Exam #1 Review
(Covers ~~2.1~~-2.2--2.6)

~~**Sec 2.1**: Rates of Change and Tangents to Curves~~

- ✓ ~~Find the average rate of change.~~
- ✓ ~~Looked at the idea of finding the slope of a tangent line using the slopes of the secant lines.~~

~~*Problems to try:*~~

~~1. From the book: pg 63: #9, #19~~

Sec 2.2: Limit of a Function and Limit Laws

- ✓ A preliminary definition of a limit and what to look for.
- ✓ Limit Laws and how to use them
- ✓ Simplifying f(x) using factoring and using a conjugate with either the denominator or the numerator
- ✓ Squeeze theorem (Sandwich Theorem)

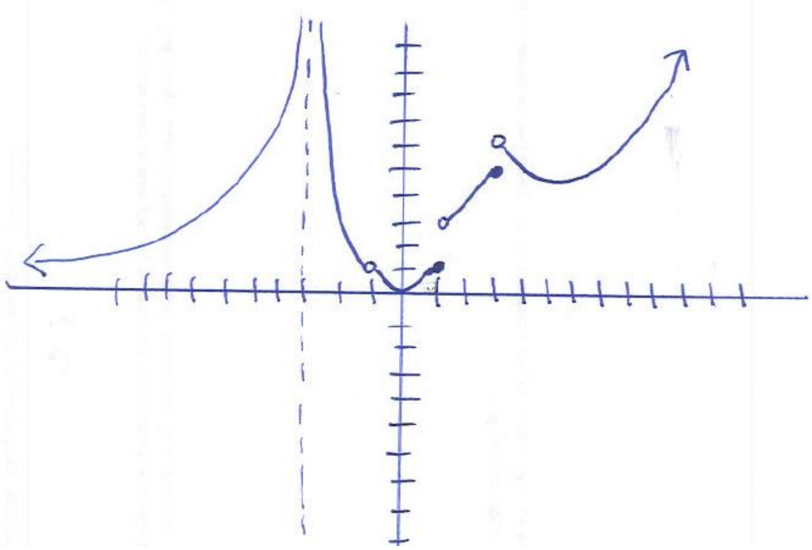
Problems to try:

2. Find a function f(x) and a number "a" such that $\lim_{x\to a} f(x) = -\infty$

3. Evaluate: $\lim_{x\to 0}\frac{\cos x}{x}$, $\lim_{x\to 2}\frac{(x^2+x-6)}{(x^2-5x+6)}$, $\lim_{h\to 0}\frac{(h+2)^2-4}{h}$, $\lim_{x\to 3}\frac{\frac{1}{x}-\frac{1}{3}}{x-3}$,

$\lim_{x\to 7}\frac{x-7}{\sqrt{x+2}-3}$, $\lim_{x\to 3^+}\frac{(x^2-3x-4)}{(x^2-9)}$, $\lim_{x\to 0}\frac{2x}{\sin(5x)}$, $\lim_{x\to 2}\frac{x-2}{\sqrt{x}-\sqrt{2}}$, $\lim_{x\to 0^+}\frac{1}{x\ln x}$, $\lim_{x\to 0}\frac{(1-x)e^x-1}{x^2}$

4. Given this graph find the limit of f(x) as x goes to -3, -1, 1 from the right side, 3, 4



5. From the book: #63

If $\sqrt{(5-2x^2} \le f(x) \le \sqrt{5-x^2}$ for $-1 \le x \le 1$, find $\lim_{x\to 0} f(x)$.

Sec 2.4: One-Sided Limits

- ✓ Be able to find the limit from the left side or from the right side
- ✓ Be able to use $\lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1$ to find other limits.

Problems to try:

6. From the book: #5, #17, #23

#5 Let $f(x) = \begin{cases} 0 & x \leq 0 \\ \sin\left(\frac{1}{x}\right) & x > 0 \end{cases}$

a. Does $\lim_{x \to 0^+} f(x)$ exist? If so, what is it? If not, why not?
b. Does $\lim_{x \to 0^-} f(x)$ exist? If so, what is it? If not, why not?
c. Does $\lim_{x \to 0} f(x)$ exist? If so, what is it? If not, why not?

#17 Find the limits

a. $\lim_{x \to -2^+} (x+3)\left(\frac{|x+2|}{x+2}\right)$

b. $\lim_{x \to -2^-} (x+3)\left(\frac{|x+2|}{x+2}\right)$

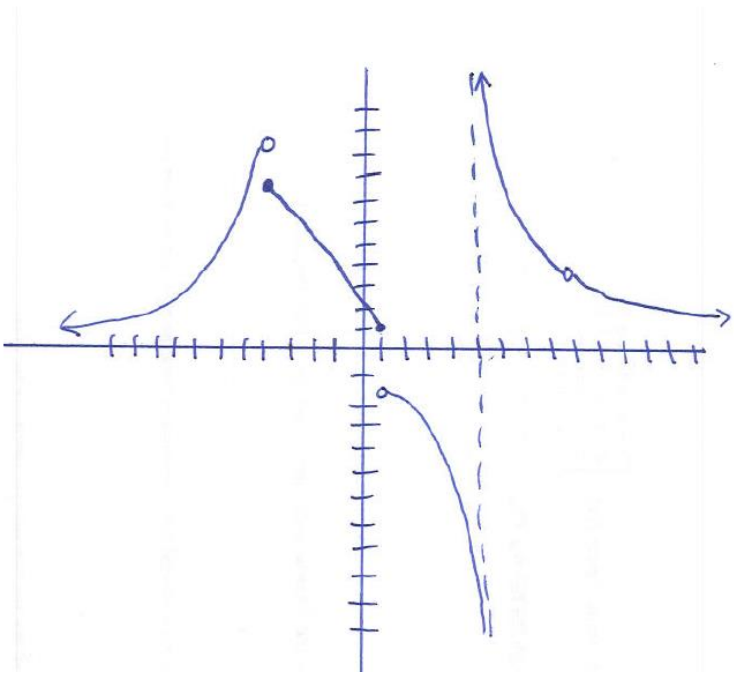
#23 Find the limit: $\lim_{y \to 0} \frac{\sin(3y)}{4y}$

Sec 2.5: Continuity

- ✓ Definition of continuity (all parts)
- ✓ Types of continuity, left/right/neither continuity, interval of continuity
- ✓ Functions that are continuous
- ✓ Continuity with composite functions
- ✓ Finding the other function to fix the removable discontinuity
- ✓ Be able to do the above with a graph or with an algebraic expression

Problems to try:

7. Using the graph what values of x is f(x) discontinuous, which values are continuous from the left or right, what type of discontinuity is it, and what are the intervals of continuity?



8. Give an example of a function that would have removable discontinuity. Explain why it is removable.

9. What type of discontinuity does $f(x) = \dfrac{x}{\sin x}$ have at $x = \pi$?

10. State the conditions for f(x) defined over [0,2] to be continuous at x=1.

11. Answer the question from #10 (above) using $f(x) = \dfrac{\sqrt{x+4}}{(x+2)(x-3)}$. (Make sure for both #10 and #14 you give an explanation for your answers).

Sec 2.6: Limits Involving Infinity; Asymptotes of Graphs

- ✓ Find limits that go to infinity (vertical and horizontal asymptotes)
- ✓ Find a graph given specific types of limits
- ✓ In class worksheet

Problems to try:

12. From the book: #56-58, #70

#56 Find the limits

$$\lim \frac{x^2 - 1}{2x + 4}$$

a. $x \to -2^+$ b. $x \to -2^-$ c. $x \to 1^+$ d. $x \to 0^-$

#57 Find the limits

$$\lim \frac{x^2 - 3x + 2}{x^3 - 2x^2}$$

a. $x \to 0^+$ b. $x \to 2^+$ c. $x \to 2^-$ d. $x \to 2$

e. What, if anything, can be said about the limit as $x \to 0$?

#58 Find the limits

$$\lim \frac{x^2 - 3x + 2}{x^3 - 4x}$$

a. $x \to 2^+$ b. $x \to -2^+$ c. $x \to 0^-$ d. $x \to 1^+$

d. What, if anything, can be said about the limit as $x \to 0$?

#70 Sketch the graph of a function $y = f(x)$ that satisfies the given conditions. No formulas are required—just label the coordinate axis and sketch an appropriate graph

$$f(0) = 0, \ \lim_{x\to\pm\infty} f(x) = 0, \ \lim_{x\to 0^+} f(x) = 2, \ and \ \lim_{x\to 0^-} f(x) = -2$$