Reciprocals of Power Functions

We now turn our attention to a short study of rational functions. A rational function is the ratio, or quotient of two polynomials. The name should not be a surprise since we know that a rational number is

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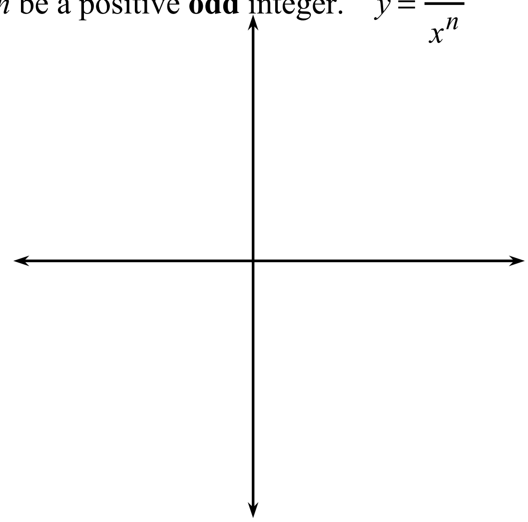
We've already looked at the functions $f(x) = x^n$ where n is a positive integer, so we'll begin our study of rational functions looking specifically at their reciprocals $g(x) = \frac{1}{f(x)} = \frac{1}{x^n}$. State the domain of each of these functions.

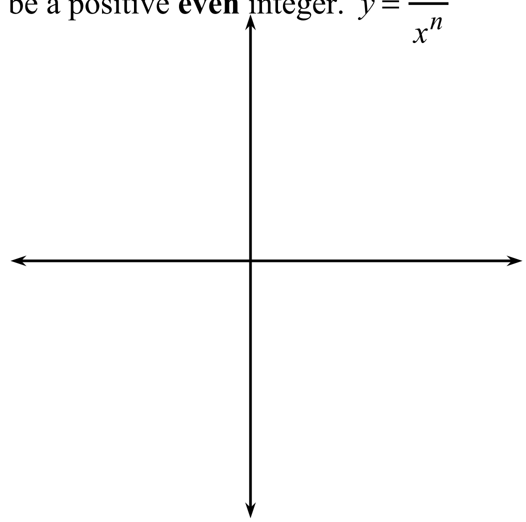
Df = ________________________________ Dg = ________________________________

As before, we need to consider the functions for n even and n odd. Sketch enough graphs in each group to make the patterns clear. You may need to adjust the window as you go to be sure to see the graphs.

Let n be a positive **odd** integer. $y = \frac{1}{x^n}$



Let n be a positive **even** integer. $y = \frac{1}{x^n}$



What is the range?

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What happens to the graphs as n increases?

Describe the basic difference between the graphs when n is even or odd.

For $x > 0$, as x gets closer and closer to 0, what happens to its reciprocal $\frac{1}{x}$?

For $x < 0$, as x gets closer and closer to 0, what happens to its reciprocal $\frac{1}{x}$?

The y-axis, $x = 0$, is called a vertical __________________________ of the graph.
Here we may write $\lim_{x\to 0^+} \frac{1}{x} = +\infty$ and $\lim_{x\to 0^-} \frac{1}{x} = -\infty$.

On the other hand, as x approaches infinity, $\frac{1}{x}$ gets close to _____________. The x-axis, $y = 0$, is a horizontal asymptote for the graph. We may write $\lim_{x\to\infty} \frac{1}{x} = 0$.