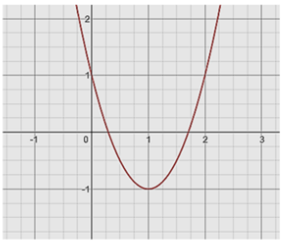
Warm-Up

WRITING A QUADRATIC EQUATION GIVEN THE GRAPH



Vertex (h, k):

Vertex Form:

MAKE AN INFERENCE

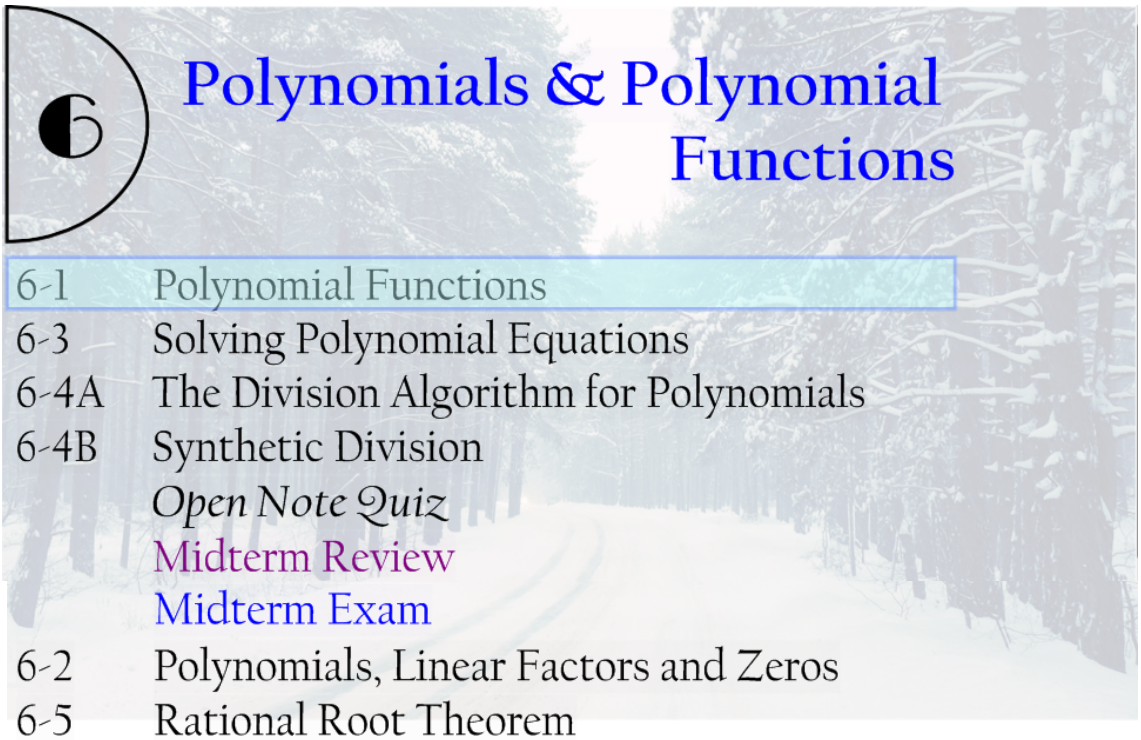
Should the value of a be positive or negative?

Second Point (x, y):

Plug in and solve for a:

h	
k	
a	

Final Equation:



6 Polynomials & Polynomial Functions

LESSON 6-1
Characteristics of Polynomials

Homework
pg. 285-7 #9-30 (multiples of 3), 45, 61

Learning Objective:
To classify a polynomial by degree & terms.
To determine "distinguishing" behaviors of a polynomial.

Language Objective:
To compare & contrast polynomial graphs.
To discuss how the graph of a polynomial function relates to its equation.

A key feature of the graph of a polynomial function is its distinguishing "behavior" as x approaches $-\infty$ or $+\infty$. I can look at the equation of a polynomial to determine this feature.

Left behavior: Does the value of y increase or decrease as x decreases ($-\infty$)?

Right behavior: Does the value of y increase or decrease as x increases ($+\infty$)?

A monomial is a real number, a variable, or a product of a real number and one or more variables with whole-number exponents.

A polynomial is a monomial or a sum of monomials.

The degree of a polynomial function is the greatest exponent among its monomial terms.

The leading coefficient of a polynomial function is the coefficient of the monomial term with the greatest exponent.

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x^1 + a_0$$

(a_n: leading coefficient; n: degree)

Classification

You can classify polynomials by degree & number of terms.

Example	Degree	Number of Terms	Name (By Degree)	Name (By Number of Terms)
$P(x) = 4x^3 - 2x + x$				
$P(x) = x + 4$				
$P(x) = 2x^4 + 5x^2$				
$P(x) = 4x^2$				
$P(x) = -x^5 + 4x^2 + 2x + 1$				

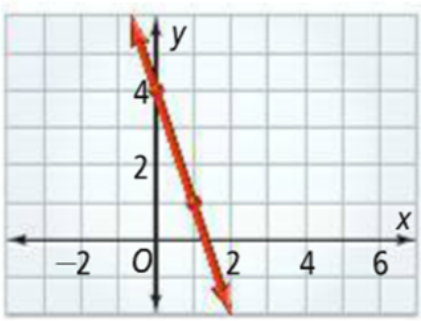
Structure

$$P(x) = ax^n + \ldots$$

The leading coefficient & degree provides information about a polynomial function's
(1) End behavior
(2) Maximum number of x-intercepts
(3) Maximum number of turning points

Write the equation and make a quick sketch of the graph then identify with your group;
(1) degree
(2) leading coefficent
(3) number of x-intercepts,
(4) number of turning points,
(5) whether the function is increasing or decreasing on each side of the graph.

$$y = -3x + 4$$



Write the equation and make a quick sketch of the graph
then identify with your group;

(1) degree
(2) leading coefficent
(3) number of x-intercepts,
(4) number of turning points,
(5) whether the function is increasing or decreasing on each side of the graph.

$y = -x^2 + 2x$

Write the equation and make a quick sketch of the graph
then identify with your group;

(1) degree
(2) leading coefficent
(3) number of x-intercepts,
(4) number of turning points,
(5) whether the function is increasing or decreasing on each side of the graph.

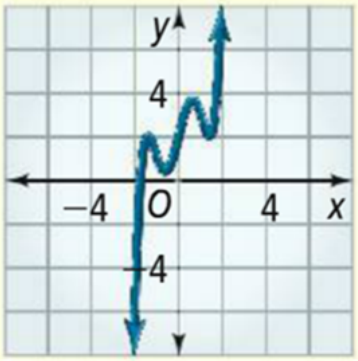
$y = -x^3 + 2x$

Write the equation and make a quick sketch of the graph
then identify with your group;
(1) degree
(2) leading coefficent
(3) number of x-intercepts,
(4) number of turning points,
(5) whether the function is increasing or decreasing on each side of the graph.

$$y = 4x^4 + 6x^3 - x$$

Write the equation and make a quick sketch of the graph
then identify with your group;
(1) degree
(2) leading coefficent
(3) number of x-intercepts,
(4) number of turning points,
(5) whether the function is increasing or decreasing on each side of the graph.

$$y = x^5 - 4x^3 + 4x + 2$$



Quick Discuss!

With a partner, .

Make a prediction.

How does the degree help us predict some of these behaviors?
How does the value of the lead coefficient help us predict some of these behaviors?

(1) End behavior
(2) Maximum number of x-intercepts
(3) Maximum number of turning points

Summary

END BEHAVIOR

can be determined by leading coefficient & degree	***n is even*** $n \neq 0$				***n is odd***			
***a** positive*	L		R		L		R	
***a** negative*	L		R		L		R	

TURNING POINTS

The maximum number of ***turning points*** is always _____ _____ than the ***degree*** of the polynomial.

SOLUTIONS

The maximum number of ***solutions*** (also known as the _____, _____, or _____) is always _____ ___ or _____ _____ the ***degree*** of the polynomial.

Lesson Check

Do you know HOW?

Classify each polynomial by degree and by number of terms.

1. $5x^3$

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

Write each polynomial in standard form.

3. $7x + 3 + 5x^2$

4. $-3 + 9x$

Do you UNDERSTAND? MATHEMATICAL PRACTICES

5. Vocabulary Describe the end behavior of the graph of $y = -2x^7 - 8x$.

6. Reasoning Can the graph of a polynomial function be a straight line? If so, give an example.