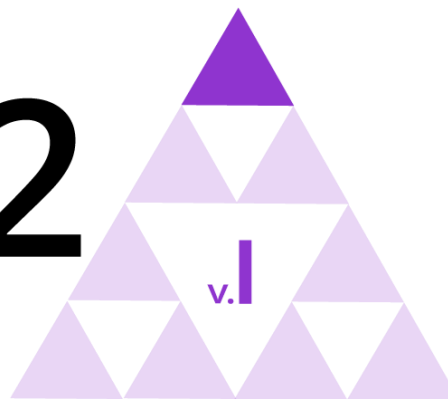


IM 9–12 MATH



Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 10

Multiplicity

Learning Goal

Let's sketch some polynomial functions.

Algebra 2

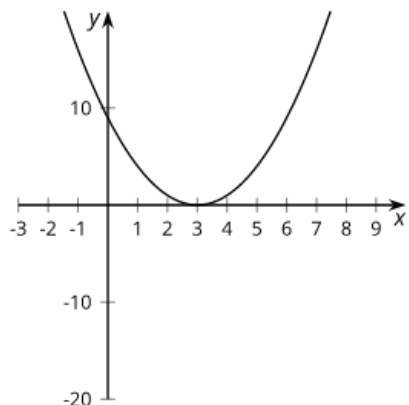
Duplicate Factors



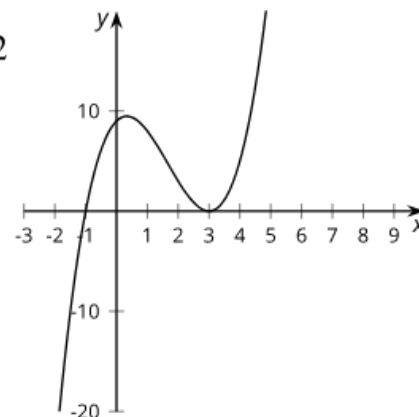
Warm-up: Notice and Wonder

What do you notice? What do you wonder?

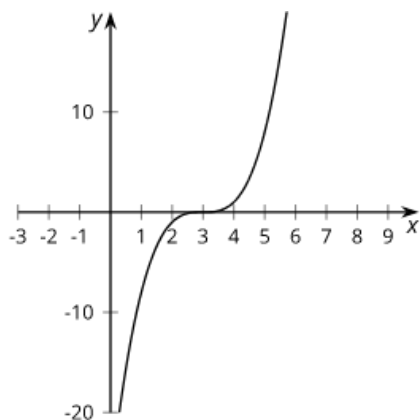
$$y = (x - 3)^2$$



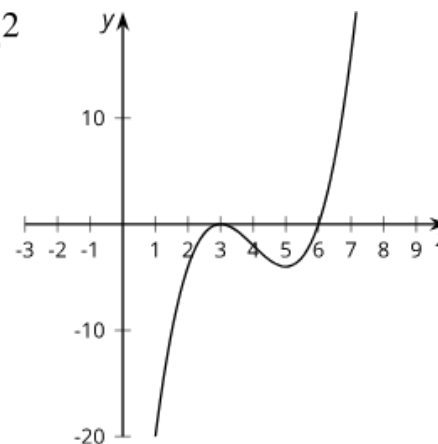
$$y = (x + 1)(x - 3)^2$$



$$y = (x - 3)^3$$



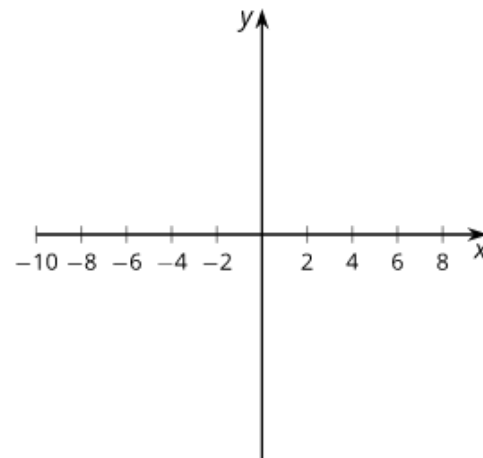
$$y = (x - 6)(x - 3)^2$$



Sketching Polynomials



$$f(x) = (x + 9)(x + 3)(x - 4)^2$$



1. For polynomials A – F :
 - a. Write the degree, all zeros, and complete the sentence about the end behavior.
 - b. Sketch a possible graph.
 - c. Check your sketch using graphing technology.

Pause here for your teacher to check your work.

1. Create your own polynomial for your partner to figure out.
 - a. Create a polynomial with degree greater than 2 and less than 8 and write the equation in the space given.
 - b. Trade papers with a partner, then fill out the information about their polynomial and complete a sketch.
 - c. Trade papers back. Check your partner's sketch using graphing technology.

Sketching Polynomials



$$A(x) = (x + 2)(x - 2)(x - 8)$$

$$B(x) = -(x + 2)(x - 2)^2$$

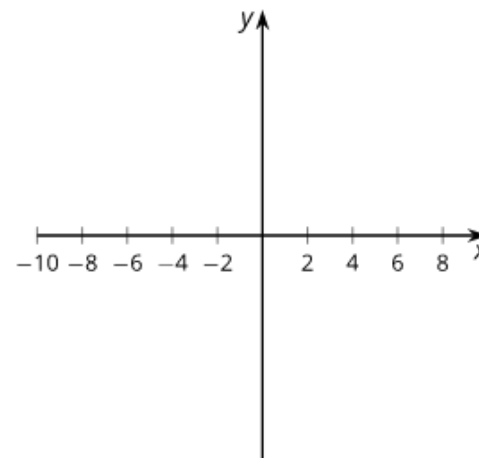
$$C(x) = (x + 6)(x + 2)^2$$

$$D(x) = -(x + 6)^2(x + 2)$$

$$E(x) = (x + 4)(x - 2)^3$$

$$F(x) = x^3(x + 4)(x - 3)^2$$

Your Polynomial

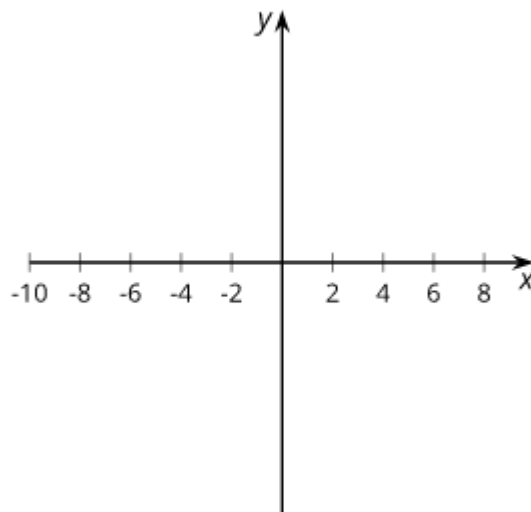


Degrees: Zeros:
End behavior: As x gets larger and larger in the negative direction.

Using Knowledge of Zeros



1. Sketch a graph for a polynomial function $y = f(x)$ that has 3 different zeros and $f(x) \geq 0$ for all values of x .
2. What is the smallest degree the polynomial could have?
3. What is a possible equation for the polynomial? Use graphing technology to see if your equation matches your sketch.





- If you have a 4th degree polynomial with only 3 unique factors, what must be true about the multiplicity of the factors?
- If you changed which of your factors had a multiplicity of 2, how would the end behavior of your graph change?
- What is one number you could change in your equation that would result in a graph with different end behavior?

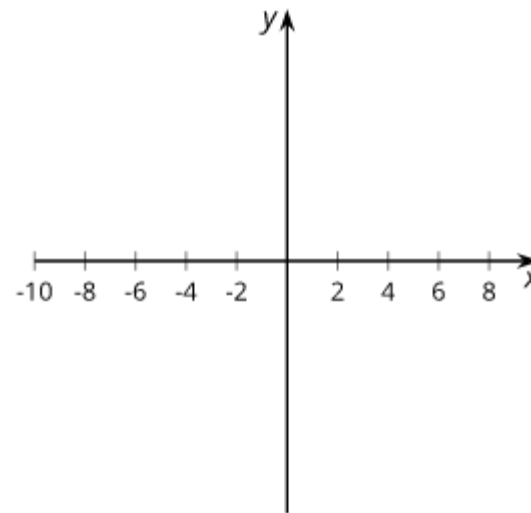
I can use zeros and multiplicities to sketch a graph of a polynomial.

Learning Targets

Algebra 2

Use the information provided to sketch a possible graph for the polynomial function described on the provided axis.

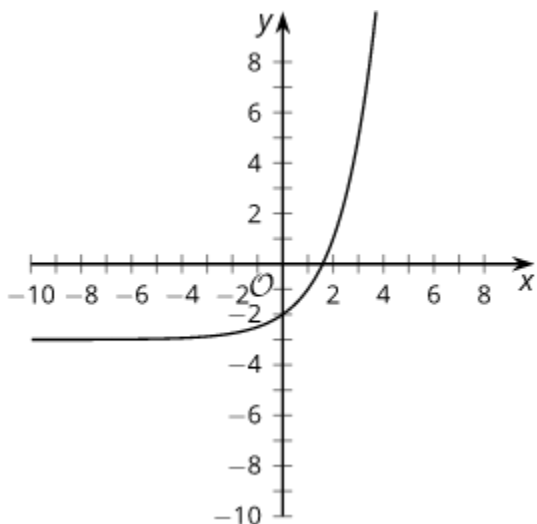
- Degree: 4
- Zeros: -3, 4, 6
- End behavior: As x gets larger and larger in either the positive or the negative direction, y gets larger and larger in the negative direction.





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.



multiplicity

The power to which a factor occurs in the factored form of a polynomial. For example, in the polynomial $(x - 1)^2(x + 3)$, the factor $x - 1$ has multiplicity 2 and the factor $x + 3$ has multiplicity 1.



This slide deck is copyright 2020 by Kendall Hunt Publishing, <https://im.kendallhunt.com/>, and is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0), <https://creativecommons.org/licenses/by-nc/4.0/>. This slide deck is copyright 2020 by Kendall Hunt Publishing, <https://im.kendallhunt.com/>, and is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0), <https://creativecommons.org/licenses/by-nc/4.0/>.

All curriculum excerpts are under the following licenses:

IM 9–12 Math is copyright 2019 by Illustrative Mathematics. It is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

This material includes public domain images or openly licensed images that are copyrighted by their respective owners. Openly licensed images remain under the terms of their respective licenses. See the image attribution section for more information.

The Illustrative Mathematics name and logo are not subject to the Creative Commons license and may not be used without the prior and express written consent of Illustrative Mathematics.