

MATH 1010 ~ Intermediate Algebra

Chapter 6: RATIONAL EXPRESSIONS,
EQUATIONS AND FUNCTIONSSection 6.5: **Dividing Polynomials**

Objectives:

- * Divide polynomials by monomials and simplify.
- * Use long division to divide polynomials by polynomials.

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

Divide by a monomial.

$$\begin{aligned} \text{a) } (x^3 + x - 2) \div x^3 &= \frac{x^3 + x - 2}{x^3} = \frac{x^3}{x^3} + \frac{x}{x^3} - \frac{2}{x^3} \\ &= 1 + \frac{1}{x^2} - \frac{2}{x^3} \end{aligned}$$

$$\begin{aligned} \text{b) } \frac{18x^4 - 24x^2}{-6x} &= \frac{\cancel{6x^2} (3x^2 - 4)}{\cancel{-6x}} \\ &= -x(3x^2 - 4), \quad x \neq 0 \end{aligned}$$

Divide by a binomial.

$$a) \frac{x^2 - 8x + 15}{x - 3} = x - 5$$

Long division!

$$\begin{array}{r}
 x-5 \\
 x-3 \overline{) x^2 - 8x + 15} \\
 \underline{+(x^2 + 3x)} \\
 -5x + 15 \\
 \underline{+(+5x + 15)} \\
 0
 \end{array}$$

$$\begin{array}{r}
 35 \\
 73 \overline{) 2561} \\
 \underline{-219} \\
 371 \\
 \underline{-365} \\
 6
 \end{array}$$

$$2561 \div 73 = 35 \frac{6}{73}$$

$$b) \frac{x^2 + 10x - 9}{x - 3} = x + 13 + \frac{30}{x - 3}$$

$$\begin{array}{r}
 x+13 \\
 x-3 \overline{) x^2 + 10x - 9} \\
 \underline{+(x^2 + 3x)} \\
 13x - 9 \\
 \underline{+(-13x + 39)} \\
 30
 \end{array}$$

$$c) \frac{4y^3 + 12y^2 + 7y - 3}{2y + 3} = 2y^2 + 3y - 1, y \neq -\frac{3}{2}$$

$$\begin{array}{r}
 2y+3 \overline{) 4y^3 + 12y^2 + 7y - 3} \\
 \underline{+ (-4y^3 + 6y^2)} \\
 6y^2 + 7y - 3 \\
 \underline{+ (-6y^2 + 9y)} \\
 -2y - 3 \\
 \underline{+ (+2y + 3)} \\
 0
 \end{array}$$

$$d) \frac{x^5 + 1}{x^2 + 1} = x^3 - x + \frac{x+1}{x^2+1}$$

$$\begin{array}{r}
 x^2+1 \overline{) x^5 + 0x^4 + 0x^3 + 0x^2 + 0x + 1} \\
 \underline{+ (-x^5 + x^3)} \\
 -x^3 + 0x^2 + 0x + 1 \\
 \underline{+ (+x^3 + x)} \\
 x + 1 \quad (\text{remainder})
 \end{array}$$

Perform this more complex division.

$$\frac{2x^3 + 2x^2 - 2x - 15}{2x^2 + 4x + 5} = x - 1 + \frac{-3x - 10}{2x^2 + 4x + 5}$$

$$\begin{array}{r}
 \overline{) 2x^3 + 2x^2 - 2x - 15} \\
 \underline{+ (-2x^3 + 4x^2 + 5x)} \\
 -2x^2 - 7x - 15 \\
 \underline{+ (+2x^2 + 4x + 5)} \\
 -3x - 10
 \end{array}$$