Sections 7.1, 7.2:
Sums, differences, products of polynomials

# CHAPTER 7: POLYNOMIALS

## Quiz results

- Average 73%: high score 100%
- Problems:
  - Keeping track of negative signs
    - — x — = +
    - — ÷ — = +
  - Function notation
    - f(x) ~ y: the result of the input
    - x is the input
- Retakes can be done up to 11 AM Oct. 11

## Sum

- The result of adding
- The sum of two positive values is a positive
- The sum of two negative values is a negative
- When the values are different signs
  - Find the difference
  - Use the sign of the one with the larger absolute value

## Difference

- Subtraction
- Needs to be done in order from left to right
- Subtract a negative value is the same as adding a positive
- Suggest you change signs of terms that are subtracted and use adding rules

## Product

- The result of multiplication of factors
- Product of two positives is positive
- Product of two negatives is positive
- If signs are opposite, the product is negative

## Term

- A constant, a variable or a product of a constant and one or more variable factors
- Terms are separated from one another by addition
- Subtraction in an expression or equation needs to be interpreted as adding a negative term:
- Change its sign and use adding rules.

## Monomial

- Single term
- May be product of a constant and one or more variables
- Variables may be raised to powers (exponents)
- Absence of a numeric constant implies the constant is 1

## Polynomial

- Monomial or sum of monomial terms
- Named by number of terms
  - Binomial: 2
  - Trinomial: 2

## Polynomial degree

- The greatest exponents in any term
- Add up the values of the exponents in each term
  - $4x^3y^2+2x^2y^2+9xy^3$
  - $1^{st}$ term: $5^{th}$ degree
  - $2^{nd}$ term: $4^{th}$ degree
  - $3^{rd}$ term: $4^{th}$ degree
- Fifth degree polynomial

## Terms are made of factors

- Numeric factor: Coefficient
- Variable factors represented by letters

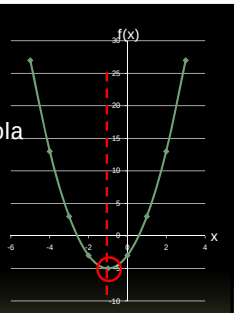
## "Like Terms"

- Have exactly the same variable set
- Combine the coefficients (numeric factors) by addition
- Recall that the term has a sign
  - Positive
  - Negative
  - Combine by addition rules

## Quadratic expression or function

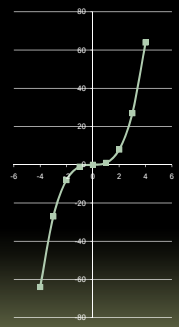
- Second degree polynomial
- $f(x) = 2x^2 + 4x - 3$
- Recall f(x) is the function, equivalent to the output
- x is the input: example x=3
- $f(3) = 2(3)^2 + 4(3) - 3 = 2(9) +12 - 3 = 27$

## Quadratic function




- Graph is called a parabola
- Vertex:
  - this has minimum value
- Axis of symmetry
- Some open downward
  - Have maximum value

## Cubic function



- Graph is a serpentine shape
- May have horizontal line that crosses graph in more than one place

## Adding functions

- $f(x) = \quad 2x^2 + 4x - 3$
- $g(x) = -3x^2 + 9x - 7$
- $(f+g)(x) = 2x^2 + 4x - 3 - 3x^2 + 9x - 7$
- Add like terms: watch the signs!!
- Do it vertical, not on one line
- $\quad 2x^2 + 4x - 3$
- $+ \; -x^2 + 9x - 7$
- $\quad -x^2 + 13x - 10$

## Subtracting functions

- $f(x) = \quad 2x^2 + 4x - 3$
- $g(x) = -3x^2 + 9x - 7$
- $(f-g)(x) = 2x^2 + 4x - 3 - (-3x^2 + 9x - 7)$
- Change every sign of function being subtracted!! Then add, watching signs
- Do it vertical, not on one line
- $\quad 2x^2 + 4x - 3$
- $+ \; +3x^2 - 9x + 7$
- $\quad 5x^2 - 5x + 4$

## Multiplying monomials (finding products)

- Multiply numeric coefficients
- Combine exponents on like variables
  - $x^2 \cdot x^3 =$
  - Write factors without exponents to 'see' what the exponent means
  - $x \cdot x \cdot x \cdot x \cdot x = x^5$

## Multiplying polynomial by monomial

- $2(3+5) = 2(8) = 16$, right?
- "Distribute" multiplication over addition
- $2(3) + 2(5) = 6 + 10 = 16$, same thing
- $2x(3x^2 + 5x) = 6x^3 + 10x^2$
  - same thing with variables,
  - just now terms are not 'like' so you cannot combine them

## Product of binomials

- (2+3)(2+5)=(5)(7)=35
- Multiply second factor by each term of first factor, then distribute
- (2+3)(2+5)=2(2+5)+3(2+5)=14+21=35
- With variables: (x+3)(x+5)=
- x(x+5)+3(x+5)=
- $x^2$+5x+3x+15=
- Combine like terms: $x^2$+8x+15

## Product of binomials

- F.O.I.L. method
- Label terms
  - Firsts, Lasts, Outsides, Insides
  - F L F L
- (x+3)(x+5)
  - O I I O
- Multiply: draw line, write product, draw, write…
  - Firsts $x^2$
  - Outsides +5x
  - Insides +3x
  - Lasts +15
- Combine like terms: $x^2$+8x+15

## Products of higher degree polynomials

- Be very methodical
- Draw line for the product of two terms
- Write the product of those terms
- Draw another line for product of terms
- Write the product of those two terms
- Etc: DO NOT DRAW ALL THE LINES AND GO BACK TO FIND THE PRODUCTS!!
- YOU WILL GET LOST!!