Homework for Test #1:

- 1.2 #1-7odd,9-18all ← limits from graphs
- 1.2 #23, 25, 27, 29, 30, 31 epsilon delta
  (and watch all of the Khan Academy epsilon-delta videos!)
- 1.3 #11,17,27-35odd, 39-61odd ← evaluating limits analytically
  1.3 #67-77odd; 87, 88 limits with trig, squeeze theorem
- 1.4 #7-17odd; limits of functions with discontinuities
  1.4 #25-28all; 39-47odd; discuss (dis)continuity
- 1.4 #19,21,23,51,57,59,63,69,71 misc. continuity problems

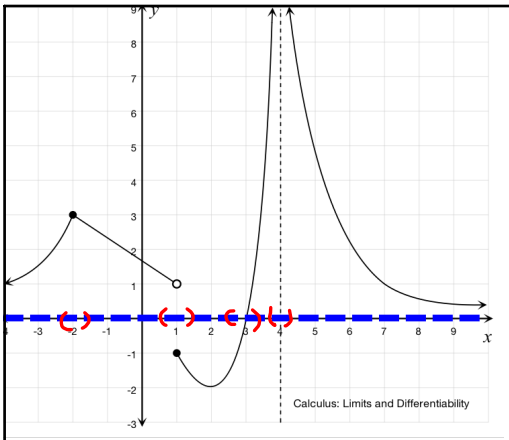
1.4 #83,85 intermediate value theorem

- 1.5 #1,3,25; 29-51odd infinite limits
- Ch 1 review pp. 88-89 #3-49odd; 51-67odd
- Test #1 Practice Problems handout

(not due until after the test, but will still help you with limits that will be on the test)

- 2.1 -#1-23odd derivative definition

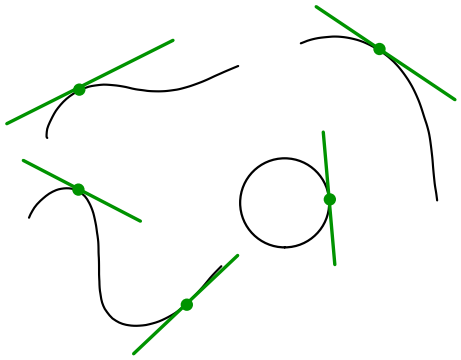
Nov 11-7:30 AM



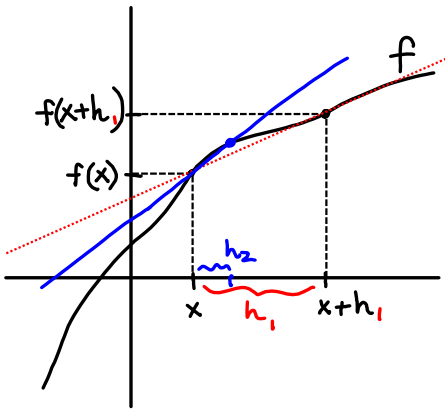
as *x* approaches..	*f(x)* approaches...
-2	3
1^- (from the left)	1
1^+ (from the right)	-1
3	0
$-\infty$	0
∞	0
4	∞

Aug 16-1:40 PM

tangent lines



Aug 15-10:16 AM



secant line

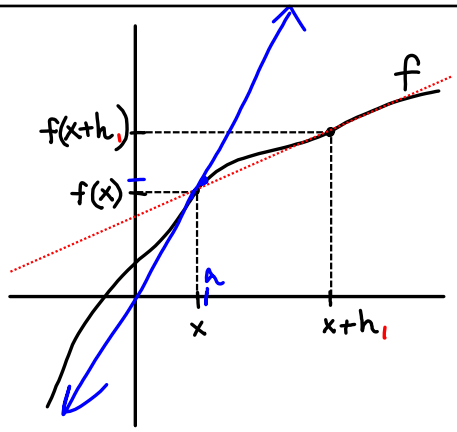
$$\text{slope} = \frac{\Delta y}{\Delta x}$$

$$= \frac{f(x+h) - f(x)}{x+h-x}$$

$$= \boxed{\frac{f(x+h) - f(x)}{h}}$$

difference quotient

Aug 11-8:26 AM



tangent line

$$\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

↑ slope of tangent line

Aug 15-10:12 AM

Δx "delta x"

change in x

$$\frac{f(x+\Delta x)-f(x)}{\Delta x} = \frac{f(x+h)-f(x)}{h}$$

(Δx over $f(x+h)$, h over Δx)

$$\lim_{\Delta x\to 0}$$

Aug 16-2:10 PM

1.2

brute force

$$f(x)=\frac{x-2}{x^2-4}, \quad x\neq 2,-2$$

(1.99-2)/(1.99^2-4)

What happens to *f(x)* as *x* approaches 2?

x	1.9	1.99	1.999	2	2.001	2.01	2.1
f(x)	0.2564	0.2506	0.2501	0.25	0.2499	0.2494	0.2439

Aug 16-2:12 PM

Informal Description of the Limit

real

If *f(x)* becomes arbitrarily close to a single number *L* as *x* approaches *c* from either side, the limit of *f(x)*, as *x* approaches *c*, is *L*.

$$\lim_{x\to c} f(x) = L$$

Note: the existence or nonexistence of *f(x)* at *x=c* has no bearing on the existence of the limit as *x* approaches *c*.

Aug 16-2:18 PM

A function can be undefined for a certain value of *c* with the limit as *x* approaches *c* still defined.

$$\lim_{x \to -3} \frac{\sqrt{1-x} - 2}{x+3} = -0.25$$

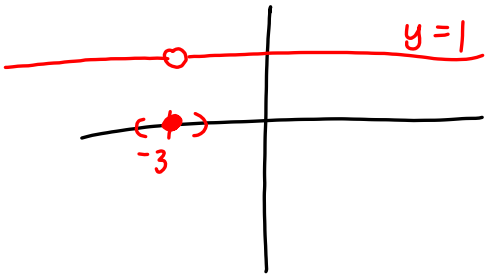
Nov 4-12:50 PM

$$f(x) = \begin{cases} 1, & x \neq -3 \\ 0, & x = -3 \end{cases}$$

$$\lim_{x \to -3} f(x) = \boxed{1}$$

y = 1

point (-3, 0)



Aug 16-2:23 PM

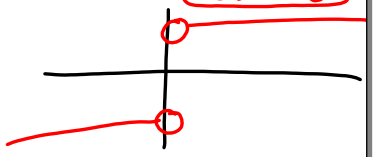
$\lim_{x\to 0} \frac{|2x|}{x}$ $\quad |x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$

$\lim_{x\to 0^+} f(x) = 2$

$\lim_{x\to 0^-} f(x) = -2$

$\lim_{x\to 0} f(x) =$ does not exist

$\frac{|2x|}{x} = \begin{cases} \frac{2x}{x} = 2, & 2x > 0 \\ & x > 0 \\ \frac{-(2x)}{x} = -2, & 2x < 0 \\ & x < 0 \end{cases}$



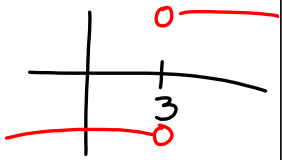
Aug 16-2:26 PM

$\lim_{x\to 3} \frac{|x-3|}{x-3}$ does not exist

$\lim_{x\to 3^-} f(x) = -1$

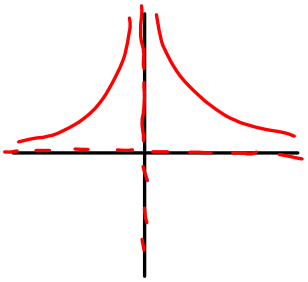
$\lim_{x\to 3^+} f(x) = 1$

$\frac{|x-3|}{x-3} = \begin{cases} \frac{x-3}{x-3} = 1, & x-3 > 0 \\ & x > 3 \\ \frac{-(x-3)}{x-3} = -1, & x-3 < 0 \\ & x < 3 \end{cases}$

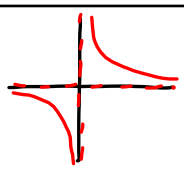


Aug 15-10:38 AM

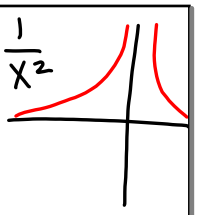
$\lim_{x \to 0} \frac{1}{x^4} = \infty$



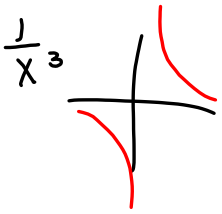
$\frac{1}{x}$



$\frac{1}{x^2}$

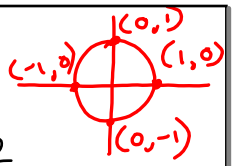


$\frac{1}{x^3}$

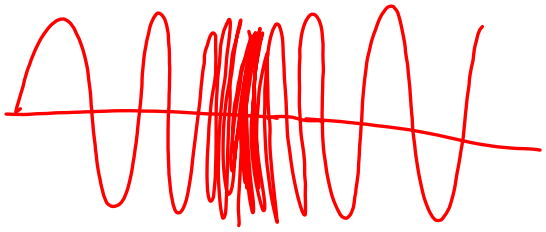


Aug 16-2:30 PM

$\lim_{x \to 0} \sin\frac{1}{x}$ does not exist



x	$\frac{2}{\pi}$	$\frac{2}{3\pi}$	$\frac{2}{5\pi}$	$\frac{2}{7\pi}$	$\frac{2}{9\pi}$	$\frac{2}{11\pi}$
$\sin\frac{1}{x}$	1	-1	1	-1	1	-1



Aug 16-2:33 PM

"Dirichlet Function"

$$f(x)=\begin{cases}0, & \text{if } x \text{ is rational}\\ 1, & \text{if } x \text{ is irrational}\end{cases}$$

limits do not exist anywhere!

Aug 16-2:38 PM

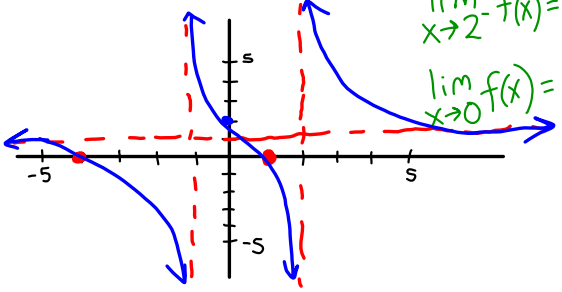
Graph the rational function.

$$f(x)=\frac{(x+4)(x-1)}{(x-2)(x+1)} \approx \frac{x^2+\dots}{x^2+\dots}=1$$

$\lim_{x\to\infty} f(x) = 1$

$\lim_{x\to 2^-} f(x) = -\infty$

$\lim_{x\to 0} f(x) = 2$



Aug 16-10:01 AM