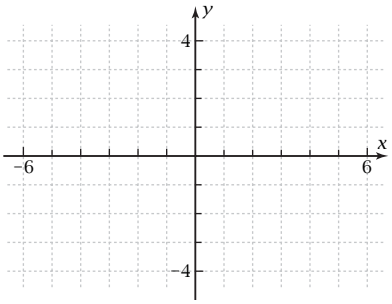
Name: _____ Group Members: _____

Exploration 15-4a: Rational Functions and Discontinuities

Date: _____

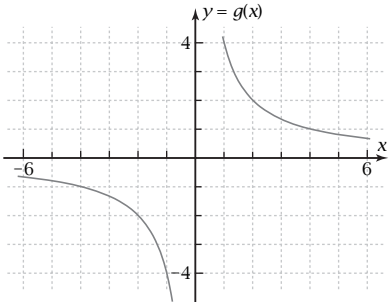
Objective: Find and classify discontinuities in the graph of a rational algebraic function.

1. On this graph paper, plot *quickly* the graph of the rational function $f(x) = \frac{1}{x}$ (no grapher).

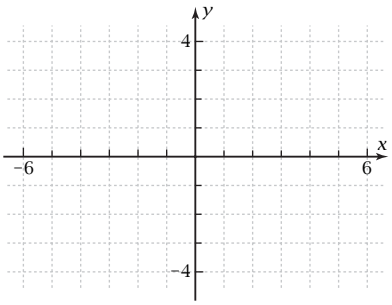


2. The graph in Problem 1 has a **vertical asymptote** at $x = 0$. Give an algebraic reason why there is such an asymptote there.

3. Identify a transformation that maps the graph of f onto the graph of g shown here. (There are at least three ways to answer this!)



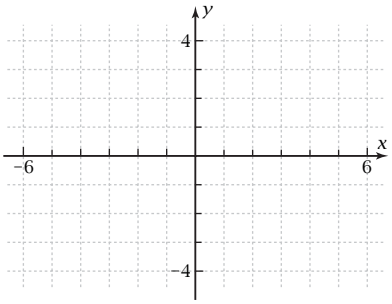
4. Let $h(x) = \frac{1}{x-3}$. What transformation of the graph of f is this? On the graph paper here, plot quickly the graph of h (no grapher).



5. Function r is called a **rational function** because $r(x)$ equals a ratio of two polynomials.

$$r(x) = \frac{x - 1}{x^2 - 4x + 3}$$

Plot the graph of r on your grapher. Use a friendly window from about $x = -5$ to $x = 5$ that includes each integer as a grid point. Sketch the result on this graph paper.



6. In what way is the graph of r similar to the graph of h in Problem 4? In what way is it different?

7. The graph of r has a **removable discontinuity** at $x = 1$. Explain algebraically why there is a discontinuity here.

8. By factoring the denominator in the equation for $r(x)$, show how the discontinuity at $x = 1$ can be "removed" algebraically.

9. Without plotting the graph, how can you tell which kind of discontinuity, removable or asymptote, the graph of a rational function will have at a value of x that makes the denominator equal zero?

10. What did you learn as a result of doing this Exploration that you did not know before?