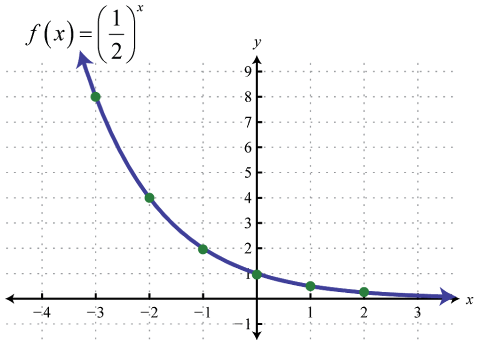
<u>Limits as x approaches positive or negative infinity:</u>

First of all, what is a limit? A limit is the value that y approaches on a graph:
(in this case it's approaching zero on the right)



(Figure 1.)

This is a limit statement:

$$\lim_{x\to 2}\left(\frac{1}{x}\right)$$

The limit statement above reads "the limit as x approaches two of one over x."

To find a limit as x approaches +/- infinity, you can look at the graph and follow the line out toward +/- infinity on the x axis and guess where the line approaches (Figure 1.), or better yet, you can calculate it.

Calculating limits as x approaches +/- infinity:

<u>Method 1) When you have a limit that looks like this:</u>

$$\lim_{x\to\infty} 4x^4 - 7$$

1. Replace all x's with +/- infinity (whichever one is under the "lim" in the problem). Remember, positive infinity to any power is just infinity. It doesn't get any bigger. Negative infinity to an odd power is negative and an even power is positive.
2. Simplify. If infinity is added to anything, it's just infinity. If it's subtracted from anything, it's now negative infinity.

Work:

$$4(\infty)^4 - 7 = \infty - 7 = \infty$$

Method 2) When you have a limit that looks like this:

$$\lim_{x \to -\infty} \frac{2+x}{52}$$

1. Like in method one, replace all x's with +/- infinity and simplify.
2. Check to see if the +/- infinity is in the numerator or the denominator. If positive infinity is in the numerator the answer is just positive infinity because infinity divided by any number is just infinity. If negative infinity is in the numerator the answer is negative infinity for the same reason. If +/- infinity is in the denominator, you have a very very *very* small fraction, so you can just round to zero.

Work:

$$\frac{2+x}{52} = \frac{2-\infty}{52} = \frac{-\infty}{52} = -\infty$$

Method 3) When you have a limit that looks like this:

$$\lim_{x \to \infty} \frac{x^4-4x^2+3}{2x^4-8x-20}$$

1. For a limit with x's on the top and bottom of the fraction, first identify the largest exponent form of x in the limit. In this case, it's x to the fourth.
2. Divide every value by the largest exponent form of x.
3. Simplify.
4. Replace every x value with +/- infinity. If the +/- infinity is in a numerator, it's just +/- infinity. If it's in a denominator, it's zero.
5. Now simplify.

Work:

$$\frac{x^4-4x^2+3}{2x^4-8x-20} = \frac{\frac{x^4}{x^4}-\frac{4x^2}{x^4}+\frac{3}{x^4}}{\frac{2x^4}{x^4}-\frac{8}{x^3}-\frac{20}{x^4}} = \frac{1-\frac{2}{x^2}+\frac{3}{x^4}}{2-\frac{8}{x^3}-\frac{20}{x^4}} = \frac{1-0+0}{2-0-0} = \frac{1}{2}$$

AN IMPORTANT NOTE: When you have infinity to the sixth minus infinity to the third, it's positive infinity. Just go with the sign of the "bigger" one. (You can also factor the equation before you replace the x's with infinities, but it's not necessary.)

Work:

$$\infty^6 - \infty^3 = \infty$$