored form:

$$(x + m)(x + n)$$

2.4 Simple Factoring

- a = 1, b is positive, c is positive
  - both m and n will be positive
- a = 1, b is negative, c is positive
  - both m and n will be negative
- Where c is negative
  - m will be negative while n is positive.
    - If b is negative, m is the larger number
    - If b is positive, n is the larger number

2.4 Simple Factoring

- With Two Variables
  - Put expression in standard form $(ax^2 + bxy + cy^2)$
    - Find factors of c that add up to b.
      $$(m * n = c \; and \; m + n = b)$$
    - Write the quadratic expression in factored form: $(x + my)(x + ny)$
  - Follow the same patterns above for the signs of m and n.

2.4 Simple Factoring

b	c	factors of c, add up to b	
		m	n
+	+	+	+
–	+	–	–
+	–	– (smaller)	+ (larger)
–	–	– (larger)	+ (smaller)

2.5 Factoring by Grouping

- Objective
  - I will be able to factor quadratic expressions with a lead coefficient other than one. I will be able to factor a cubic expression by grouping.
- Vocabulary

Factoring by Grouping	Reverse FOIL	Tic-Tac-Toe Method

2.5 Factoring by Grouping

- Quadratic with $a \neq 1$
  - Reverse FOIL
    - Recall that when multiplying two binomials, you get like terms for the Inner and Outer products.
    - If the terms in the quadratic have a GCF, you will need to factor it out first.

2.5 Factoring by Grouping

- Reverse FOIL uses factors of ac to split the bx term in the quadratic expression.
  - Find ac.
  - Find factors of ac that add up to b $(m * n = ac \text{ and } m + n = b)$
  - Replace bx with mx and nx.
  - Pair the first two terms and the last two terms.
  - Factor out the GCF of each side.
  - Use the distributive property to write the factors as the product of two binomials.

2.5 Factoring by Grouping

- Tic-Tac-Toe Method
  - Uses a table to organize factoring a quadratic.
  - Factor out any GCF of the entire expression first.
  - Find ac and its factors that add up to b

$$(m * n = ac \; and \; m + n = b)$$

2.5 Factoring by Grouping

- Organize the terms in the table:

- Find the GCF of each column and row.
- The sum of the top row GCFs is one factor, and the sum of the first column GCFs is the other.

2.5 Factoring by Grouping

- Cubic Expression
  - Some polynomials of a degree greater than 2 can be factored.
  - Factoring by Grouping should be used when there are 4 terms in the polynomial.
  - Always factor out any GCF from the entire expression first.

2.5 Factoring by Grouping

- This method is similar to Reverse FOIL.
  - Group consecutive pairs of terms when the polynomial is written in standard form.
  - Factor out a GCF from each pair.
  - Use the distributive property.

2.6 Factoring Special Cases

- Objective
  - I will be able to factor perfect square trinomials and the difference of two squares.
- Vocabulary

• Perfect-Square Trinomial	• Difference of Two Squares

2.6 Factoring Special Cases

- Factoring a perfect-square trinomial
  - A perfect-square trinomial is the result of squaring a binomial.
  - For every real number a and b,
    - $a^2 + 2ab + b^2 = (a + b)^2$
    - $a^2 - 2ab + b^2 = (a - b)^2$

2.6 Factoring Special Cases

- How to recognize a perfect-square trinomial:
  - First and last terms are perfect squares
  - The middle term is twice the product of one factor from the first term and one factor from the second term.

2.6 Factoring Special Cases

- Factoring the difference of two squares
  - The difference of two squares is the subtraction of one perfect square from another.
  - For every real number a and b,

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

2.6 Factoring Special Cases

- Summary of Factoring Polynomials
  - Factor out the GCF
  - If the polynomial has two terms or three terms, look for a difference of two squares, a perfect-square trinomial, or a pair of binomial factors.
  - If the polynomial has four or more terms, group terms and factor to find common binomial factors.
  - As a final check, make sure there are no common factors other than 1.