

Exploring Rational Functions Class Work

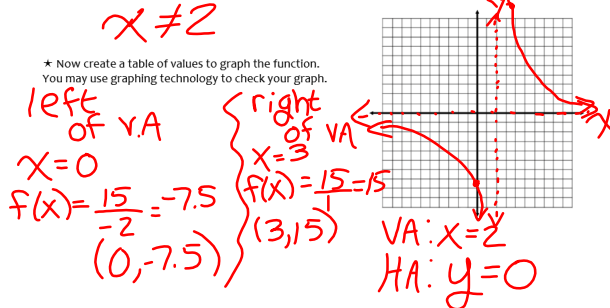
Objective: You will be able to describe the relationships between the equations for, graphs of, and domains of rational functions.

★ Definition: **Rational Function:** A rational function is any function that is written as a ratio (fraction).

WITH YOUR PARTNERS: Explore each rational function.

1. Consider the function $f(x) = \frac{15}{x-2}$.

★ Jot down any ideas you have about the function to start.



- There is a vertical line that the graph of this function approaches, but never actually reaches.

What is the equation of this vertical line? $x=2$

*We call this a **vertical asymptote**.

Considering the given equation and table of values, why does it make sense that the graph will not actually ever touch this line?

cannot divide by zero

- What is the domain of $f(x)$? (x-values) Left \Rightarrow right
 $(-\infty, 2) \cup (2, \infty)$

Function	Table of Values	Graph	Vertical Asymptote and Domain
2. $g(x) = \frac{9}{x+3}$	$x=-6, f(x) = \frac{9}{-3} = -3$ $(-6, -3)$ $x=0, f(x) = \frac{9}{3} = 3$ $(0, 3)$		VA: $x = -3$ HA: $y = 0$ $(-\infty, -3) \cup (-3, \infty)$
2. $c(x) = \frac{4}{x-2}$	$x=0, c(x) = \frac{4}{-2} = -2$ $(0, -2)$ $x=4, c(x) = \frac{4}{2} = 2$ $(4, 2)$		VA: $x = 2$ HA: $y = 0$ $(-\infty, 2) \cup (2, \infty)$
3. $h(x) = \frac{5}{x^2-9}$	$x=-6, f(x) = \frac{5}{27}$ $(x+3)(x-3)$ $x=6, f(x) = \frac{5}{27}$ $x=0, f(x) = -\frac{5}{9}$ $x=3, f(x) = \frac{5}{0} = -1$		VA: $x = 3$ $x = -3$ $(-\infty, -3) \cup (-3, 3)$ $\cup (3, \infty)$

*What makes $j(x)$ and $m(x)$ different from the rational functions above?!

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

simplified hole at $x=0$, $x=-1$
VA: $x=1$

$$m(x) = \frac{x-5}{x^2-4x-5} = \frac{x-5}{(x-5)(x+1)} = \frac{1}{x+1}$$

hole: when $x=5$
VA: $x=-1$

Simplify each function, and identify the vertical asymptotes and holes for each.

4. $y = \frac{2x^2-4}{x^2-3x-10}$

5. $y = \frac{x^2+5x-24}{x^2+9x+8}$

VA: the lines $x=5$ and $x=-2$
no holes

VA: the line $x=-1$
hole: when $x=-8$

Concept Map: *Understanding Rational Functions*

Complete the map in your own words.
Then create and include an example to illustrate the ideas you worked with today!

