#7 Quiz 1

$\lim_{x \to 5} f(x) = 3 \qquad \lim_{x \to 5} g(x) = 1$

$$\lim_{x \to 5} \frac{6f(x) - 3g(x)}{5 + g(x)}$$

$$= \frac{\lim_{x \to 5} 6f(x) - \lim_{x \to 5} 3g(x)}{\lim_{x \to 5} 5 + \lim_{x \to 5} g(x)}$$

$$= \frac{6\lim_{x \to 5} f(x) - 3\lim_{x \to 5} g(x)}{5 + 1}$$

$$= \frac{6 \cdot 3 - 3 \cdot 1}{6}$$

$$= \frac{15}{6} = \frac{5}{2}$$

p. 106 #19 $f(x) = y = x^3 \quad (1, 1)$

$$y' = 3x^2 \Big|_{x=1} = 3 = m$$

evaluated at (vertical bar)

(a) tangent line:

(point-slope) $y = \underbrace{f(1)}_{y_1} + \underbrace{f'(1)}_{m}(x - \underbrace{1}_{x_1})$

$$y = 1 + 3(x - 1)$$

(b) normal:

$$y = \underbrace{f(1)}_{y_1} \underbrace{- \frac{1}{f'(1)}}_{m} (x - \underbrace{1}_{x_1})$$

$$y = 1 - \frac{1}{3}(x - 1)$$

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

$$m = \frac{y - y_1}{x - x_1}$$

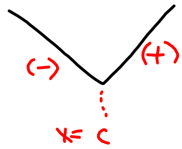
$$y = y_1 + m(x - x_1)$$

Topic: differentiability.

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

exists as two-sided limit

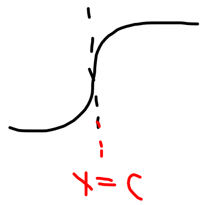
Ways functions can fail to be differentiable.

1. 

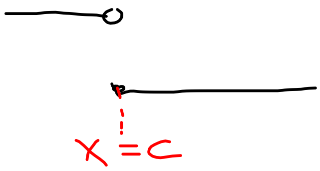
corner

2. 

cusp.

3. 

vertical tangent
$\lim_{h\to 0} \frac{f(c+h)-f(c)}{h} = \infty$

4. 

(jump) discont.

Differentiability $\Longrightarrow$ Local Linearity.

if differentiable @ $x=c$,

Then locally linear @ $x=c$

Local linear model of differentiable fcn $f(x)$ @ $x=c$ is ...

$$\boxed{y=\underbrace{f(c)}_{y_1}+\underbrace{f'(c)}_{m}(x-\underbrace{c}_{x_1})}$$

NDER in book

means numerical derivative on your calculator

$$\frac{d}{d\boxed{X}}\left(\boxed{Y_1}\right)\Big|_{x=\boxed{X}}$$

$nDeriv(Y_1, X, X)$

calculator uses a symmetric difference quotient to approx. the derivative