Get out lesson 4.2 from last time and take the next few minutes to finish it - it will be collected shortly.

Rational Function Summary (from 4.1 & 4.2)

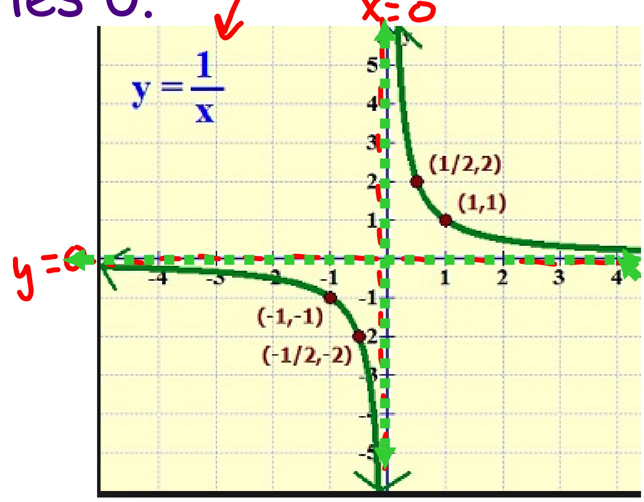
not rational $\frac{2x}{3x^0} = \frac{2}{3}x$

-Fraction with variable (polynomial) in denominator. $\frac{1}{x}$

-Asymptotes at x- and y-axes.

-End behavior approaches 0.

parent rational function



-No roots for 1/x.

-Domain: $\mathbb{R} - \{0\}$

$(-\infty, 0) \cup (0, \infty)$

-Range:

$\mathbb{R} - \{0\}$

$(-\infty, 0) \cup (0, \infty)$

$\frac{1}{x} \neq 0$

4.2 All in the Family

A Develop Understanding Task

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We have studied several families of functions over the past few years including linear, exponential, quadratic, logarithmic, square root, and polynomials in general. In this task, we will examine features of families of functions from our previous work and also look at the features of the functions we call rational functions.

Part I: Finding features. Use the table to describe the process you would use to find a given feature based on the function and then write how this feature can be found for any function.

1.	The process I use to **find roots** (x-intercept) for the following functions:	
Linear	Logarithmic	Polynomial (in factored form)
In general, you find the roots of a function by... setting y=0 and solving for x.		

2.	The process I use to determine **end behavior** for the following functions:	
Quadratic	Exponential	Polynomial
→ ∞ if a is + → −∞ if a is −	a^x $-a^x$	even or odd function
In general, you determine the end behavior of a function by... determining if leading coefficient is +/− and if function is even/odd (using generalized methods).		

3.	**Asymptotes** occur when...	
Logarithmic	Exponential	
	always x-axis unless shifted	↑ or ↓
In general, asymptotes of a function occur when... we have undefined x or y-values. And you can determine asymptotes by... determining undefined values (÷ing by 0)		

4.	The **Domain** of a function is...	
Square root	Logarithmic	Polynomial
[0,∞)		(−∞,∞)
In general, the domain of a function is... all of the x-values we can substitute into the function		

Part II: Characteristics of Rational Functions

In Birthday Gift we saw a rational function used to model the situation with Chile. Rational Functions are any function $f(x)$ such that $f(x) = \frac{P(x)}{Q(x)}$ where P and Q are polynomials in x and Q is not the zero polynomial. In other words a rational function is a ratio between two polynomials.

Below are examples of rational functions. Like other functions we have studied, rational functions come in different forms, with each form highlighting different aspects of the function.

$f(x) = \frac{1}{x}$ $\qquad f(x) = \frac{x}{x+3} + \frac{5}{x-2}$ $\qquad f(x) = \frac{x^2+5x-1}{x^4+3x^2-6}$ $\qquad f(x) = \frac{(x-3)(x+1)}{x(x-1)(x-4)}$

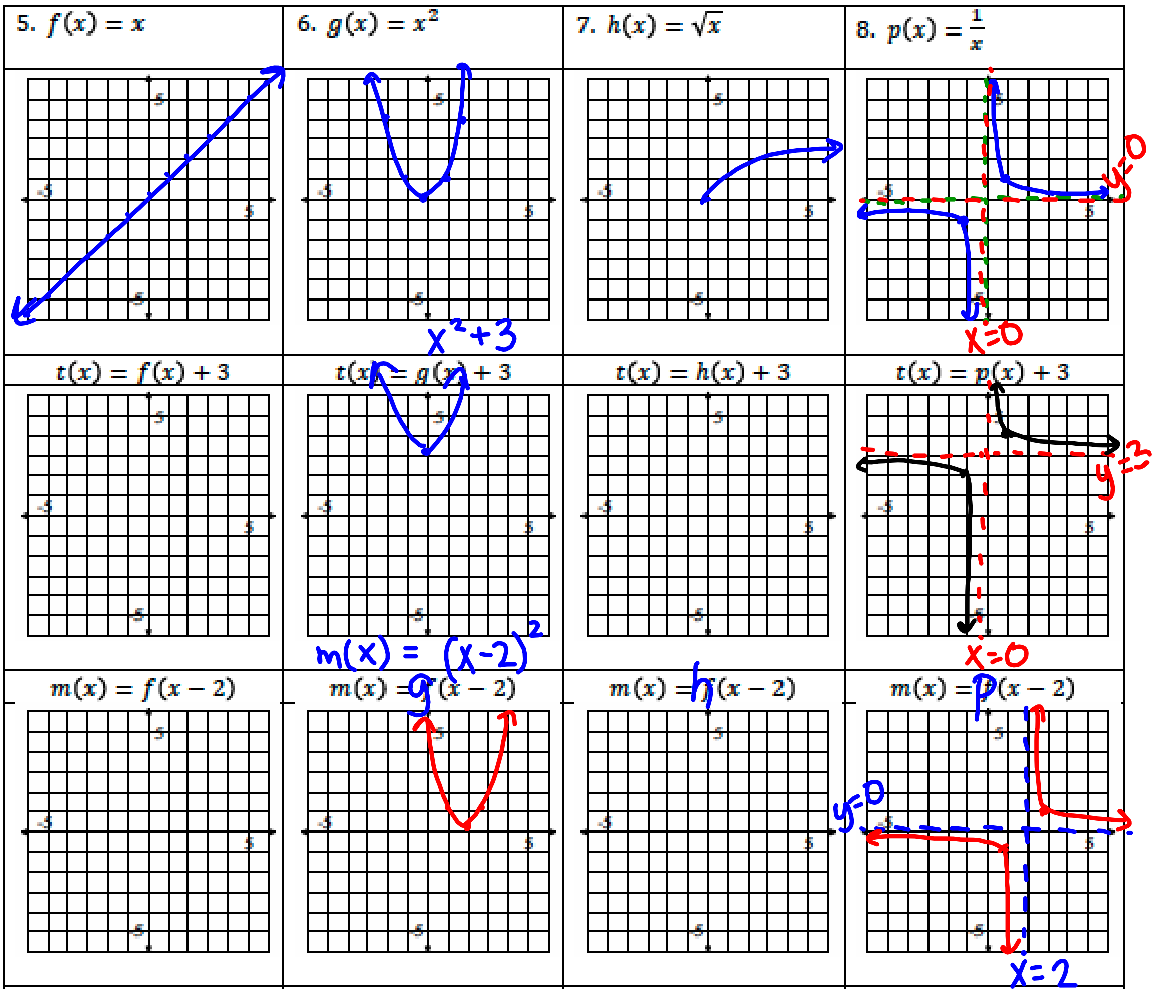
Based on other functions we have studied, make a conjecture as to how you would find the following features of a rational function.

5.

Conjecture as to how to determine each feature of a rational function:	Find the features of this function: $f(x) = \frac{(x-3)(x+1)}{x(x-1)(x-4)}$ = 0
To find roots... find where numerator is equal to 0	Roots: 0/whatever; numerator = 0; $x = 3, -1$
To determine end behavior... → 0 unless it's special	End Behavior: As $x \to \infty, f(x) \to 0$; As $x \to -\infty, f(x) \to 0$
To find asymptotes... look for where denominator = 0.	Asymptotes: $x = 0, 1, 4$ (vertical lines)

Part III: Parent Functions and transformations.

The linear, quadratic, square root, and rational parent function are below. Sketch a graph of the parent function and then sketch the graphs of "parents transformed". Use a table of values to assist you.



9. Each function type has characteristics that separate it from other families of functions, yet there are also connections to be made across families. Summarize this task by explaining how you see rational functions as different from other functions you have studied as well as by how they are similar to all functions.

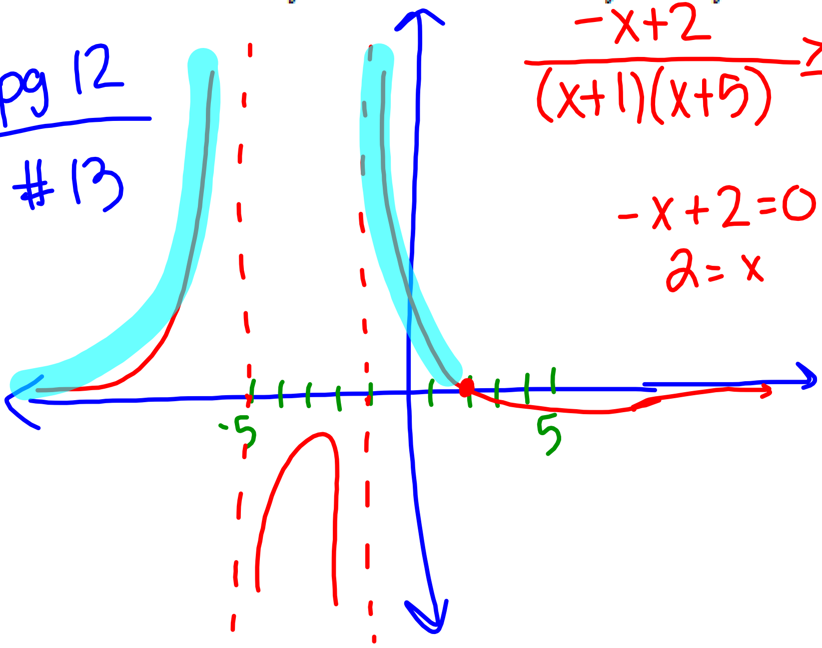
pg 12 #13

$\begin{cases} x < -5 \\ -1 < x \leq 2 \end{cases}$

$\frac{-x+2}{(x+1)(x+5)} \geq 0$

$-x+2=0$

$2 = x$



4.3 What Does it Mean to Be Rational?

A Solidify Understanding Task

Part I: Comparing rational numbers and rational fractions.

1. In your own words, define *rational number.*

   Circle the numbers below that are rational and refine your definition, if needed.

   $3 \quad -5 \quad \frac{2}{3} \quad \frac{20}{3} \quad 14 \quad 2.7 \quad \sqrt{5} \quad 2^3 \quad 3^{-3} \quad log_2 8 \quad \frac{7}{0}$

2. The definition of a *rational function* is as follows:

   A function $f(x)$ is called a rational function if and only if it can be written in the form $f(x) = \frac{P(x)}{Q(x)}$ where P and Q are polynomials in x and Q is not the zero polynomial.

   Interpret this meaning in your own words and then write three examples of rational functions.

3. How are rational numbers and rational functions similar? Different?

Part II: Arithmetic of Rational Expressions: making connections between rational numbers and rational expressions. Solve problems in the first column and then use the same process to simplify the rational expressions in the second column.

Arithmetic of rational numbers	Arithmetic of rational expressions
4a. $\frac{2}{3}+\frac{4}{7}$	4b. $\frac{3}{(x+1)}+\frac{4}{(x-1)}$

5a. $\frac{3}{8}+\frac{5}{6}$	5b. $\frac{2x}{(x+3)}+\frac{4x}{(x-1)(x+3)}$

6a. $\frac{7}{8}-\frac{1}{6}$	6b. $\frac{2x}{(x+3)}-\frac{4}{(x-1)}$

7a. $\frac{3}{8}\times\frac{5}{6}$	7b. $\frac{(x+1)(x-2)}{(x+2)}\times\frac{(x+5)}{(x-2)(x+2)}$

8a. $\frac{3}{8}\div\frac{5}{6}$	8b. $\frac{(x+1)(x-2)}{(x+2)}\div\frac{(x+5)}{(x-2)(x+2)}$

Feb 4-10:20 AM

9. To summarize, explain how you would perform the following arithmetic operations on rational expressions:

Adding:

Subtracting:

Multiplying:

Dividing:

Homework/Classwork

Finish the "Ready, Set, Go" pages that you have been given, #1-24, and anything else you have **not** finished from the 4.3 worksheets. Whatever is not finished in class is homework!

Oct 21-8:47 AM