Calculus I Review

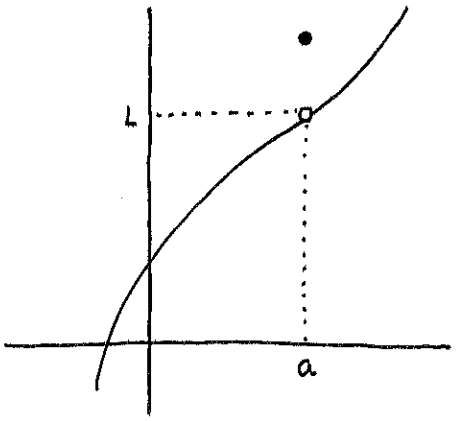
Text: Calculus Early Transcendentals 6th Ed. by James Stewart

Three Major Ideas:

I. The Limit

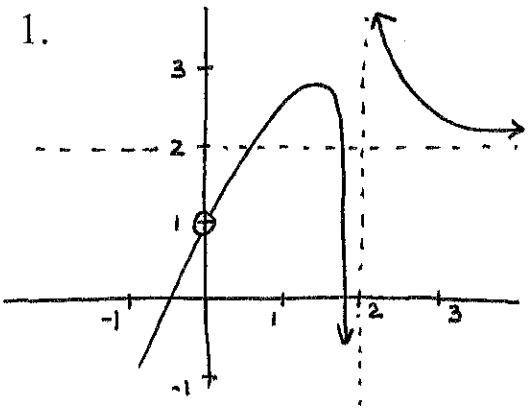
The idea:

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



Examples:

1.



$\lim_{x\to 0} f(x) = 1$ $\quad\quad$ $\lim_{x\to 2+} f(x) = \infty$

$\lim_{x\to 2} f(x) =$ d.n.e. $\quad\quad$ $\lim_{x\to\infty} f(x) = 2$

2. $\lim_{x\to 2} (5x - 2) = 8$

3. $\lim_{x\to 3} \frac{x^2-9}{x-3} = \lim_{x\to 3} (x+3) = 6$

The graph of $y = \frac{x^2-9}{x-3}$ looks like the graph of $y = x+3$ with a hole at the point (3,6)

4. $\lim_{x\to\infty} \frac{2x^2-9}{5x^2+x-3} = \frac{2}{5}$

5. $\lim_{x\to\infty} \frac{2x^2-9}{x-3} = \infty$

6. $\lim_{x\to 3-} \frac{x+5}{x-3} = -\infty$

numerator is almost 8

denominator is tiny, negative

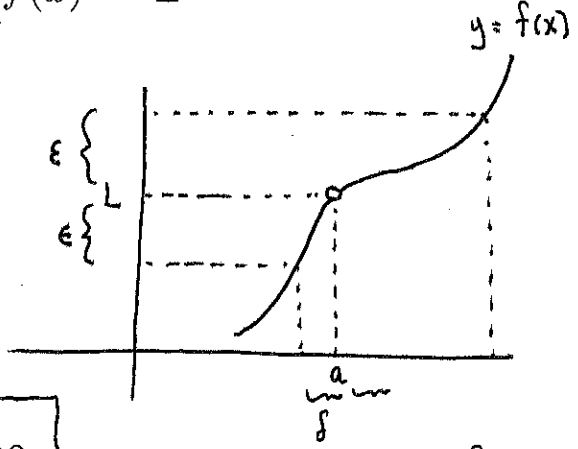
7. $\lim_{x\to\infty} \sin(x) =$ d.n.e.

Definition: Let $f(x)$ be defined for all x in some open interval containing a with the possible exception that $f(a)$ may or may not exist. Then

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

means that

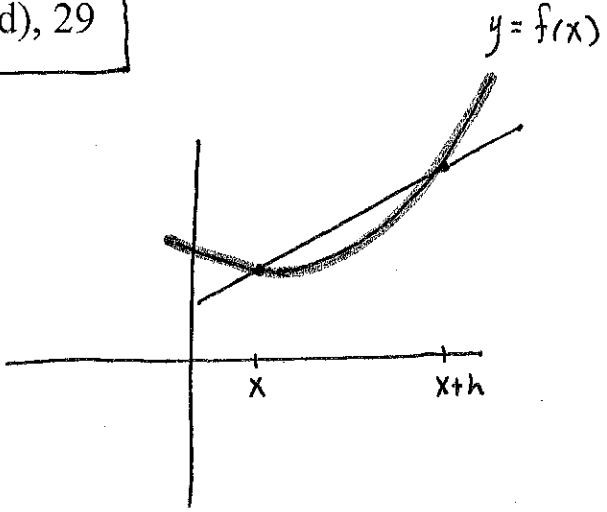
given any $\epsilon > 0$,
we can find a $\delta > 0$
such that $|f(x) - L| < \epsilon$
whenever $0 < |x - a| < \delta$.



Practice: Limits page 167 # 1-19 (odd), 29

II. Derivatives

Picture idea:



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

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

know the following:

$\frac{d}{dx} \sin(x) = \cos(x)$ $\qquad$ $\frac{d}{dx} \cos(x) = -\sin(x)$

$\frac{d}{dx} \tan(x) = \sec^2(x)$ $\qquad$ $\frac{d}{dx} \cot(x) = -\csc^2(x)$

$\frac{d}{dx} \sec(x) = \tan(x)\sec(x)$ $\qquad$ $\frac{d}{dx} \csc(x) = -\cot(x)\csc(x)$

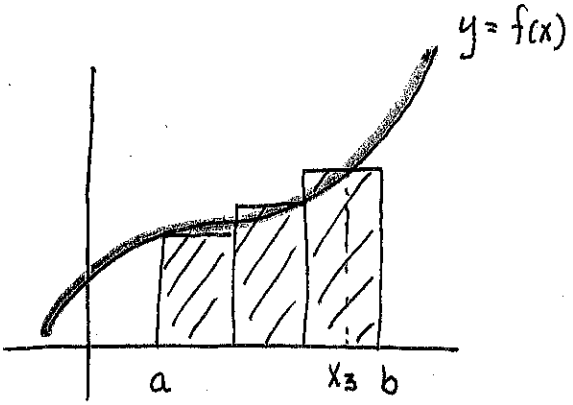
$\frac{d}{dx} e^x = e^x$ $\qquad$ $\frac{d}{dx} \ln(x) = \frac{1}{x}$

Power rule, Product Rule, Quotient Rule,
Chain Rule, Implicite Differentiation

Practice: Derivatives page 262 # 1-25(odd), 41

III. Integration

$$\int_a^b f(x)\,dx = \lim_{\triangle x \to 0} \sum_{i=1}^{n} f(x_i)\,\triangle x$$



Fundamental Theorem of Calculus: Let $f(x)$ be continuous on an interval [a,b] *and* $F'(x) = f(x)$,
then $\int_a^b f(x)\,dx = F(x)|_a^b = F(b) - F(a)$.

Example: $\int (3x^2 + 5)\,dx = x^3 + 5x + C$

Practice: Integration page 410 # 9-37 (odd)

Read ahead:

The first sections we will cover in class will be Inverse Functions 1.6 and Implicite Differentiation 3.5.