

## Section 4.4 notes

**Objective: Dividing rational expressions**

**Dividing Polynomials:** When you divide two polynomials, factor the top and bottom completely. Check to see if there are any factors in common. If there are, these factors cancel out. Otherwise, the fraction can't be simplified. (You can't cancel things that are being added or subtracted, only entire factors).

**Rational Function:** A function that has a polynomial in the numerator and in the denominator.

**Domain of a Rational Function: (Fraction):** The domain of a function is all the numbers that you can plug in for  $x$  that don't cause problems. Since we aren't allowed to divide by zero, anything that makes the denominator of a fraction equal to zero causes a problem.

- To find the domain of a rational function, solve the inequality "denominator  $\neq 0$ " for  $x$ .
  - The  $\neq$  sign works exactly like an equal sign. Your goal is to get  $x$  by itself.
  - Answers should look like this:  $\{x | x \neq 2, -3\}$ . The way you read this is "All  $x$ 's such that  $x$  is not equal to 2 or  $-3$ ." That's a fancy way of saying that you can plug in any  $x$  you want except for those two numbers.
  - Always find the domain *before* you simplify the fraction.

**Examples:** Find the domain of the following rational expressions.

a)  $\frac{2x+1}{x-3}$

$$x - 3 = 0$$

$$\begin{array}{r} \cancel{-3} \\ +3 \quad +3 \end{array}$$

$$\boxed{x \neq 3}$$

b)  $\frac{x+3}{7}$

$$7 = 0$$

no

$$\mathbb{R}$$

$$c) \frac{(2x+1)(x-4)}{(x+4)(2x+1)}$$

Domain  $x+4=0$   
 $\begin{array}{r} -4 \\ -4 \end{array}$   
 $x \neq -4$

$$2x+1 \neq 0$$

$$\begin{array}{r} -1 \\ -1 \end{array}$$

$$\frac{2x}{2} = \frac{-1}{2}$$

$$x \neq -\frac{1}{2}$$

$$d) \frac{5x+1}{(x-4)(3x+2)}$$

Domain

$$x-4=0$$

$$\begin{array}{r} +4 \\ +4 \end{array}$$

$$x \neq 4$$

$$3x+2=0$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

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

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

**Examples:** Simplify each rational expression. (Talk about domain.)

$$a) \frac{2x+1}{2x}$$

simplified

$$b) \frac{(x+2)}{(x+2)} = 1$$

$$c) \frac{\cancel{(x+2)}}{\cancel{(x+2)}(3x-1)}$$

$$\frac{1}{3x-1}$$

$$d) \frac{(4x+1)\cancel{(x-3)}}{\cancel{(x-3)}}$$

$$\frac{4x+1}{1}$$

$$e) \frac{(2x-7)(\cancel{3x+1})}{(\cancel{3x+1})(x-8)}$$

$$\frac{2x-7}{x-8}$$

$$f) \frac{\cancel{8}(x+4)}{\cancel{8}}$$

$$\boxed{x+4}$$