Part I (due at the beginning of class Friday, September 19)

We will continue with our discussion of the important trig limits on Friday, so here's an introduction to the next topic after that. The reading questions are included throughout the reading.

So far, we've looked at limits at a particular point; now we want to expand our view to talk about what happens with a function as x gets really big in the positive or negative direction ($x \to \infty$ or $x \to -\infty$).

For a starting example, consider the function $f(x) = x^2$.

1. What happens to this function $f(x)$ as x gets bigger and bigger in the positive direction (as $x \to \infty$)?
2. What happens to this function $f(x)$ as x gets bigger and bigger in the negative direction (as $x \to -\infty$)?
3. Answer the same questions for the following functions.
   (a) $g(x) = x^3$
   (b) $h(x) = \dfrac{1}{x}$
   (c) $f(x) = \dfrac{1}{x^2}$
4. Revisit your answers in the questions above and use limit notation to describe what's going on, if you did not already use such notation. Can you generalize what's happening; i.e., can you say what the limit of x^n will be as $x \to \infty$ or $x \to -\infty$, depending on the value of n?

Here are Calculus I definitions for the kinds of limits we're considering:

Definition 1.
- $\lim_{x\to\infty} f(x) = L$ *if* $f(x)$ *can be made as close as we like to* L *by taking* x *sufficiently large.*
- $\lim_{x\to-\infty} f(x) = L$ *if* $f(x)$ *can be made as close as we like to* L *by taking* x *sufficiently large negatively.*
- $\lim_{x\to\infty} f(x) = \infty$ *if* $f(x)$ *can be made as large as we like by taking* x *sufficiently large (and can similarly use* $-\infty$ *in any of these cases)*

Definition 2. *If either* $\lim x \to \infty f(x) = L$ *or* $\lim x \to -\infty f(x) = L$*, then the line* $y = L$ *is a* horizontal asymptote *for* $f(x)$*.*

Recall, what you turn in for Part I should have 3 subparts, as mentioned in the syllabus:

(a) Your response(s) to the reading question(s).

(b) Your own questions/comments on the reading.

(c) The amount of time you spent on Part I (including the time spent reading/watching).

Part II: WeBWorK (due Saturday, September 20, by 11 PM)

No new WeBWorK this time; just complete the DW 6 and 7 assignments.

Part III: Homework Problems (due Wednesday, September 24 at the beginning of class)

Review the homework guidelines and the sample homework in the syllabus to ensure that the solutions you turn in meet the guidelines.

1. For each part, draw a graph of a function that has the given characteristics.
   (a) $g(x)$ is not continuous at $x = -2$, but $\lim_{x \to -2} g(x)$ exists and $g(-2)$ exists
   (b) $f(x)$ has a removable discontinuity at $x = 0$, a jump discontinuity at $x = -2$, $\lim_{x \to 4^-} f(x) = \infty$, and $\lim_{x \to 4^+} f(x) = 3$.
2. Use the Squeeze Theorem to find $\lim_{x \to 3} \left((x^2 - 9) \sin \frac{1}{x^2 - 9} \right)$.

Friday's mini-Celebration of Learning

Friday's mini-Celebration of Learning, which will be during the last 10–15 minutes of class, will be your first opportunity to earn an M for Learning Targets L3 and L5.