Assignments for the Week of Sept 6:

- Read 2.1-2-2
- 45 minutes of Khan Academy
- Due Fri. 9 Sept:
  2.1 #1-41 odd; 65-89 odd
  2.2 #3-67 odd; 87-95 odd; 97-100 all; 105,106,111,113,115

$$\lim_{x\to 0} \frac{5x^4+8x^2}{3x^4-16x^2} = \lim_{x\to 0} \frac{\cancel{x^2}(5x^2+8)}{\cancel{x^2}(3x^2-16)}$$

$$= \frac{8}{-16} = -\frac{1}{2}$$

2.1 The Derivative & The Tangent Line Problem

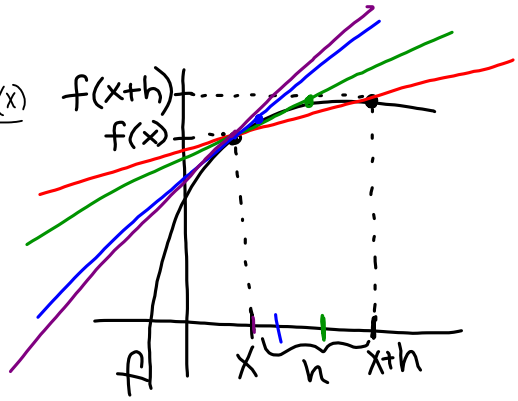
secant line
crosses through a function at two points

slope of the secant line:

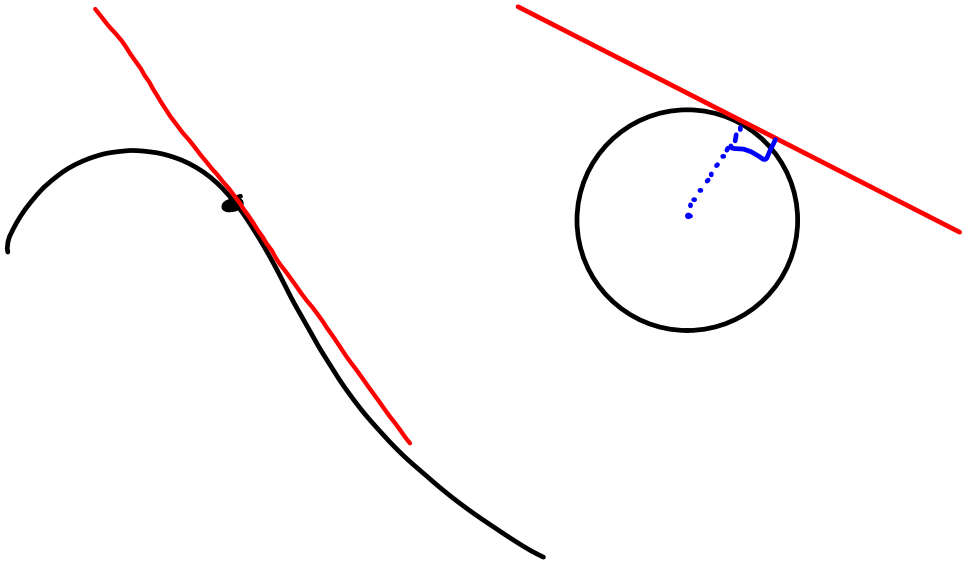
$$\frac{f(x+h)-f(x)}{x+h-x} = \frac{f(x+h)-f(x)}{h}$$

what happens as $h \to 0$?

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



As $h \to 0$, the secant line approximates the tangent line, and the limit is the slope of the tangent line and we call it **the derivative of f at x**.



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

$\boldsymbol{f'(x)}$	$"f\ prime\ of\ x"$
$\boldsymbol{\frac{dy}{dx}}$	$"derivative\ of\ y\ with\ respect\ to\ x"$
$\boldsymbol{y'}$	$"y\ prime"$
$\boldsymbol{\frac{d}{dx}[f(x)]}$	$"the\ derivative\ with\ respect\ to\ x\ of\ f(x)"$
$\boldsymbol{D_x[y]}$	$"the\ partial\ derivative\ with\ respect\ to\ x\ of\ y"$

The Derivative

The slope of the tangent line to the graph of f at the point $(c, f(c))$ is given by:

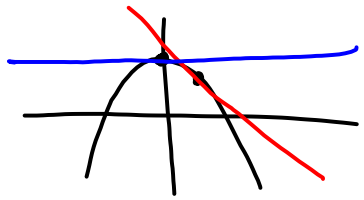
$$m = \lim_{\Delta x\to 0}\frac{\Delta y}{\Delta x} = \lim_{\Delta x\to 0}\frac{f(c+\Delta x)-f(c)}{\Delta x}$$

The derivative of f at x is given by

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

8. $g(x) = 5 - x^2$

find slope of tangent line at the points $(2,1)$ & $(0,5)$



$m = \lim_{\Delta x \to 0} \frac{f(c+\Delta x) - f(c)}{\Delta x}$

$(2,1) = (c, g(c))$

$m = \lim_{\Delta x \to 0} \frac{5 - (2+\Delta x)^2 - 1}{\Delta x}$

$= \lim_{\Delta x \to 0} \frac{4 - (4 + 4\Delta x + (\Delta x)^2)}{\Delta x}$

$= \lim_{\Delta x \to 0} \frac{-4\Delta x - (\Delta x)^2}{\Delta x} = \lim_{\Delta x \to 0} \frac{\Delta x(-4 - \Delta x)}{\Delta x}$

$= -4 - 0 = \boxed{-4}$

$m = \lim_{\Delta x \to 0} \frac{5 - (0+\Delta x)^2 - 5}{\Delta x}$

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

$= \boxed{0}$

20. $f(x) = x^3 + x^2$

find the derivative

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

$= \lim_{h \to 0} \frac{(x+h)^3 + (x+h)^2 - (x^3 + x^2)}{h}$

$= \lim_{h \to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 + x^2 + 2xh + h^2 - x^3 - x^2}{h}$

$= \lim_{h \to 0} \frac{h(3x^2 + 3xh + h^2 + 2x + h)}{h}$

$= \boxed{3x^2 + 2x}$