Polynomials

- A **POLYNOMIAL** is the monomial or the sum of monomials with
  - > all exponents as whole numbers and
  - > coefficients are all real numbers.

Examples or NonExamples?

$f(x) = -0.5x + \pi x^2 - \sqrt{2}$

$f(x) = x^3 + 3x$

$f(x) = 6x^4 - 2x^{-1} + x$

$f(x) = x^4 + 3x - 2x^2 - 5^x$

Polynomials should be written in STANDARD FORM

Ordered from left to right in descending degree of each term.

A polynomial's DEGREE is the largest exponent of the polynomial. It determines the polynomial's number of zeros.

Other Vocabulary

Leading Coefficient (LC) - Coefficient of term with greatest degree. (Line leader when in standard form.)

Constant - Value with a no variable.

Naming Polys by TERM and DEGREE

# of Terms	Name	Degree	Name
1	monomial	0	constant
2	binomial	1	linear
3	trinomial	2	quadratic
Bigger	poly with # terms	3	cubic
		4	quartic
		5	quintic

a. $2x^2 - 4 - 3x^4 + 12x^3$

Standard Form: $-3x^4 + 12x^3 + 2x^2 - 4$

Degree: 4

Leading Coefficient: -3

Constant: -4

b. $3 - x$

Standard Form: $-x + 3$

Degree: 1

Leading Coefficient: -1

Constant: 3

Polynomial	# of Terms	Name by #	DEGREE	Name by
12	1	Monomial	0	Constant
8x	1	Monomial	1	Linear
$4x^2 + 3$	2	Binomial	2	Quadratic
$5x^3 + x^2$	2	Binomial	3	Cubic
$3x^2 - 4x + 6$	3	Trinomial	2	Quadratic
$7t^4 - 7t + 3$	3	Trinomial	4	Quartic

Operations with Polynomials

- For + : Combine like terms
- For - : Distribute the - and then CLT.
- For *: Use the distributive property and then CLT.

When CLT, the degree doesn't change, but the coeffiecients are combined. $5x^2 + 2x^2 = 7x^2$

When you multiply terms, add exponents of like variables and multiply coefficients. $2x^1(x^2 + 2x^1 - 1) = 2x^3 + 4y^2 - 2x$

1) $(4y^3 - 5y^2) + (12y^5 - 2y^3 + 14y^2)$

$12y^5 + 2y^3 + 9y^2$

2) $(3y^5 + 8y^3 - 10y^2) - (-12y^5 + 4y^3 + 14y^2)$

$3y^5 + 8y^3 - 10y^2$
$+12y^5 - 4y^3 - 14y^2$
$15y^5 + 4y^3 - 24y^2$

3) $(-7n^2 + 8n - 4) - (-11n + 2 - 14n^2)$

$-7n^2 + 8n - 4$
$14n^2 + 11n - 2$
$7n^2 + 19n - 6$

4) $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

$6k^4 - 10k^2 + 7k$
$-4k^4 \quad -14k - 14$
$2k^4 - 10k^2 - 7k - 14$

More Practice

Functions and Relations

- Relation: Any set of input that has an output.
- Function: A relation such that every single input has exactly one output.
  - **~~Never~~ The x's don't repeat **

Function Notation:

- Function notation is a way to represent "y." F(x). It is pronounced "f of x".
- f(x) is a fancy way of writing y in an Functim
  - Example: y = 2x + 4 is the same as F(x) = 2x+4

$f(x) = 6x^2 - 3x + 5$ $\quad g(x) = 4x^2 + 5x - 8$

1) $g(x) - f(x)$

$g - f$

$(g - f)(x)$

$4x^2 + 5x - 8 - (6x^2 - 3x + 5)$

$4x^2 + 5x - 8 - 6x^2 + 3x - 5$

$-2x^2 + 8x - 13$

2. Given the functions $f(x)=6x^2-x+3$ and $g(x)=x^2+3x$
Find $2f(x)+3g(x)$

$2(6x^2-x+3)+3(x^2+3x)$
$12x^2-2x+6$
$3x^2+9x$
$15x^2+7x+6$

3. Given the functions $f(x)=2x-4$ and $g(x)=x^2-3$
Find $2g(x)\cdot f(x)$

$2(x^2-3)(2x-4)$
$(2x^2-6)(2x-4)$
$4x^3-8x^2-12x+24$

Given the functions $f(x)=4x^2-2x+5$ and $g(x)=x^2+7x-8$

4. Find $f(x)+g(x)$

$4x^2-2x+5$
x^2+7x-8
$5x^2+5x-3$

5. Find $4g(x)-f(x)$

$4x^2+28x-32$
$-4x^2+2x-5$
$30x-37$

Given $f(x)=5x^2-9x+2$ $g(x)=x^2+3x-8$ $h(x)=-2x^2+1$ and $k(x)=4x-3$

13. Find $3f(x)\cdot h(x)$

$(15x^2-27x+6)(-2x^2+1)$
$-30x^4+15x^3+54x^3-27x$
$-12x^2+6$
$-30x^4+54x^3+3x^2-27x+6$

6. Find $4f(x)+3g(x)$
7. Find $h(x)-f(x)$
8. Find $h(x)\cdot k(x)$
9. Find $h(3)+g(-4)$
10. Find $5f(x)+7a(x)$
12. Find $h(2)-f(-1)$

14. Fill in Pascal's Triangle

Pascal's

$(x+1)^0=1$
$(x+1)^1=x+1$
$(x+1)^2=x^2+2x+1$
$(x+1)^3=x^3+3x^2+3x+1$
$(x+1)^4=x^4+4x^3+6x^2+4x+1$

15. $(x+2)^6$

$(x+2)^6=1x^6+6x^5+15x^4+20x^3+15x^2+6x+1$
1st term: x
2nd term: 2
$n=6$ (exp)
$k=0,1,2,3,4,5,6$
$x^6+12x^5+60x^4+160x^3+240x^2+192x+64$

$(2x+1)^3=(2x+1)(2x+1)(2x+1)$
$=(4x^2+2x+2x+1)(2x+1)$
$=(4x^2+4x+1)(2x+1)$
$=8x^3+4x^2+8x^2+4x+2x+1$
$=8x^3+12x^2+6x+1$

$1(2x)^3(1)^0+3(2x)^2(1)^1+3(2x)^1(1)^2+1(2x)^0(1)^3$

Extra Practice

1. $f(x) = 4x - 1 + 2x^4 + 10x^3$

standard form:

degree:

leading coefficient:

constant:

2. $h(x) = 2x - 5x^2 + 4$

standard form:

degree:

leading coefficient:

constant:

7. $-3x^2 + 2$

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

14. $(9a^2b + 5ab + 11a) + (-2a^2b + 4ab - 8a)$

Given the functions $f(x) = 3x^2 + 5x - 8$ and $g(x) = 2x^2 + 4x - 9$

4. Find $2f(x) - g(x)$

Given the functions $f(x) = 2x^2 + 3x - 5$ and $g(x) = x^2 + 5x$ and $h(x) = 3x^2$

10. Find $-2f(x) - 5g(x) + 7h(x)$