DOINGWHATWORKS

SAMPLE MATERIAL

Lesson Objectives and Handouts: Finding Patterns Within Functions

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Topic: National Math Panel: Major Topics of School Algebra

Practice: Topics of Algebra

First, Julie Shively describes the objectives for her lessons on describing a graph of a function, understanding why functions behave as they do, and recognizing how the behavior of functions changes with changing a sign, a coefficient size, or a constant.

Following the lesson objectives are five student handouts that serve as worksheets for the lessons:

- Absolute Value Function Exploration
- Exponent Function Exploration Squares
- Rational Function Exploration
- Comparing Functions

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Lesson Objectives: Finding Patterns Within Functions

My goals for the lesson are first for the students to describe a basic functions graph. Second I want the students to understand why functions behave as they do, and to begin to recognize how the behavior of the function changes with changing a sign, a coefficient size or a constant.

I begin with a handout of four different basic functions (sometimes called a parent function), such as g(x) = \x+2\, and variations of the basic function, like h(x) = \x-2\, j(x) = \x\+2, and K(x) = \x\-2. The students create a table and then graph the function on their graphing white boards, after which they transfer the graph to the handout. Once they have completed the graphs, they then discuss with their partners or group what the patterns are that they observe, and they write the patterns and what conclusions they can make about the behavior of the graph, based on their observations.

After they write their observations and conclusions, I put the graphs on the overhead and the students compare theirs with mine, and we talk about what happened to the graphs. I want them to be able to, not only see that the graph moved vertically, but see what in the function caused it to do so. Why the graph transposed, why the graph is a parabola and why it is concave up or down.

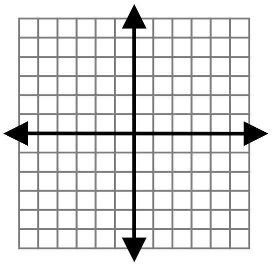
The students have the most trouble with negatives in the radical, and with functions that create asymptotes.

Absolute Value Function Exploration

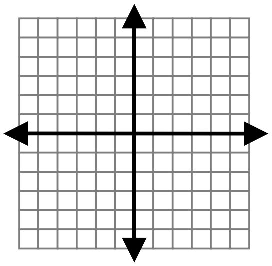
Name ____

With your table, create a function table using -3 to 3 as values for x. Next, graph each of the following functions on the white board with a grid. Then draw the graph on this paper.

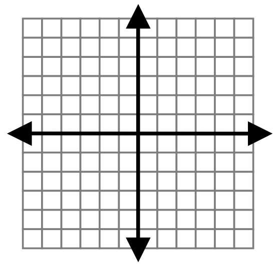
$g(x) = |x+2|$



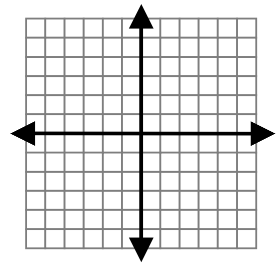
$h(x) = |x-2|$



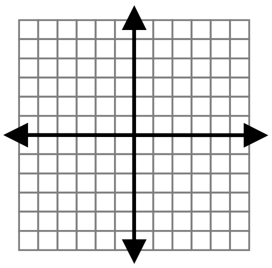
$j(x) = |x| + 2$



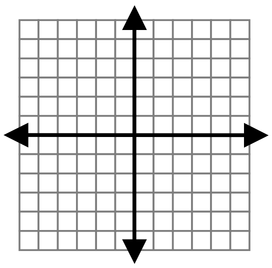
$k(x) = |x| - 2$



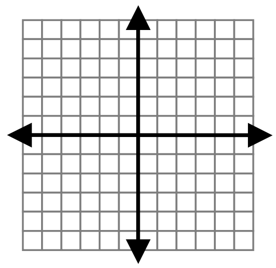
$m(x) = |x+5|$



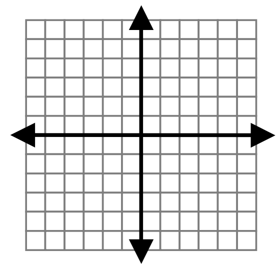
$n(x) = |x-5|$



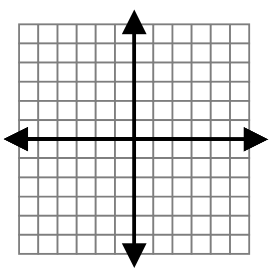
$p(x) = |x| + 5$



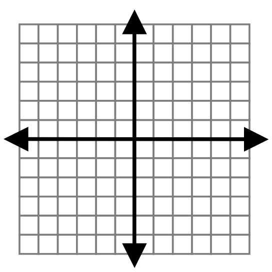
$r(x) = |x| - 5$



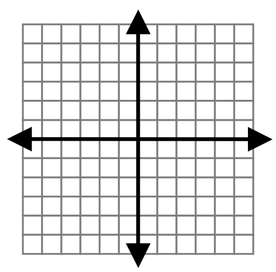
$t(x) = |x+3|$



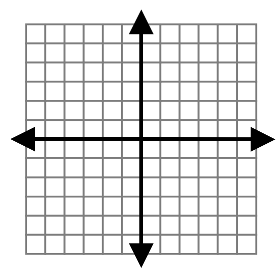
$a(x) = |x-3|$



$b(x) = |x| + 3$



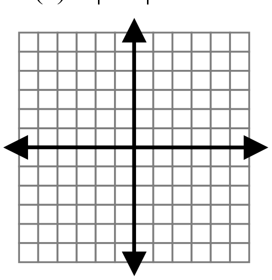
$d(x) = |x| - 3$



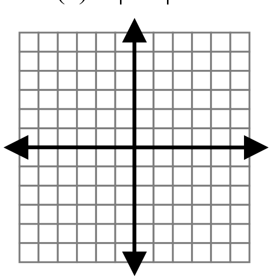
Look at the graphs above. What patterns do you notice? What conclusions can you make based on these graphs? Explain your observations on another sheet of paper.

What happens when you combine the patterns? Complete the following with your group, then transfer your graphs below.

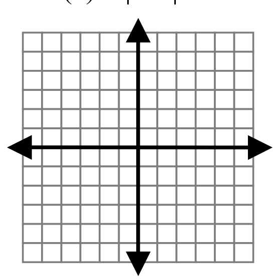
$t(x) = |x+3| - 2$



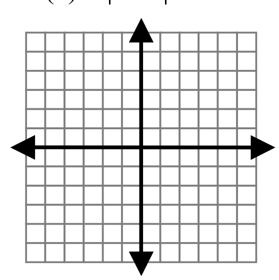
$a(x) = |x-5| + 3$



$b(x) = |x-2| + 5$



$d(x) = |x+2| - 3$

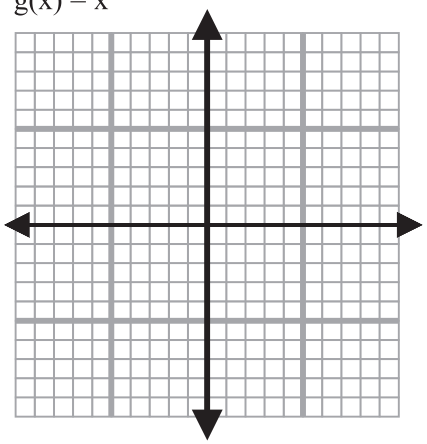


Exponent Function Exploration Squares

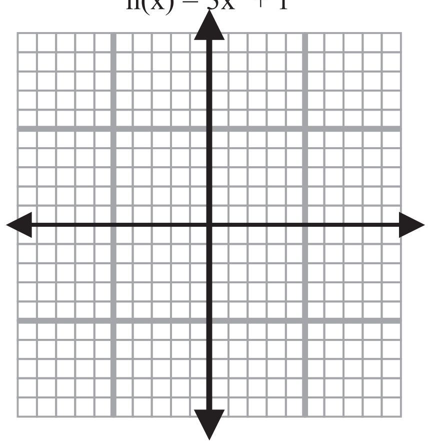
Name ____

With your table, create a function table using -5, -3, -1, 0, 1, 3, and 5 as values for x. (Do this on another sheet of paper.) Next, graph each of the following functions on the white board with a grid. Then draw the graph on this paper.

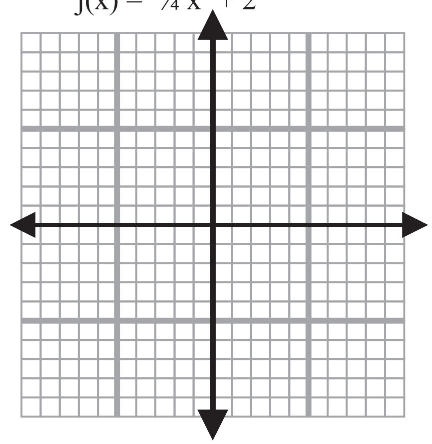
$g(x) = x^2$



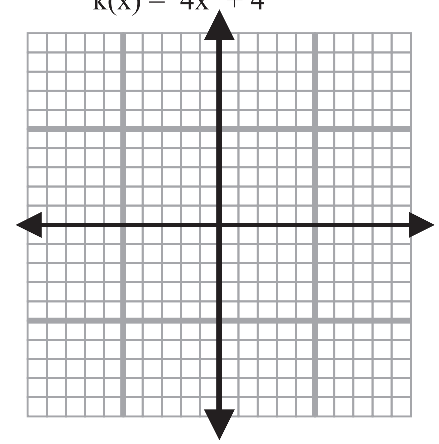
$h(x) = 3x^2 + 1$



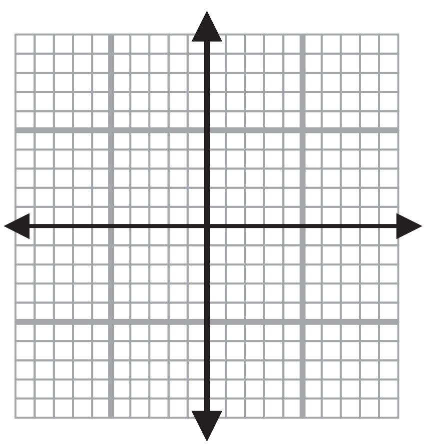
$j(x) = \frac{1}{4} x^2 + 2$



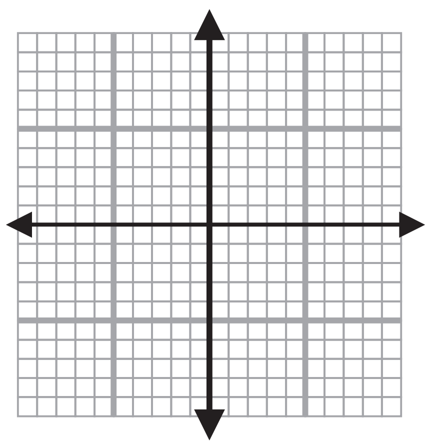
$k(x) = 4x^2 + 4$



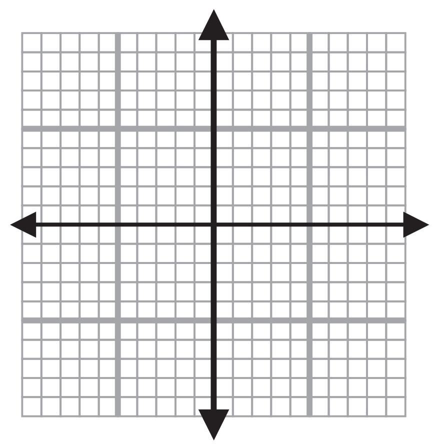
$m(x) = -x^2$



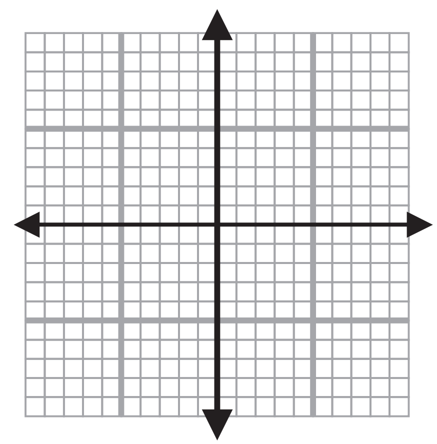
$n(x) = -3x^2 + 1$



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



$r(x) = -4x^2 + 4$



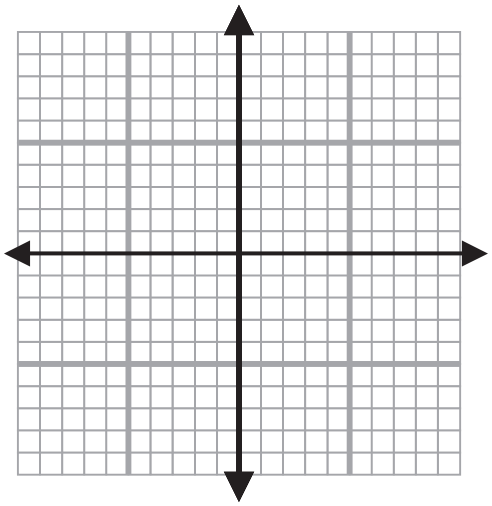
Look at the graphs above. What patterns do you notice? What conclusions can you make based on these graphs? Explain your observations on another sheet of paper.

Rational Function Exploration

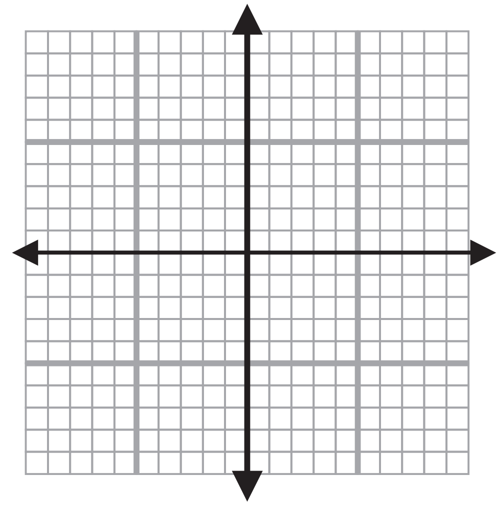
Name ____

With the others at your table, create a function table using 5 values for x. Next, graph each of the following functions on the white board with a grid. Then draw the graph on this paper.

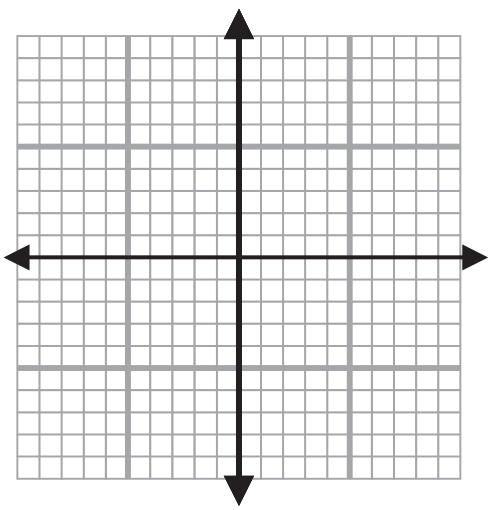
$g(x) = \frac{1}{x} + 4$



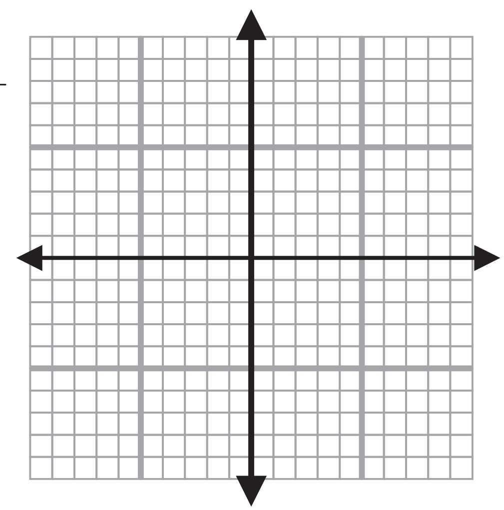
$h(x) = \frac{1}{x} - 3$



$j(x) = \frac{1}{x+4}$



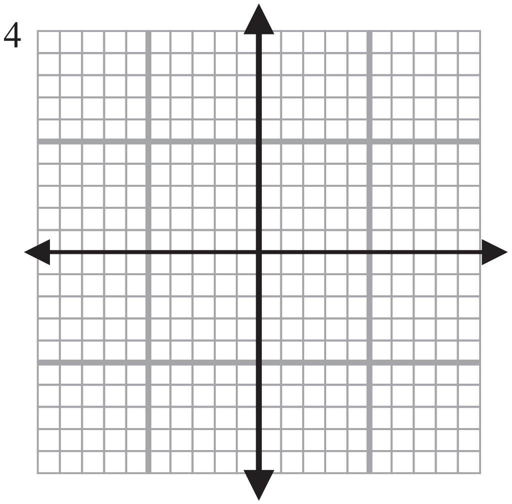
$k(x) = \frac{1}{x-3}$



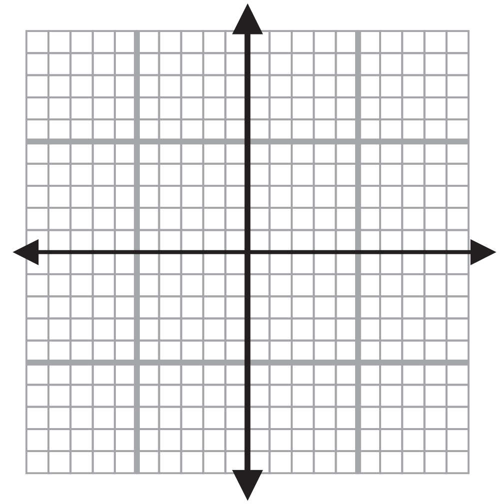
Look at the graphs above. What patterns do you notice? What conclusions can you make based on these graphs? Explain your observations. What do you know about the possible values of a denominator? How does this help you determine the vertical asymptote? (Use the back of this sheet or another sheet of paper.)

What happens when you combine the patterns? Complete the following with your group, then transfer your graphs below.

$g(x) = \dfrac{1}{x - 3} + 4$



$h(x) = \dfrac{1}{x + 4} - 3$



Comparing Functions

Compare the following functions. What do you observe?

$$g(x) = (x-4)^2$$

$$h(x) = (x-4)^3$$

$$j(x) = \sqrt{x-4}$$

$$k(x) = \frac{1}{x-4}$$