Calculus I Steve Mills

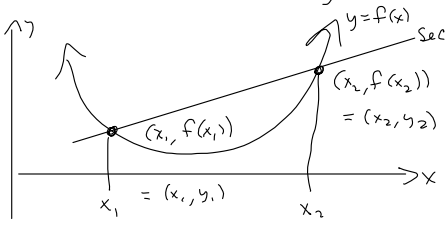
5 credits

MWF 2:45-4:10 pm

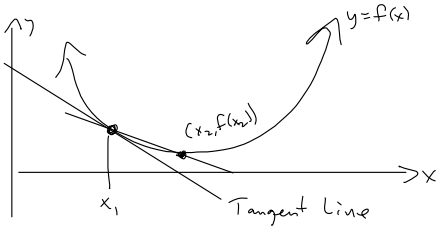
Three plus three is six.

3+3=6

Differential Calculus: Slope at a point on a curve, as the limit of slope between 2 points on the curve (slope of the secant line) as the 2 points get closer (infinitesimally close).



Slope $= m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$



Newton says:
"Nature is continuous and smooth."

Big Solve: Slope of the tangent line

$\lim_{x_2 \to x_1} \frac{f(x_2) - f(x_1)}{x_2 - x_1}$ = Slope at a single point, x_1!

We generalize the slope of a line!

Integral Calculus, later.

Simplify the difference quotient:

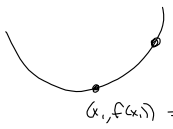
$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$ for $f(x) = x^2$

$\frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{x_2^2 - x_1^2}{x_2 - x_1} = \frac{(x_2 - x_1)(x_2 + x_1)}{x_2 - x_1} = x_2 + x_1$

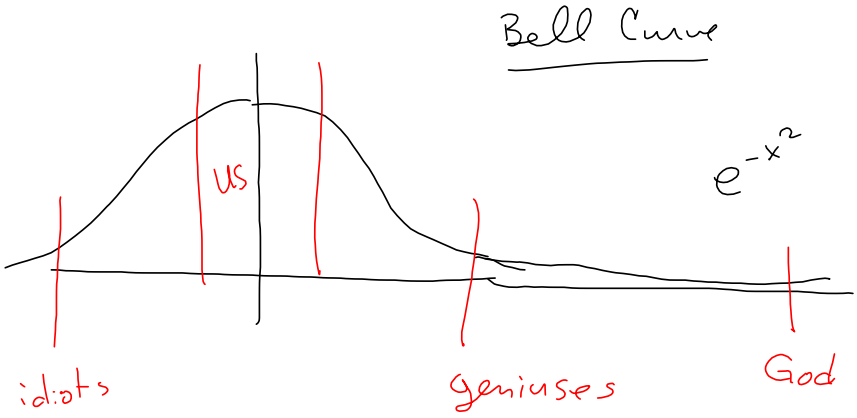
Calculus: $x_2 \to x_1$ $\longrightarrow$ $x_1 + x_1 = 2x_1$ = Slope at $x = x_1$!

$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^2 - x^2}{h} = \frac{x^2 + 2xh + h^2 - x^2}{h} =$

$= \frac{2xh + h^2}{h} = \frac{h(2x+h)}{h} = 2x + h \xrightarrow{h \to 0} 2x$ = slope of x^2 @ x!



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


Bell Curve
e^{-x^2}
us
idiots
geniuses
God

Remote. WebAssign for homework & tests*

* I would like to do in-person & we'll talk about that.

aims 8483 0227 Class Key to access WebAssign

https://www.webassign.net/wa-auth/login

Austin and Erik with insight on WebAssign.

Videos on harryzaims.com !
Virtually all the homework exercises represented.
Heuristic Learning - Problem-solving mode.

https://harryzaims.com/

§1.1-1.3 is 90% 121-122 stuff.
Functions, Domain of function, etc.
§1.4 we start doing $\frac{f(x+h)-f(x)}{h}$ by brute force, which sucks. Tedious motivation I did a spreadsheet to eliminate the tedium.

Thanks, Dawn, for the WebAssign thing in chat.

Domain $\{x \mid f(x) \exists\}$

2 things to worry about:
$\mathcal{D} = \mathbb{R} = (-\infty, \infty)$, unless...

$\frac{\text{Stuff}}{0}$ $\frac{A}{B}$ need $B \neq 0$

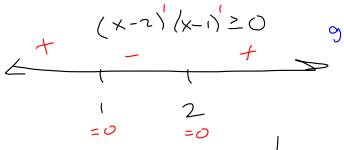
$\sqrt{\text{negative}}$ $\sqrt[2n]{A}$ need $A \geq 0$

$f(x) = \sqrt{x^2-3x+2}$

$\mathcal{D}(f) = \{x \mid x^2-3x+2 \geq 0\}$

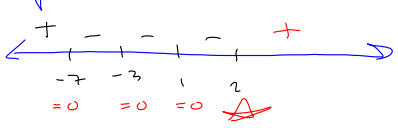
$x^2-3x+2 \geq 0$

$(x-2)'(x-1)' \geq 0$ $g(x) =$



End behavior &
sign-change management
when possible.

$\sqrt{\frac{(x-1)^2(x+7)^5(x+3)^9}{(x-2)^3}} = \sqrt{\text{stuff}}$



stuff ≥ 0

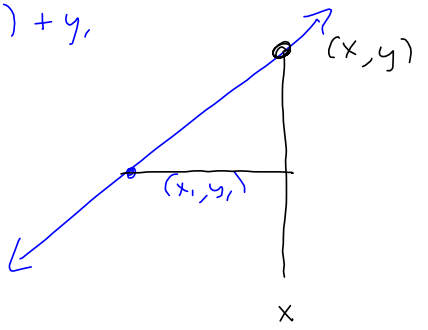
Lucas ! Nice catch.

$\mathcal{D}(g) = (-\infty, -7] \cup \{-3\} \cup \{1\} \cup (2, \infty)$

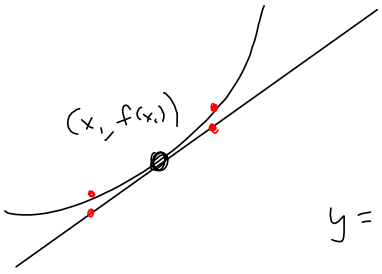
Lines. Point-Slope form: Given (x_1, y_1) & m,

$y - y_1 = m(x - x_1)$

$y = m(x - x_1) + y_1$



$y = y_1 + m(x - x_1)$



Tangent-Line Approximation.

$y = m(x - x_1) + y_1$

$y = f'(x_1)(x - x_1) + f(x_1)$

slope @ x_1 — Distance from $x = x_1$ — starting height.

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

$= \lim_{x_2 \to x_1} \frac{f(x_2) - f(x_1)}{x_2 - x_1}$