IM 9–12 MATH v.1

Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 6

Different Forms

Illustrative Mathematics®

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Learning Goal

Let's use the different forms of polynomials to learn about them.

Algebra 2

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Small Differences

Warm-up: Which One Doesn't Belong?

Which one doesn't belong?

A. $y = (x + 4)(x - 6)$

B. $y = 2x^2 - 8x - 24$

C. $y = x^2 + 5x - 25$

D. $y = x^3 + 3x^2 - 10x - 24$

The Return of the Box

Earlier, we learned we can make a box from a piece of paper by cutting squares of side length x from each corner and then folding up the sides. Let's say we now have a piece of paper that is 8.5 inches by 14 inches. The volume V, in cubic inches, of the box is a function of the side length x where $V(x) = (14 - 2x)(8.5 - 2x)(x)$.

1. Identify the degree and leading term of the polynomial. Explain or show your reasoning.
2. Without graphing, what can you say about the horizontal and vertical intercepts of the graph of V? Do these points make sense in this situation?

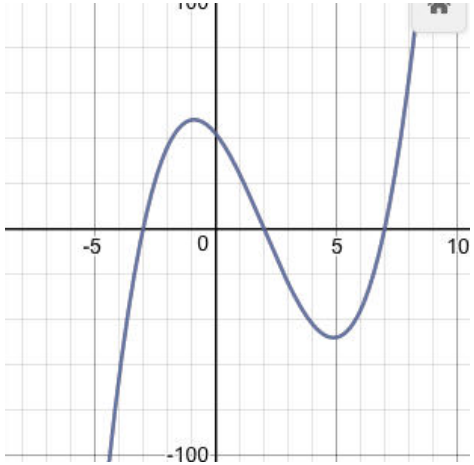
Using Diagrams to Multiply

1. Use the distributive property to show that each pair of expressions is equivalent.
   a. $(x+2)(x+4)$ and x^2+6x+8
   b. $(x+6)(x+-5)$ and x^2+x+30
   c. $(x^2+10x+7)(2x-1)$ and $2x^3+19x^2+4x-7$
   d. $(4x^3-8)(x^2+3)$ and $4x^5+12x^3-8x^2-24$
2. Write a pair of expressions that each have 2 or 3 terms, and trade them with your partner. Multiply the expressions they gave you.

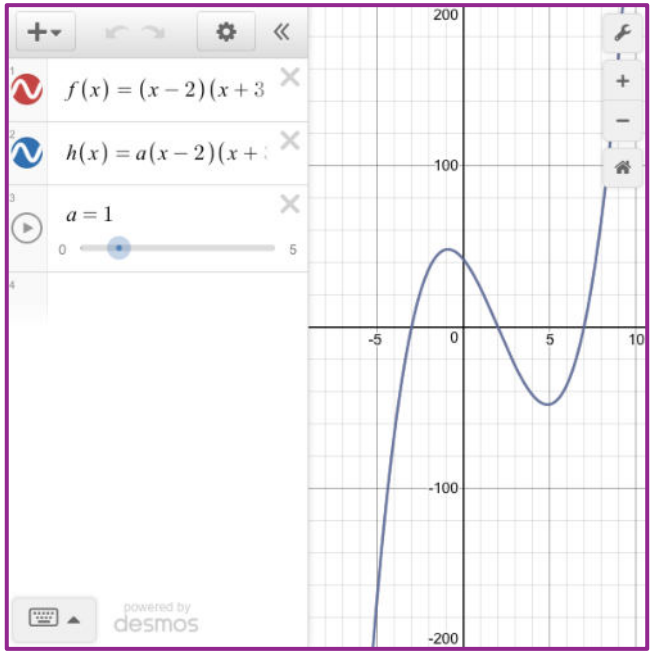
Spot the Differences

Let $f(x) = (x - 2)(x + 3)(x - 7)$ and $g(x) = \frac{1}{2}(x - 2)(x + 3)(x - 7)$.

1. Use the applet to explore both functions in the same window of $-10 \leq x \leq 10$ and $-100 \leq y \leq 100$. Describe how the two graphs are the same and how they are different.
2. What degree do these polynomials have? Rewrite each expression in standard form to check.
3. Let $h(x) = (3ix - 6)(x + 3)(x - 7)$. What do you think the graph of $y = h(x)$ will look like compared to $y = f(x)$? Use the applet to check your prediction.



Spot the Differences

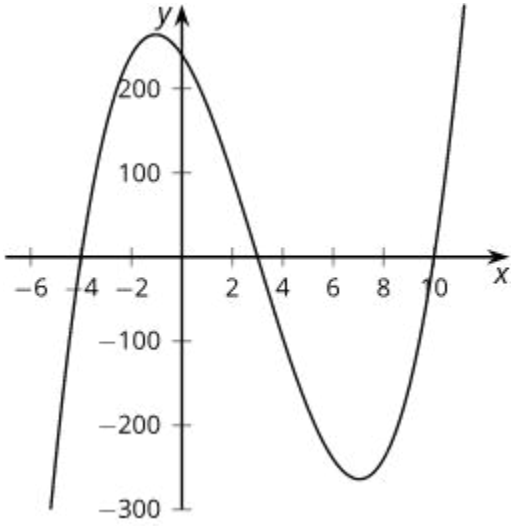


Different Forms

Lesson Synthesis

$f(x) = 2x^3 - 18x^2 - 44x + 240$

$f(x) = (x + 4)(2x - 6)(x - 10)$



- Where can you see the 240 in the factored form of the equation? In the graph?
- Which form do you think is better?
- Let's say $g(x)$ is a polynomial with the same zeros and degree as $f(x)$, but with a vertical intercept at (0, 120) instead of (0, 240). What could the equation for $g(x)$ be?

I can identify features of polynomials and their graphs using their standard and factored forms.

Learning Targets

Algebra 2

Identifying Polynomial Features

Cool-down

Let P be a polynomial where $P(x) = (x + 6)(x + 3)(x - 5)$.

1. Rewrite the polynomial in standard form.
2. Identify the degree and the constant term.