IM 9–12 MATH v.1

Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 8

End Behavior (Part 1)

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Let's investigate the shape of polynomials.

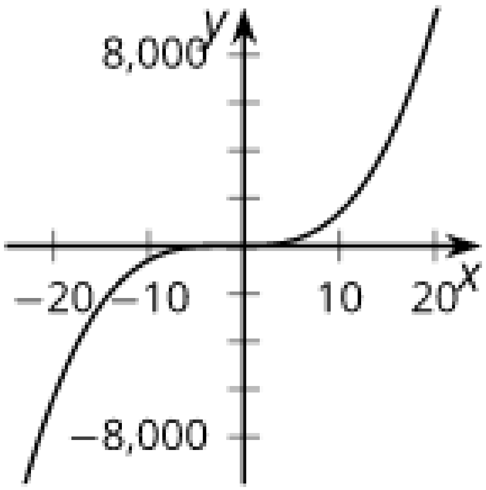
Algebra 2

A Different View

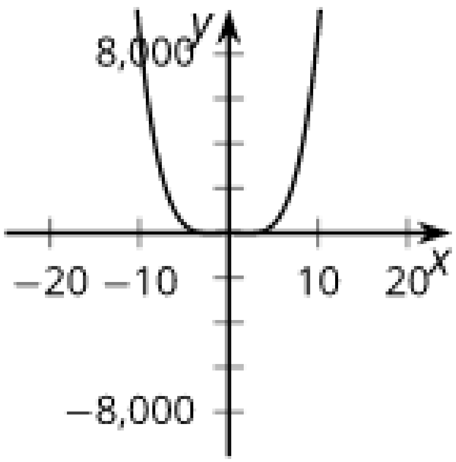
Warm-up: Notice and Wonder

What do you notice? What do you wonder?

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



$$y = x^4 - 10x^2 + 9$$



Polynomial End Behavior

x	$y=x^2+1$	$y=x^3+1$	$y=x^4+1$	$y=x^5+1$
-1000				
-100				
-10				
-1				
1				
10				
100				
1000				

1. For your assigned polynomial, complete the column for the different values of *x*. Discuss with your group what you notice.
2. Sketch what you think the **end behavior** of your polynomial looks like, then check your work using graphing technology.

Two Polynomial Equations

$$y = (x+1)\left(x^2-4\right)(x-5)(2x+3)$$

Consider the polynomial $y = 2x^5 - 5x^4 - 30x^3 + 5x^2 + 88x + 60$.

1. Identify the degree of the polynomial.
2. Which of the 6 terms, $2x^5$, $5x^4$, $30x^3$, $5x^2$, $88x$, or 60, is greatest when:
   a. $x = 0$
   b. $x = 1$
   c. $x = 3$
   d. $x = 5$
3. Describe the end behavior of the polynomial.

End Behavior (Part 1)

Lesson Synthesis

Stand up to play a game. Wiggle your arms and do some stretches.

1. A series of polynomial equations will be displayed one at a time.
2. After an equation is displayed, there will be a brief quiet think time to identify the end behavior. Give a hand signal when you are ready.
3. When you hear “Pose!” (or a different word chosen by the class), use your arms to show the end behavior of the function. For example, for $y = x^2$, you put both hands up in the air. For something like $y = x^3$, you have your left arm down and your right arm up.

I understand why a function's end behavior is determined by its leading term.

Learning Targets

Algebra 2

Identifying End Behavior

Cool-down

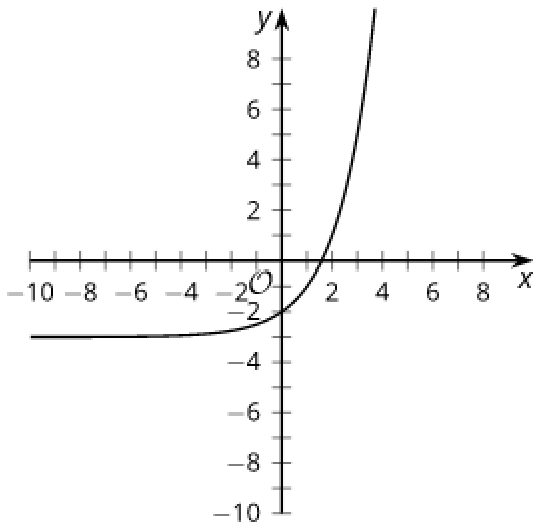
State the degree and end behavior of the following polynomial function:

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

Explain or show your reasoning.

end behavior

How the outputs of a function change as we look at input values further and further from 0.



This function shows different end behavior in the positive and negative directions. In the positive direction the values get larger and larger. In the negative direction the values get closer and closer to -3.