Pre-AP Algebra 2
Unit 7 - Lesson 6 – Polynomial Division

Objectives: Students will be able to:
- divide polynomials using the long division algorithm

Materials: hw #7-5 answers overhead; quiz #2; special note-taking templates; pair work and answers overhead; hw #7-6

Time	Activity
5 min	**Homework Review** Show answer to hw #7-5 on the overhead. Pass around tally sheets.
10 min	**Homework Presentation** Review top 2 or 3 problems from tally sheets. Problems to grade: part 1 #3, part 2 #1, 3, 4, part 3
15 min	**Quiz**
25 min	**Direct Instruction** Hand out the special note-taking templates. **Lesson 6:** Polynomial Division **Section:** Polynomials and Exponents Work through the background information together. Make sure students understand the DMSB algorithm for long division. Whenever they get stuck on polynomial division, they should look back at a numerical example to help. The concepts are already written out to save time. Read the preparation step together, and then set up the first example. Take students through the first example carefully, pointing out the pitfalls (dividing only the first term, multiplying by the whole divisor, subtracting correctly). Repeat with the second problem, focusing on how to deal with the missing term properly.
25 min	**Pair Work** Hand out the pair work. Problems are grouped by difficulty level – students should pick the ones they want to work on. Put the answers on the overhead.
15 min	**Direct Instruction** Work through the back of the notes sheet. Students will learn synthetic division.

Homework #7-6: Polynomial Operations

Pre-AP Algebra 2 **Name: _____**
Pair Work

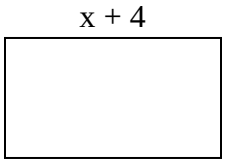
Dividing Polynomials

Pick your preferred level of dividing flavor!

Mild

1) $\left(x^2+2x+6\right)\div\left(x-3\right)$

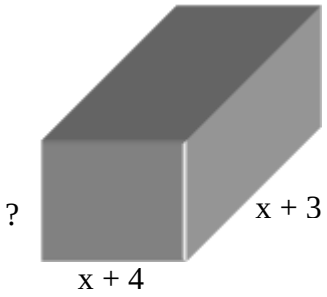
2) Find the length of the missing side.
The area equals $x^2 + 2x - 8$.



Spicy

1) $\left(4x^3-7x+8\right)\div\left(2x-1\right)$

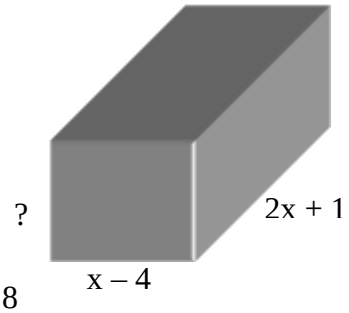
2) Find the missing dimension.
The volume equals $x^3 + 4x^2 - 9x - 36$

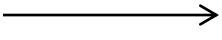


Habanero

1) $\left(2x^4+3x-1\right)\div\left(x^2+2x+1\right)$

2) Find the missing dimension.
The volume equals $2x^3 - 11x^2 + 10x + 8$





Ms. Nice's Super Atomic Salsa of Doom

1) $\left(x^3 - 2x^2 + 5x - 1\right) \div \left(3x + 2\right)$

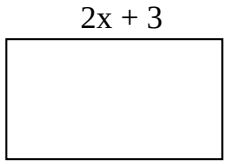
2) *You only get one. You can't handle two!*

Pre-AP Algebra 2 **Name: _____**
Homework #7-6

Hw #7-6: Polynomial Operations

Do all work on a separate sheet of paper. Write answers on this handout. Staple your work to the back.

1) Find the missing side if the area of the rectangle is $6x^2 - 5x - 21$:



2) $\frac{x^3-3x^2+2x-6}{x^2+3x-1} =$

3) $(x^4 - 3x^3 - 2x + 1) \div (x^2 + 1) =$
Don't forget to use 0's for placeholders.

4) $(4x^3 - 2x^2 + 1) \div (x + 2) =$

5) Divide $f(x) = 2x^4 + 7x^3 - 4x^2 - 27x - 18$ by $(x - 2)$

6) Fully factor $x^3 - 8x^2 + 5x + 14$, **given that** $(\boldsymbol{x - 2})$ is one of the factors.
Hint: if you know that one factor of 259 is 7, how do you find the other factor?

Bonus (+3 points): $\frac{2x^3-4x^2+3x+5}{4x^2+2x-1} =$

HW #7-5 Answers

Part 1:

1) $x^3 + 5x^2 - 16x - 80$

2) $x^4 - 5x^2 + 4$

3) $x^4 + 6x^2 - 27$

Part 2:

1) **a)** $x = -5, 0, 4$ **b)** _____

c) $x < -5$ or $0 < x < 4$

d) as $x \to +\infty$, $f(x) \to -\infty$

as $x \to -\infty$, $f(x) \to +\infty$

2) **a)** $x = \pm 4, -1.5$ **b)** _____

c) $-4 < x < -1.5$ or $x > 4$

d) as $x \to +\infty$, $f(x) \to +\infty$

as $x \to -\infty$, $f(x) \to -\infty$

3) **a)** $x = \pm 2, \pm 5$ **b)** _____

c) $(-\infty, -5) \cup (-2, 2) \cup (5, +\infty)$

d) as $x \to +\infty$, $f(x) \to +\infty$

as $x \to -\infty$, $f(x) \to +\infty$

4) **a)** $x = \pm 5/7$ **b)** _____

c) $x < -5/7$ or $x > 5/7$

d) as $x \to +\infty$, $f(x) \to +\infty$

as $x \to -\infty$, $f(x) \to +\infty$

5) $x = \pm 5, 2, -1 \pm i\sqrt{3}$ **(5 solutions)**

HW #7-5 Tally Sheet

Part 1:

1)

2)

3)

Part 2:

1) **a)** **b)**

c)

d)

2) **a)** **b)**

c)

d)

3) **a)** **b)**

c)

d)

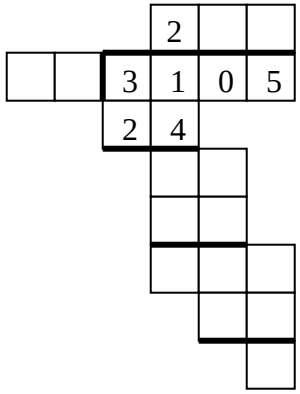
4) **a)** **b)**

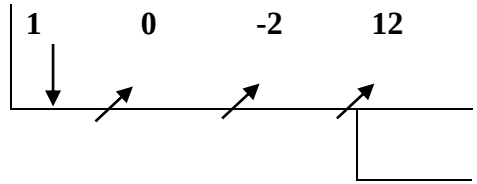
c)

d)

5)

Lesson Name: _____ **Date:** _____ **Student:** _____

Concepts	Examples	Background Information
How to Divide Polynomials **Prepare:** Write the problem in "long division form". That means you change $a \div b$ or $\frac{a}{b}$ into $b\overline{)a}$. Write the polynomials in standard form, and **put 0's as placeholders for any missing term in the divisor and dividend**. **Process:** 1) **D**ivide the **first term** of the dividend by the **first term** of the divisor. Line up the result **above the like term** in the dividend. 2) **M**ultiply the result of the division by the **entire** divisor. Write it below the dividend's first term. 3) **S**ubtract the **entire** product from the terms above it. Use parentheses! 4) **B**ring down the next term from the dividend. 5) Repeat **DMSB** until you are left with a remainder (or 0). Write the remainder as a fraction with the divisor as the denominator.	**Example 1:** $(x^3 - x^2 - x - 2) \div (x - 2)$ **Example 2:** $\frac{x^3 - 2x + 12}{x + 3}$	Remember long division? Fill in the digits to complete the problem:  What number is the - *dividend*? - *divisor?* - *quotient?* - *remainder*? Check that the result of your division is correct: How would the results be different if you changed 3105 to 315? Why?

Concepts	Examples
If $f(x)$ is divided by $\boldsymbol{x-k}$ we can use a shortcut called **synthetic division.** 1. Write the coefficients in order with 0's for any missing terms 2. Bring the leading coefficient down 3. Multiply the number by **k** and write it under the next coefficient 4. Add vertically 5. Repeat until down	**Example 3:** $\dfrac{x^3-2x+12}{x+3}$ **-3** **1** **0** **-2** **12**  **Example 4:** Divide $\boldsymbol{2x^3+9x^2+14x+5}$ **by** $\boldsymbol{x-3}$