5.0 - 5.1 Notes

An Introduction to Polynomials

Vocabulary

Monomial - one term

Ex: $5x^3$

Constant - a number (no variable)

Ex: 3 or -2

Polynomial - more than one term

Ex: $x^2 + 2x + 7 - 3x^4$

More Vocabulary

The monomials that make up a polynomial are called the terms of the polynomial.

In the polynomial $x^2 + 2x + x + 4$, the monomials 2*x* and *x* can be combined because they are like terms. The result is $x^2 + 3x + 4$.

The polynomial $x^2 + 3x + 4$ is a trinomial because it has 3 unlike terms.

A polynomial such as $5y^3 + y^2$ is a binomial because it has 2 unlike terms.

The degree of a polynomial is the degree of the monomial with the greatest degree. For example, the degree of $x^2 + 3x + 4$ is 2 and the degree of $5y^3 + y^2$ is 3.

Monomials	Not Monomials
x , 2	$\sqrt{x}$ → no variables under radicals
$2x^4$, $\sqrt{3}x$	$\frac{1}{x}$ → no variables in denominators
$\frac{x}{3}$, $3x^2$	x^{-2} → no negative exponents

Example 1: Which of the following are polynomials? If it's a polynomial, state the degree.

a) $x^2 - 6x + 2x^3 + 3$

yes; deg = 3

b) $x^6 - 4x^3 - \frac{2}{x^3}$

No

c) $(2x-8)(x-4)^3$

$(2x-8)(x-4)(x-4)(x-4)$

$(2x-8)(x^3 + \cdots)$

$2x^4 + \cdots$

yes, deg = 4

d) $3 - \sqrt{x}$

No

Classifying Polynomials: We classify polynomials by the **number of terms** and the **degree**. Complete the chart below.

Polynomial Example	Degree	Name using Degree	Number of Terms	Name using Number of Terms
6	0	Constant	1	monomial
$x+3$	1	Linear	2	binomial
$3x^2$	2	Quadratic	1	monomial
$2x^3-5x^2-2x$	3	Cubic	3	trinomial
x^4+3x^2	4	Quartic	2	binomial
$-2x^5+3x^2-x+4$	5	Quintic	4	polynomial of 4 terms

More Vocabulary

Standard Form - A polynomial is written in **standard form** when

- the terms are arranged by degree in descending number order
- all coefficients are real numbers
- all exponents are non-negative integers

Using the example $7x^3 + x - 2x^5 + 3$

In *standard form* this would be written as $-2x^5 + 7x^3 + x + 3$

The **leading term** is $-2x^5$

The **leading coefficient** is -2

The **degree** is 5

Example 2: Write each polynomial in standard form and fill in the blanks below.

a. $\frac{12x^2+9x}{3} = 4x^2+3x$

Standard form: $4x^2+3x$

Leading term: $4x^2$

Leading coefficient: 4

Degree: 2

Classify by degree: Quadratic

Classify by number of terms: Binomial

b. $5x^2-x^4+6x$

Standard form: $-x^4+5x^2+6x$

Leading term: $-x^4$

Leading coefficient: -1

Degree: 4

Classify by degree: Quartic

Classify by number of terms: Trinomial

Operations with Polynomials

Example 3: **Given** $f(x) = x^2 - 3x + 1$, $g(x) = 4x + 5$

Find $f(x)+g(x)$ **and** $f(x)-g(x)$

Addition $f(x)+g(x)$	Subtraction $f(x)-g(x)$
$(x^2-3x+1)+(4x+5)$	$(x^2-3x+1)-(4x+5)$
$x^2-3x+1+4x+5$	$x^2-3x+1-4x-5$
x^2+x+6	x^2-7x-4

Example 4: Given $\boxed{\begin{aligned} f(x) &= x^2 + 5x - 1 \\ g(x) &= 3x - 2 \end{aligned}}$

Find $f(x) \bullet g(x)$ and $f(x) \div g(x)$

Multiplication $f(x) \bullet g(x)$	Division $f(x) \div g(x) = \frac{f(x)}{g(x)}$
$(x^2+5x-1)(3x-2)$ $(3x-2)(x^2+5x-1)$ $3x^3+15x^2-3x$ $-2x^2-10x+2$ $+$ $3x^3+13x^2-13x+2$	$\frac{x^2+5x-1}{3x-2}$

Example 5: Given

$$f(x) = 4x + 2$$
$$g(x) = 4x - 1$$

Find the following.

Addition

$f(x) + g(x)$

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

$4x+2+4x-1$

$8x+1$

Subtraction

$f(x) - g(x)$

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

$4x+2-4x+1$

3

Multiplication

$f(x) \cdot g(x)$

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

$16x^2 - 4x + 8x - 2$

$16x^2 + 4x - 2$

Division

$f(x) \div g(x) = \frac{f(x)}{g(x)}$

$\frac{4x+2}{4x-1}$

Example 6: Given $f(x) = -x^2 + 2x + 5$ → Type in Y1

Find $f(2)$

$= -(2)^2 + 2(2) + 5$

$-4 + 4 + 5$

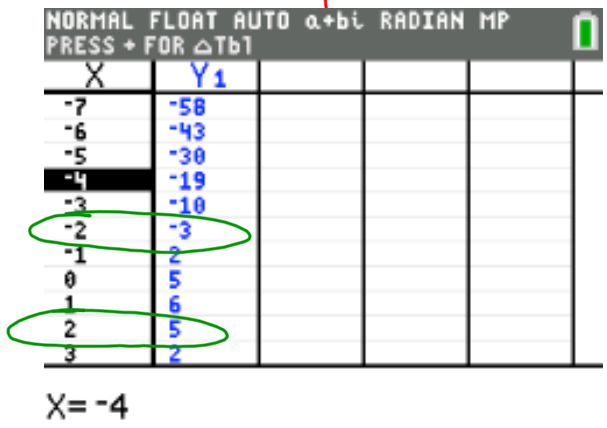
5

Find $f(-2)$

$-(-2)^2 + 2(-2) + 5$

$-4 - 4 + 5$

-3



Homework: 5.0 - 5.1 worksheet (1 - 9, 21 - 24)

Below are two problems from the HW worksheet.