5.5 Dividing Polynomials

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Objectives:

- Divide a polynomial by a monomial.
- Divide a polynomial by a polynomial of two or more terms.
- Divide polynomial functions.

Parts of a Division Problem

- There are three parts to a division problem: the **dividend**, the **divisor**, and the **quotient**.
- A division problem can be written three different ways:

$$\frac{dividend}{divisor} = quotient$$

$$(dividend) \div (divisor) = quotient$$

$$divisor\overline{)\,dividend}\quad quotient$$

Dividing a Polynomial by a Monomial

To divide a polynomial by a monomial, _____

_____,

and then write each quotient in _____.

- Divide.

$$(12m^6 + 18m^5 + 30m^4) \div 6m^2$$

Example 1

- Divide.

$$\frac{50m^4 - 30m^3 + 20m}{10m^3}$$

Example 2

- Divide.

$$(-8p^4 - 6p^3 - 12p^5) \div (-3p^3)$$

Example 3

- Divide.

$$\frac{45x^4y^3 + 30x^2y^2 - 60x^2y}{15x^2y}$$

Long Division

- Divide. $3{,}257 \div 12$

Divide: $(5x - 8 + 4x^3 - 4x^2) \div (2x - 1)$

- Step 1: Rewrite as a long division problem. Make sure that both polynomials are written in descending order, fill in any missing terms with a zero term.

- Step 2:
  a) Take the first term of the dividend and divide by the first term of the divisor:

Place this value above it's like term.

Dividing a Polynomial by a Polynomial

- Step 2:
  - b) Multiply the $2x^2$ by $2x - 1$ to get $1 = 4x^3 - 2x^2$. Place this value below the like terms.

$$2x-1\overline{)4x^3-4x^2+5x-8}\qquad 2x^2$$

  - c) Subtract.

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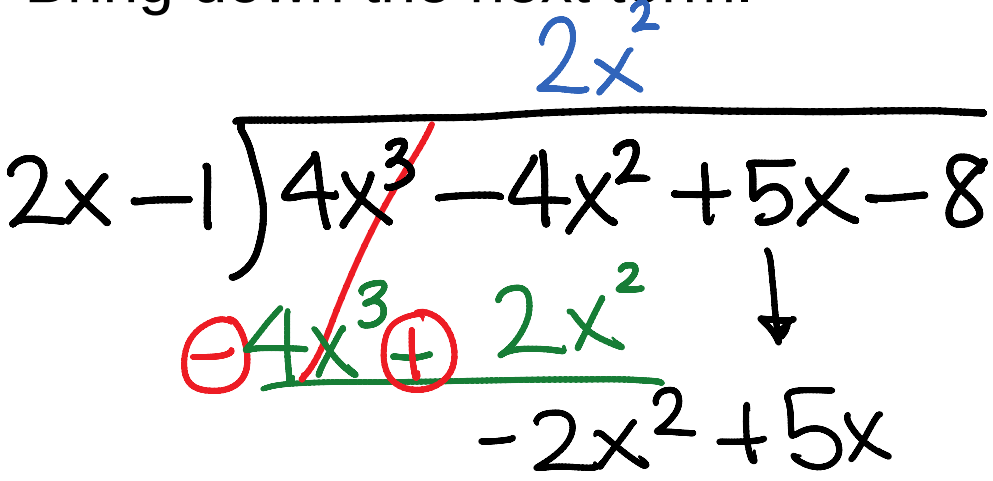
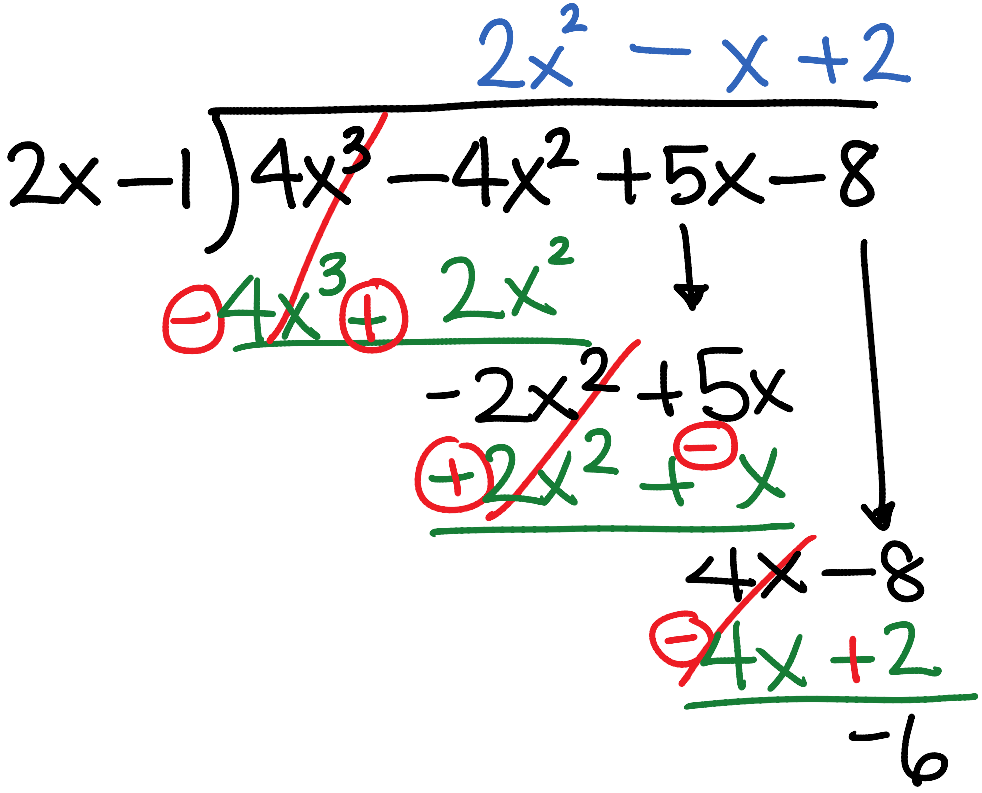
- Step 3: Bring down the next term.



- Step 4: Repeat steps 2 and 3 until you have brought down the last term.

Dividing a Polynomial by a Polynomial

- Step 5: State your answer. If there is a remainder, place the remainder over the divisor and add it to the quotient.



Dividing a Polynomial by a Polynomial

- Step 6: Check. Multiply the divisor by the quotient and add the remainder.

Dividing a Polynomial by a Polynomial

To divide a polynomial by a polynomial, follow the six steps outlined below.

- **Step 1**: Rewrite as a long division problem. Make sure that both polynomials are written in descending order, filling in any missing terms with a zero term.
- **Step 2**:
  a) Divide the first term of the dividend by the first term of the divisor. Place that quotient above it's like term.
  b) Multiply the quotient from part a by the divisor. Place that product below it's like term.
  c) Subtract.
- **Step 3**: Bring down the next term.
- **Step 4**: Repeat steps 2 and 3 until you have brought down the last term.
- **Step 5**: State your answer. If there is a remainder, place the remainder over the divisor and add it to the quotient.
- **Step 6**: Check. Multiply the divisor by the quotient and add the remainder.

Example 4

- Divide $8x^3 - 4x^2 - 14x + 15 \ \ by \ \ 2x + 3.$

Example 5

- Divide $\dfrac{2x^3 + 5x + x^2 + 13}{2x + 3}$

Example 6

- Divide $4x^3 + 3x - 8 \ \ by \ \ x + 2$
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Example 7

- Divide $\dfrac{6m^4 + 9m^3 + 2m^2 - 8m + 7}{3m^2 - 2}$

Example 8

- Divide $3x^3 + 7x^2 + 7x + 11 \ \ by \ \ 3x + 6$

Example 9

- For $f(x) = 2x^2 + 17x + 30$ and $g(x) = 2x + 5$, find $\left(\frac{f}{g}\right)(x)$ and $\left(\frac{f}{g}\right)(-1)$.