Honors Algebra 2
5.3 Polynomial Functions
5.4 Analyzing Graphs of Polynomial Functions

Polynomial Function: A monomial or a sum of monomials.

Written in the form: $f(x) =$

The exponents are whole numbers and the coefficients are real numbers.

Example: Polynomial or not? Explain:

$f(x) = 3x^2 + 2x - 10$	$f(x) = x^{\frac{1}{2}} - 4ix - 10$	$f(x) = -2x^{10} + \sqrt{\pi}\, x^7 + 4x - 1$

Degree: The ____________________ exponent (____________________) of the variable x.

* The degree indicates the number of ____________________ for the polynomial (real & imaginary)*

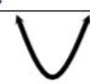
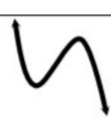
Leading Coefficient: The coefficient of the term with the ________________________ exponent.

Example:

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

Degree: **Leading Coefficient:** **Total Number of Zeros:**

End Behavior: the direction the graph goes as $x \to -\infty$ (x approaches negative infinity) and as $x \to +\infty$ (x approaches positive infinity)

	Odd Degree	Even Degree
Positive Leading Coefficient	Example: $2x^3$  $x \to +\infty,\ f(x) \to$ ________ $x \to -\infty,\ f(x) \to$ ________	Example: $2x^2$  $x \to +\infty,\ f(x) \to$ ________ $x \to -\infty,\ f(x) \to$ ________
Negative Leading Coefficient	Example: $-2x^3$  $x \to +\infty,\ f(x) \to$ ________ $x \to -\infty,\ f(x) \to$ ________	Example: $-2x^2$  $x \to +\infty,\ f(x) \to$ ________ $x \to -\infty,\ f(x) \to$ ________
	If the degree is ODD, then the tails go in opposite directions.	**If the degree is EVEN, then the tails go in the same direction.**

EXAMPLES:
State End Behavior

3] $f(x) = \boxed{3x^4} + 2x^2 - 1$

$x \to +\infty,\ f(x) \to$ ________

$x \to -\infty,\ f(x) \to$ ________

4] $f(x) = \boxed{-x^5} + 3x^4 - 2x^3 - 4x - 1$

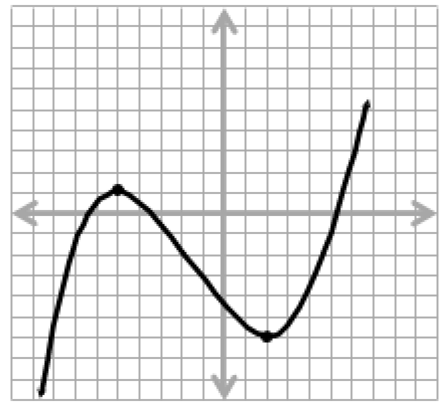
$x \to +\infty,\ f(x) \to$ ________

$x \to -\infty,\ f(x) \to$ ________

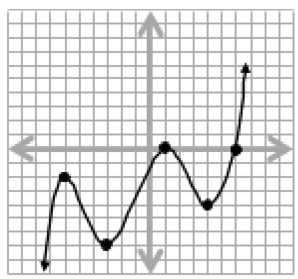
Relative (Local) Maximum: The turning point of the function that is higher than all nearby points

Relative (Local) Minimum: The turning point of the function that is lower than all nearby points

List all **relative extrema** (maxima/minima) as **<u>ordered pairs</u>**
Real Zeros: Will also be the x-values of the x-intercepts



1.
Degree: Odd Even



Leading Coeff. sign:

______

Relative Maxima:

____

Relative Minima:

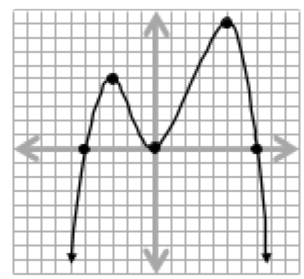
____

Real zeros: __________________

End Behavior:

Domain: __________ Range: ___________

2.
Degree: Odd Even



Leading Coeff. sign:

______

Relative Maxima:

____

Relative Minima:

____

Real zeros: __________________

End Behavior:

Domain: __________ Range: ___________

3. $f(x) = -x^3 + 2x^2 + 15x + 2$

Degree:________

Leading Coefficient Value: _______

Total Number of Zeros: __________

End Behavior:

Domain: __________

4. $f(x) = 2x^4 - 3x^3 - 2x^2 + 7x + 1$

Degree:________

Leading Coefficient Value: _______

Total Number of Zeros: __________

End Behavior:

Domain: __________

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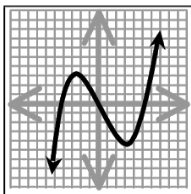
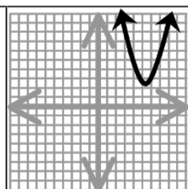
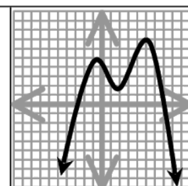
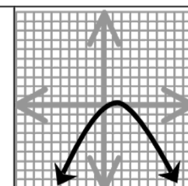
Real Zeros: Real zeros exist when the graph ________________________ the x-axis.

Imaginary Zeros: Imaginary zeros exist when the graph _____________________ touch the x-axis

Double Zeros: Occur when the graph __________________________ the x-axis then turns away.

Polynomial of Least Degree: The smallest degree of a polynomial that will fit the given graph or zeros.

Example: State the types of zeros contained in the following polynomials of least degree.

A polynomial function is in **Standard Form** if its terms are written in descending order of ___________________ from left to right.

Example: Decide whether the function is a polynomial function. If so, write it in **standard form** and state its **degree,** and **leading coefficient**.

1. $f(x) = x^4 - \frac{1}{4}x^7 + 2$

2. $f(x) = x^3 - 0.3x^{-1}$

3. $f(x) = 7x - \sqrt{3} + \pi x^2$

4. $f(x) = x + 2^x$