See Syllabus

Working on Schedule, now.

I'll send you an e-mail.

I will post today's and every day's notes on harryzaims.com

https://harryzaims.com/

Get the cheapest book you can. The edition doesn't matter.

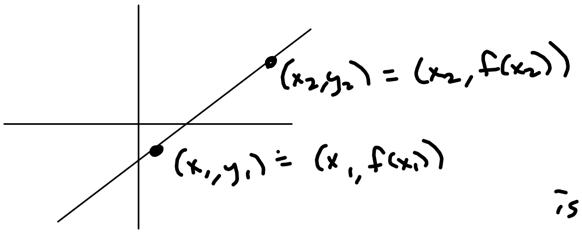
Also, the WebAssign comes with an eBook.

Working on Integrating WebAssign with D2L.

What is differential calculus?

Slope-on-a-curve question

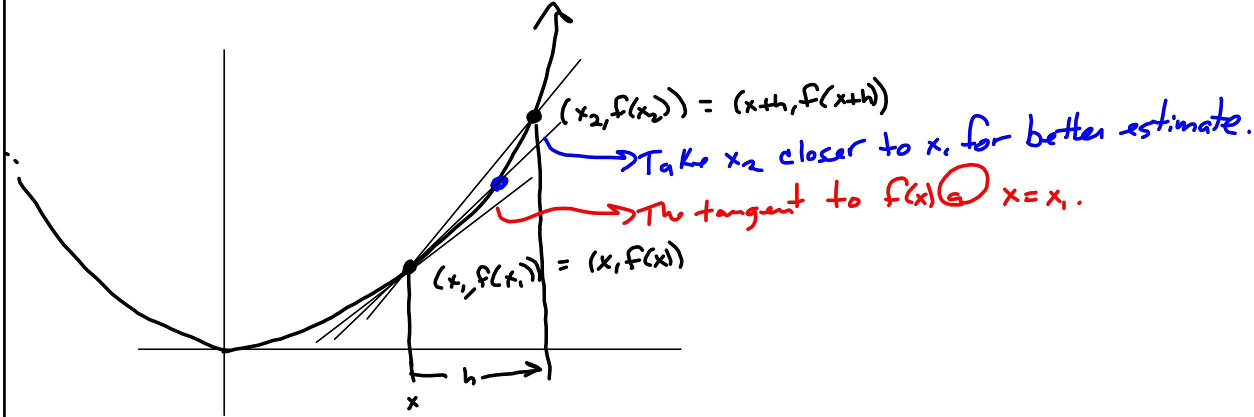
The tangent-line problem



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

is great for lines!

Sucks for curves!



Genius of Newton: Take the limit as x2 approaches x1, in order to obtain the best possible estimate of the slope of the tangent line.

$f(x) = x^2$

$$\text{Slope of secant line} = \frac{y_2-y_1}{x_2-x_1} = \frac{f(x_2)-f(x_1)}{x_2-x_1}$$

$$= \frac{x_2^2-x_1^2}{x_2-x_1} = \frac{\cancel{(x_2-x_1)}(x_2+x_1)}{\cancel{(x_2-x_1)}} = x_2+x_1 \xrightarrow{\text{Let } x_2 \to x_1} x_1+x_1 = 2x_1$$

Now, slope of x^2 @ $x_1 = 3$ is $2(3)=6$

And the tangent line goes thru $(3,9)$.

$m = 6, \quad (x_1,y_1) = (3,9)$

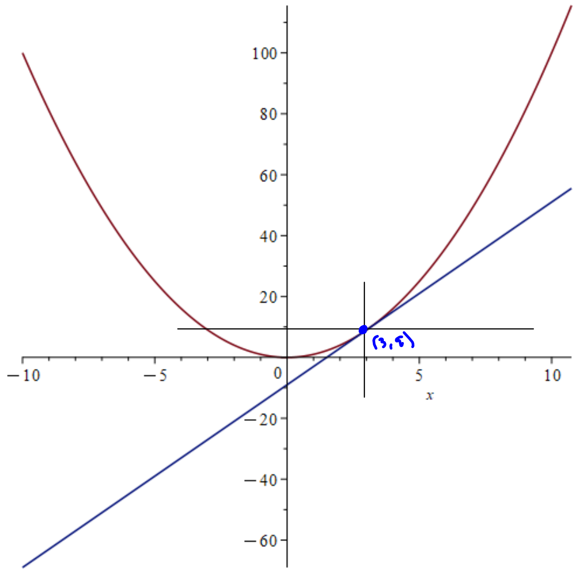
$y - y_1 = m(x-x_1)$ is your point-slope

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

$y = 6(x-3)+9$

$= 6x-18+9$

$y = 6x-9$



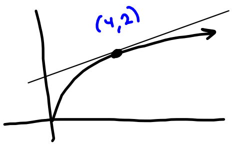
See ?
$y = 6x - 9$ is tangent to $y = x^2$ @ $(x, y) = (3, 9)$

Slope at a point by the limit definition.

Build the equation of the tangent line and graph it.

Find Slope of $f(x) = \sqrt{x}$ @ $x = 4$

Write eq'n of tangent line to $f(x)$ @ $x = 4$ $(y = 2)$



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

Allow $h \to 0$.

"Conjugate" of $\sqrt{x+h} - \sqrt{x}$

Trick: $$\left(\frac{\sqrt{x+h} - \sqrt{x}}{h}\right)\left(\frac{\boxed{\sqrt{x+h} + \sqrt{x}}}{\sqrt{x+h} + \sqrt{x}}\right)$$

$$(a-b)(a+b) = a^2 - b^2$$

$$= \frac{(\sqrt{x+h})^2 - (\sqrt{x})^2}{h(\sqrt{x+h} + \sqrt{x})} = \frac{x+h-x}{h(\sqrt{x+h} + \sqrt{x})} = \frac{\cancel{h}}{\cancel{h}(\sqrt{x+h} + \sqrt{x})}$$

$$= \frac{1}{\sqrt{x+h} + \sqrt{x}} \xrightarrow{h \to 0} \frac{1}{\sqrt{x+0} + \sqrt{x}} = \frac{1}{\sqrt{x} + \sqrt{x}}$$

(provided $h \neq 0$)

$$= \frac{1}{2\sqrt{x}} \;!$$

Slope @ $x = 4$ is

$$\frac{1}{2\sqrt{4}} = \frac{1}{2 \cdot 2} = \frac{1}{4} = m$$

$$y = \frac{1}{4}(x - 4) + 2$$

Lots of the early homework is drill and kill, trying to convince you that these limits do exist and work the way we say they do.

"Estimate the slope of the curve at (1, 1) =(1, f(1)), by finding the slope of secant lines from (1, 1) to

(1.1, f(1.1)), (1.01, f(1.01)), ..., (1.00001, f(1.00001)).

Domain of a function y = f(x) is the set of all x such that f(x) is real.

Really only 2 things to it:

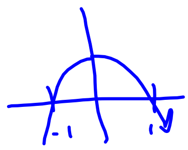
1. Can't divide by zero
2. Everything under an even-index radical must be nonnegative.

$f(x) = \sqrt{1-x^2}$

$\mathcal{D}$: Need $1-x^2 \geq 0$

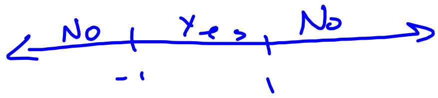
$(1-x)(1+x)$

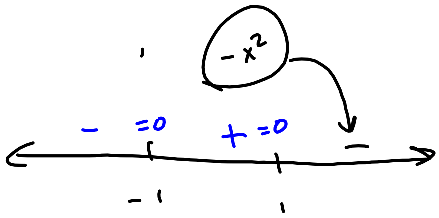
Key pts: $x = \pm 1$



Need $-1 \leq x \leq 1$

$\mathcal{D} = [-1,1]$





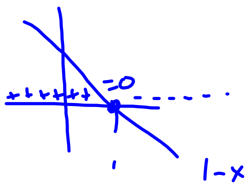
$(-\infty,-1)$: -2 $\quad 1-(-2)^2 = 1-4 = -3$ NO

$(-1,1)$: 0 $\quad 1-0^2 = 1 > 0$ Yes

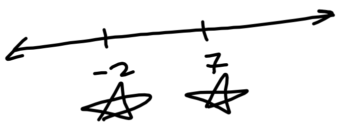
$(1,\infty)$: 2 $\quad 1-(2)^2 = -3$ NO

$(1-x)(1+x)$

$\mathcal{D} = [-1,1]$



$g(x) = \dfrac{1}{x^2-5x-14} = \dfrac{1}{(x-7)(x+2)}$



Need $x^2-5x-14 \neq 0$

$x^2-5x-14 \neq 0$

$(x-7)(x+2) \neq 0$

$x \neq 7$ and $x \neq 2$

Combo:

$\dfrac{1}{\sqrt{1-x^2}}$ Need $1-x^2 \geq 0$ "$\sqrt{\ }$"

Need $\sqrt{1-x^2} \neq 0$ $\quad \dfrac{\text{stuff}}{0}$ Bad

$\Updownarrow$

$1-x^2 \neq 0$

Combine: $\underline{1-x^2 > 0}$

$\mathcal{D}$: $(-1,1)$