Polynomial Functions (5.1) **Math 98**

Graph the following functions on your graphing calculator and observe differences between polynomial and non-polynomial functions.

Polynomial Functions	**Non-polynomial Functions**
$f(x)=x^2+3x+5$	$g(x)=\lvert x-4\rvert$
$h(x)=4$	$i(x)=1+\sqrt{2x-5}$
$j(x)=-0.5x^4+5x-2.3$	$k(x)=\dfrac{x-7}{2x}$

Polynomial Definitions and Vocabulary

- A number or variable raised to a power or a product of numbers and variables raised to powers is a _________________.
- A ______________________ is one or more terms combined with addition and subtraction. The powers must be _______________________ ________________

- The _______________ of a term is the sum of the _______________

- The _____________________ of a term is the constant (or number) of the term.

- The _____________________ __________ of a polynomial is the term of highest degree. Its coefficient is the _____________________ _____________________.

- The _______________ of a polynomial is the degree of the ____________________ _______________ in the polynomial.

  Example:

- Types of polynomials (by number of terms):
  - A _________________________ is a polynomial with one term.
  - A _________________________ is a polynomial with two terms.
  - A _________________________ is a polynomial with three terms.

- Types of polynomials (by degree):
  - _____________________ if it has degree 0 or 1
  - _____________________ if it has degree 2
  - _____________________ if it has degree 3

- The order of a polynomial:
  - _____________________ _______________ is when the exponents of one variable ________________ from left to right in the polynomial.
  - _____________________ _______________ is when the exponents of one variable ________________ from left to right in the polynomial.

Example 1: For each polynomial, find the degree of each term, the degree of the polynomial, the leading term, and the leading coefficient.

a.) $3x^4 - 17x^2 + 2x - 5$

Term:

Degree:

Leading term:

Leading Coefficient:

Degree of the polynomial:

b.) $3x^3 - 5x^2y^3 - 8x^4y^2 + 4y^4 + 4x - 7$

Term:

Degree:

Leading term:

Leading Coefficient:

Degree of the polynomial:

Example 2: Arrange the polynomial $3x - 10x^4 + 8 - 3x^2 - 4x^3$ in both ascending and descending order.

Ascending:

Descending:

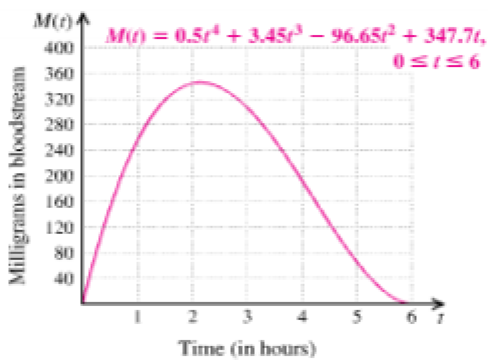
A ______________________ ________________ has the form $P(x) = a_n x^n + a_{n-1}x^{n-1} + ... + a_2 x^2 + a_1 x + a_0$ where each a_i is a constant and *n* is a non-negative integer.

Example 3: Find $P(-3)$ for $P(x) = -x^2 - 5x + 2$ by hand, evaluating with the calculator, using the table, and by looking at the graph.

Example 4: Ibuprofen is a medication used to relieve pain. We can estimate the number of milligrams of ibuprofen in the bloodstream *t* hours after 400 mg of medication has been swallowed with the polynomial function $M(t) = 0.5t^4 + 3.45t^3 - 96.65t^2 + 347.7t,\ 0 \le t \le 6$.

a.) How many milligrams of ibuprofen are in the bloodstream 2 hours after 400 mg has been swallowed?

b.) Use the graph to find and interpret $M(4)$



Fact about polynomials: The domain of the previous example was limited to six hours because of the application. However, the *domain* of every polynomial is ______________________ (provided there aren't restrictions added on).

Example 5: Find the domain and range of the following polynomials

a.) $f(x) = x^3 - 3x^2 + 6$

Domain:

Range:

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

Domain:

Range:

Example 6: Combine like terms

a.) $3t^2 - 4t - 4t^2 - 3t + 8$

b.) $5x^2y - 6xy^2 + 2x^2y^2 + 9xy^2 - 9x^2y$

Example 7: Add or subtract polynomials

a.) $\left(2x^3 - 4x^2 + 5\right) + \left(3x^3 - 5x - 3\right)$

b.) $\left(4s^3 - 7s^2 + 3s + 8\right) + \left(-3s^3 - 2s^2 - 5s + 2\right)$

c.) $\left(4x^2y - 7xy + 3y\right) + \left(x^2y - 2xy - 7y\right)$

d.) $\left(3t^2 - 4t - 8\right) - \left(t^2 + 2t - 5\right)$

e.) $\left(-4r^3 + 3r - 7\right) - \left(3r^2 - 5r + 4\right)$

f.) $\left(4x^2y - 7xy + 3y\right) - \left(x^2y - 2xy - 7y\right)$