IM 9–12 MATH v.1

Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 12

Polynomial Division (Part 1)

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Let's learn a way to divide polynomials.

Algebra 2

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A Different Use for Diagrams

Warm-up: Notice and Wonder

What do you notice? What do you wonder?

A. $(x - 3)(x + 5) = x^2 + 5) = x^2 + 2x - 15$

	x	**5**
x	x^2	$5x$
-3	$-3x$	-15

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

	x^2	$3x$	**-4**
x	x^3	$3x^2$	$-4x$
-1	$-x^2$	$-3x$	+4

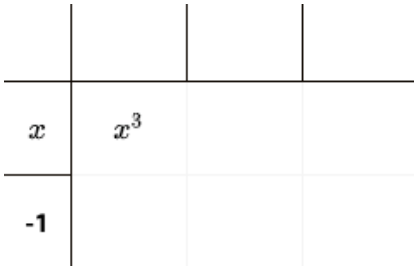
A. $(x - 2)(?) = (x^3 - x^2 - 4x + 4)$

x	x^3		
-2			

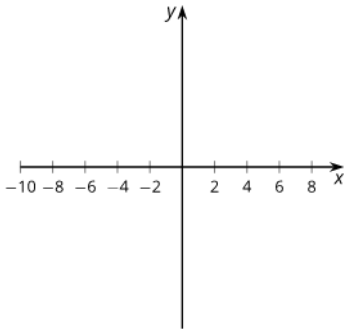
Factoring with Diagrams

Priya wants to sketch a graph of the polynomial f defined by $f(x) = x^3 + 5x^2 + 2x - 8$. She notices that the coefficients of the terms of $f(x)$ sum up to zero, which means that 1 is a zero of $f(x)$. Is she right? Be prepared to explain her reasoning.

Priya wants to sketch a graph of the polynomial f defined by $f(x) = x^3 + 5x^2 + 2x - 8$. She knows $f(1) = 0$, so she suspects that $(x - 1)$ could be a factor of $x^3 + 5x^2 + 2x - 8$ and writes $(x^3 + 5x^2 + 2x - 8) = x - 1)(?x^2 + ?x + ?)$ and draws a diagram.



1. Finish Priya's diagram.
2. Write $f(x)$ as the product of $(x - 1)$ and another factor.
3. Write $f(x)$ as the product of three linear factors.
4. Make a sketch of $y = f(x)$.



More Factoring with Diagrams

Here are some polynomial functions with known factors. Rewrite each polynomial as a product of linear factors. Note: you may not need to use all the columns in each diagram. For some problems, you may need to make another diagram.

1. $A(x) = x^3 - 7x^2 - 16x + 112, \ (x - 7)$

	x^2		
x	x^3	0	
-7	$-7x^2$		

2. $B(x) = 2x^3 - x^2 - 27x + 36, \ \left(x - \frac{3}{2}\right)$

	$2x^2$		
x	$2x^3$	$2x^2$	
$-\frac{3}{2}$	$-3x^2$		

3. $C(x) = x^3 - 3x^2 - 13x + 15, \ (x + 3)$

.

x			
3			

More Factoring with Diagrams

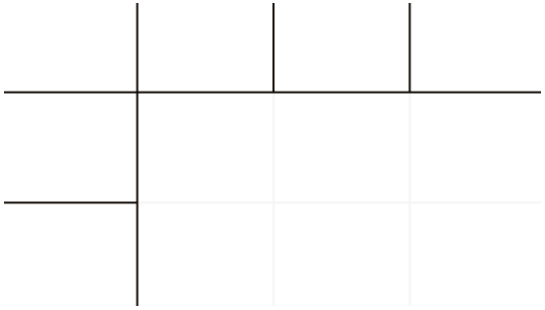
Here are some polynomial functions with known factors. Rewrite each polynomial as a product of linear factors. Note: you may not need to use all the columns in each diagram. For some problems, you may need to make another diagram.

4. $D(x) = x^4 - 13x^2 - 36, \ (x-2)(x+2)$

$\left(Hint: \ x^4 - 13x^2 + 36 = x^4 + 0x^3 - 13x^2 + 0x + 36\right)$

5.

$F(x) = 4x^4 - 15x^3 - 48x^2 + 109x + 30, \ (x-5)(x-2)(x+3)$



Polynomial Division (Part 1)

Lesson Synthesis

The polynomial $E(x) = -4x^2 - 17x - 15$ has a known linear factor of $(x + 3)$. Rewrite the quadratic as two linear factors.

I can divide one polynomial by another.

Learning Targets

Algebra 2

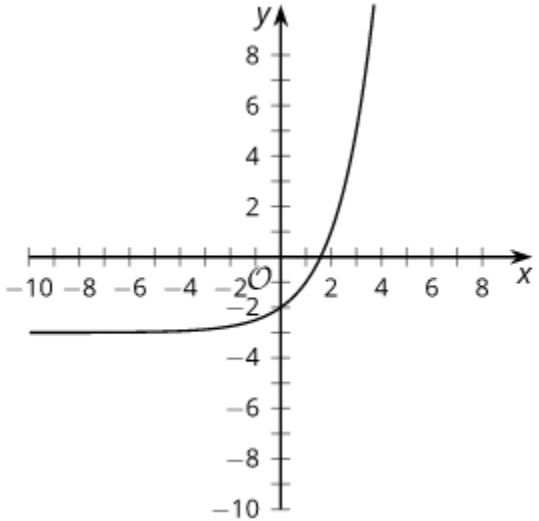
Find Some More Points

Cool-down

Find all points of intersection between the graphs of the functions $f(x) = (x + 5)(x - 4)$ and $g(x) = x + 5$.

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.