MA 121 - 002

Thursday, September 6

(1.3 ; 1.4)

1.1: LIMITS

$$\lim_{x\to\infty} \frac{f(x)}{g(x)}$$

(1) $\lim_{x\to\infty} \dots$

$$\frac{2x+1}{3x^2-5x+11} = \lim_{x\to\infty} \frac{\frac{2x}{x^2}+\frac{1}{x^2}}{\frac{3x^2}{x^2}-\frac{5x}{x^2}+\frac{11}{x^2}}$$

$\frac{3}{5} \dots \frac{4}{100} \dots \frac{5}{10,000} \dots \frac{7}{1,000,000} \dots \to 0$

$$= \lim_{x\to\infty} \frac{\frac{2}{x}+\frac{1}{x^2}}{3+\frac{5}{x}+\frac{11}{x^2}} = \frac{0}{3} = 0$$

(2) $\lim_{x\to\infty} \dots$

$$\frac{2x+1}{3x+5} = \text{same degree num \& denom}$$

$$\lim_{x\to\infty} \frac{\frac{2x}{x}+\frac{1}{x}}{\frac{3x}{x}+\frac{5}{x}} = \lim_{x\to\infty} \frac{2+\frac{1}{x}}{3+\frac{5}{x}} = \frac{2}{3}$$

(3) $\lim_{x\to\infty} \dots$

$$\frac{2x^2-x+5}{3x+4} = \text{D.N.E.}$$

$\frac{10}{3} \dots \frac{100}{4} \dots \frac{10,000}{7} \dots \frac{1,000,000}{11} \dots$

$$\lim_{x\to\infty} \frac{\frac{2x^2}{x^2} - \frac{x}{x^2} + \frac{5}{x^2}}{\frac{3x}{x^2} + \frac{4}{x^2}} = \text{D.N.E.}$$

$$= \lim_{x\to\infty} \frac{2 + \frac{1}{x} + \frac{5}{x^2}}{\frac{3}{x} + \frac{4}{x^2}} = \frac{2}{0}$$

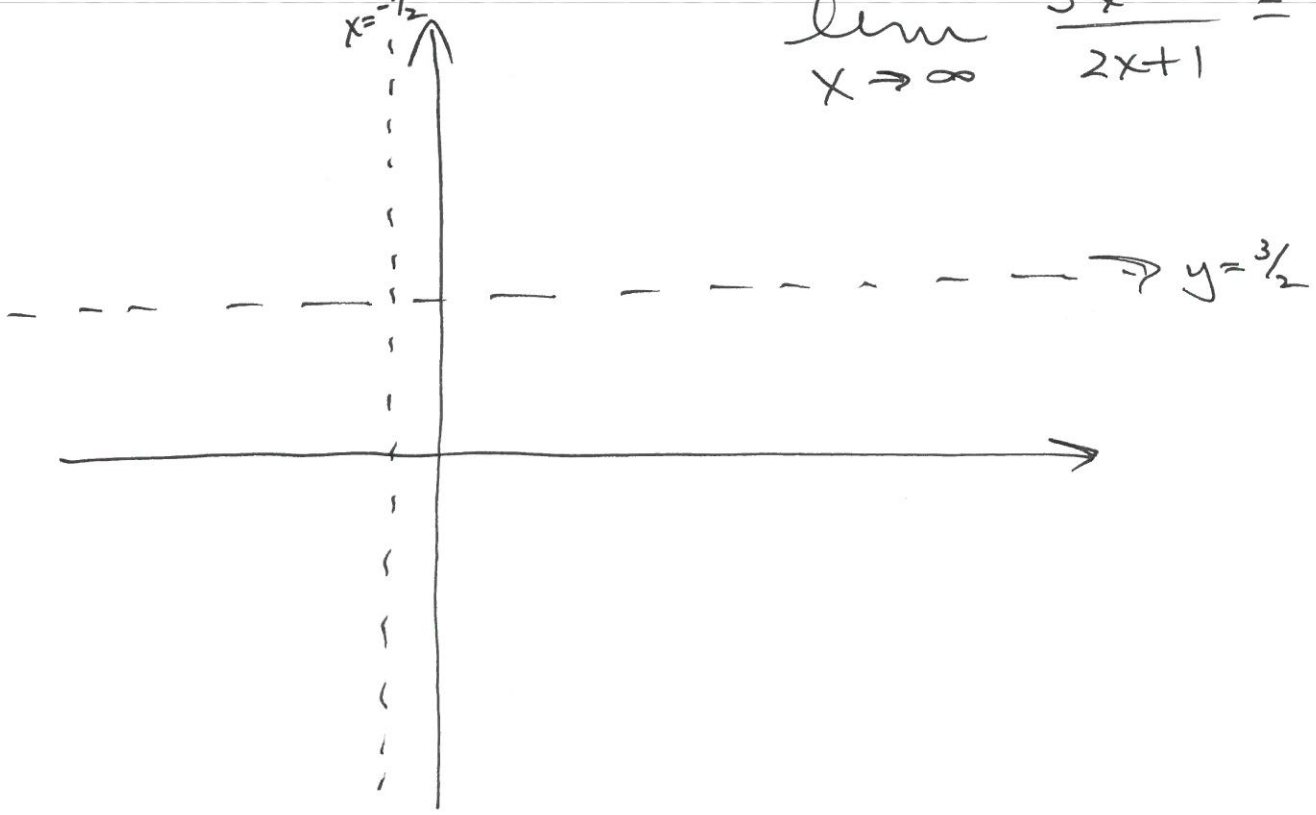
($\frac{1}{x} \to 0$, $\frac{5}{x^2} \to 0$, $\frac{3}{x} \to 0$, $\frac{4}{x^2} \to 0$)

$$f(x) = \frac{3x-5}{2x+1}$$

V.A.: $x = -1/2$

H.A.: $y = 3/2$

$$\lim_{x\to\infty} \frac{3x-5}{2x+1} = \frac{3}{2}$$

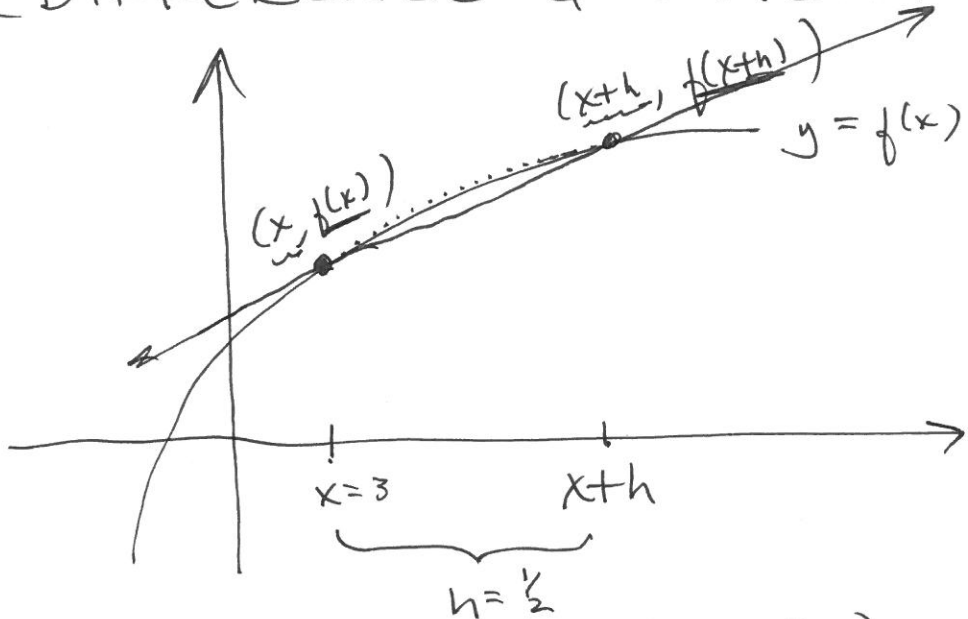


1.3:

AVERAGE RATE OF CHANGE

(SLOPE OF THE SECANT LINE) 2 pts of the curve

(DIFFERENCE QUOTIENT)



x = initial x-value

h = change in x

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

$f(x) = 3x^2 - 5x + 7$

find m_{SEC}; simplified difference quotient $(x+h)^2 = x^2+2xh+h^2$

$$m_{SEC} = \frac{f(x+h)-f(x)}{h} = \frac{[3(x+h)^2-5(x+h)+7]-[3x^2-5x+7]}{h}$$

$$m_{SEC} = \frac{3x^2+6xh+3h^2-5x-5h+7-3x^2+5x-7}{h}$$

$$= \frac{h(6x+3h-5)}{h} \quad (h \neq 0) = \boxed{6x+3h-5 = m_{SEC}}$$

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

$$f(x) = \frac{3}{2x+1}$$

$$m_{SEC} = \frac{f(x+h) - f(x)}{h} = \frac{\frac{3}{2(x+h)+1} - \frac{3}{2x+1}}{h}$$

$$= \left[\frac{3(2x+1)}{[2(x+h)+1](2x+1)} - \frac{3[2(x+h)+1]}{(2x+1)[2(x+h)+1]} \right] \cdot \frac{1}{h}$$

$$= \frac{3(2x+1) - 3[2(x+h)+1]}{[2(x+h)+1] \cdot (2x+1) \cdot h}$$

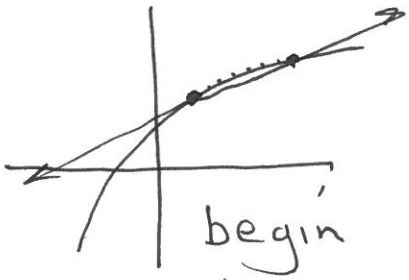
$$= \frac{6x + 3 - 6x - 6h - 3}{[2(x+h)+1] \cdot (2x+1) \cdot h} = \frac{h(-6)}{[2(x+h)+1] \cdot [2x+1] \cdot h}$$

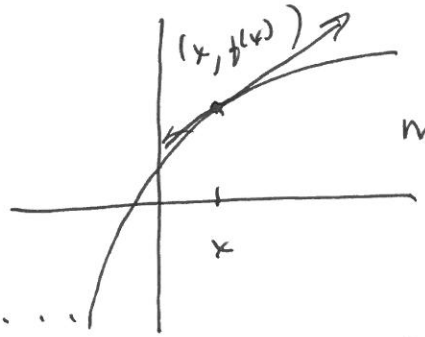
$(h \neq 0)$

$$= \boxed{\frac{-6}{[2(x+h)+1] \cdot [2x+1]} = m_{SEC}}$$

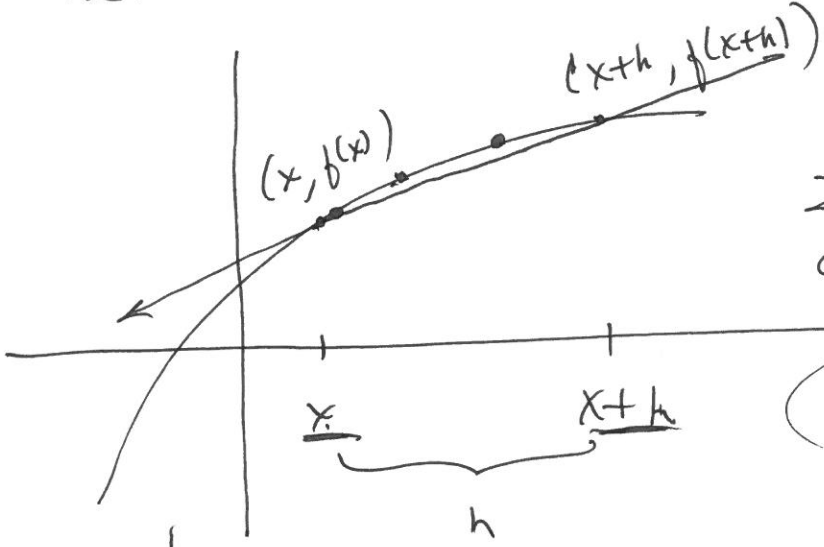
1.4:

INSTANTANEOUS RATE OF CHANGE (DERIVATIVE) (SLOPE OF THE TANGENT LINE)





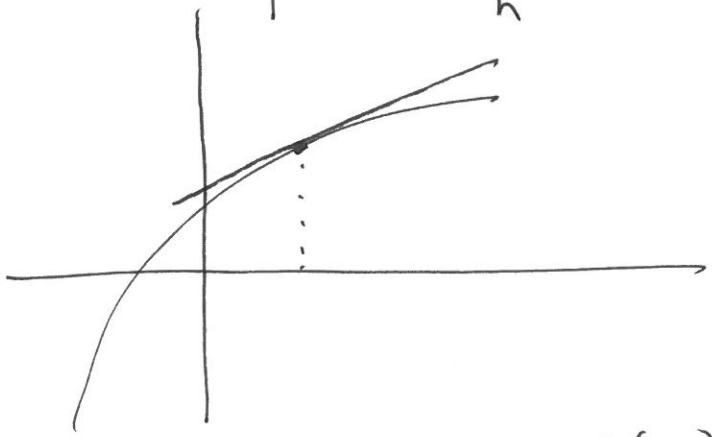
$$m = \frac{f(x) - f(x)}{x - x}$$



2 points closer ~~together~~

$h \to 0$

$(h \neq 0,$
$h = .000000000001$



$$m_{TAN} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = f'(x) = \text{INST. RATE OF CH.}$$

"prime"

DERIVATIVE

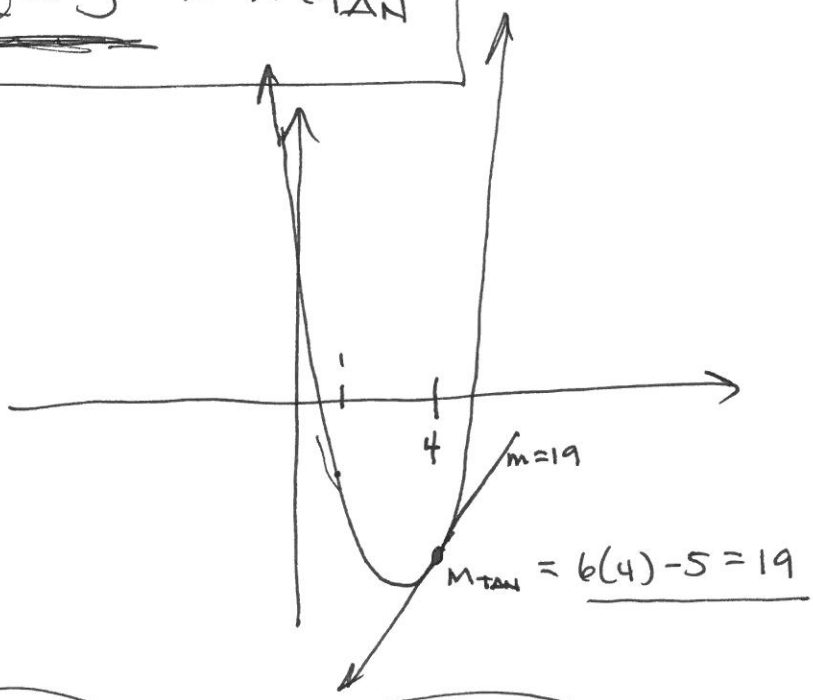
DEF. OF DERIV.

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

$f(x) = 3x^2 - 5x + 7$ ✓

$$f'(x) = \lim_{h \to 0} \frac{6x + 3h - 5}{(h \neq 0)}$$ ← from earlier today

$$f'(x) = 6x - 5 = m_{TAN}$$



$$f(x) = \frac{3}{2x+1}$$ ← from earlier today

$$m_{sec} = \frac{f(x+h) - f(x)}{h} = \frac{-6}{[2(x+h)+1] \cdot [2x+1]}$$

$$m_{TAN} = f'(x) = \lim_{h \to 0} \left(\frac{-6}{[2(x+\cancel{h}^{0})+1] \cdot [2x+1]} \right)$$

$$f'(x) = \frac{-6}{[2x+1] \cdot [2x+1]} = \frac{-6}{(2x+1)^2}$$

$f(x) = \dfrac{3}{2x+1}$

V.A.: $x = -1/2$

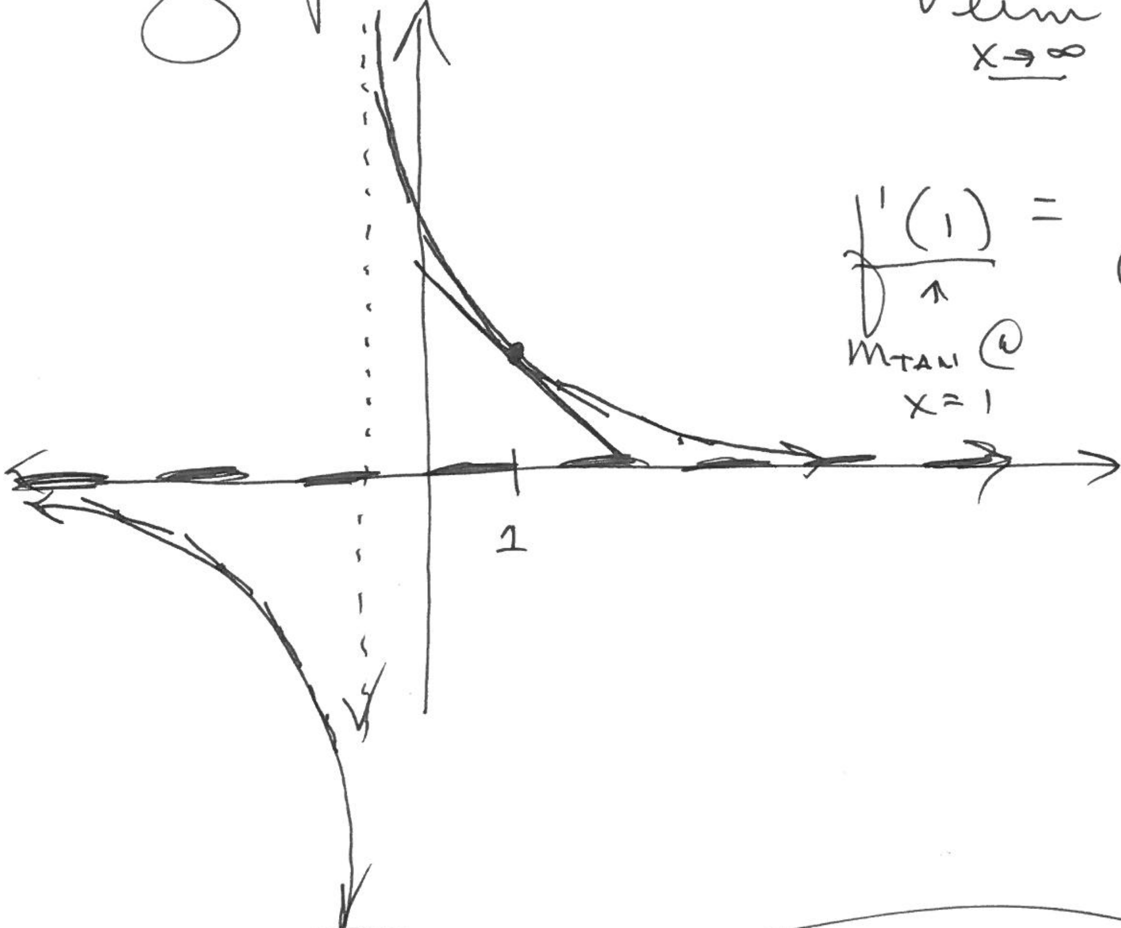
H.A.: $y = 0$

graph

$f'(x) = \dfrac{-6}{(2x+1)^2} = m_{TAN}$

DECR $f'(x) = \dfrac{-}{+} = (-)$

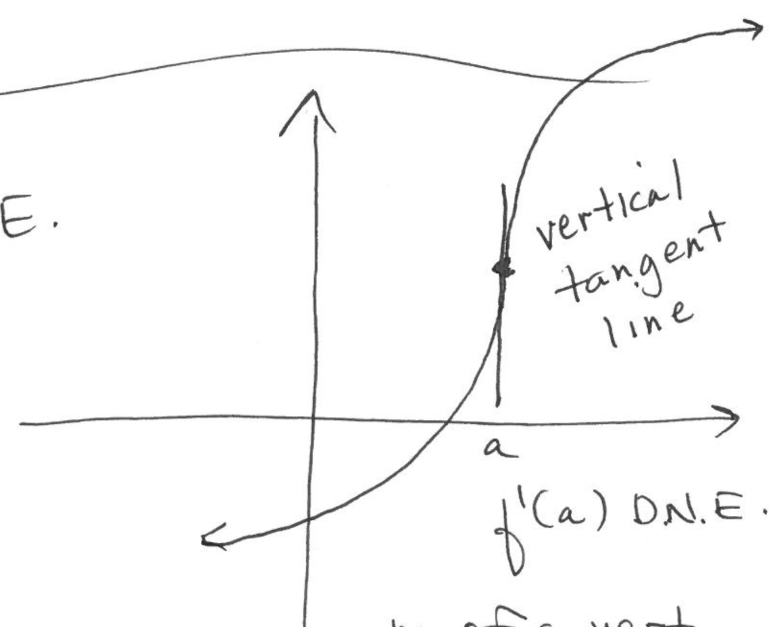
$\lim_{x \to \infty} \dfrac{3}{2x+1} = 0$



$f'(1) = \dfrac{-6}{(2(1)+1)^2} = \dfrac{-6}{9}$

m_{TAN} @ $x = 1$

$f'(1) = -2/3$



$f'(a)$ D.N.E.

m of a vert line is undef.

NC STATE FOOTBALL
FAITH & FAMILY DAY

SATURDAY, SEPTEMBER 8

VS. GEORGIA STATE

KICKOFF: 12:30 PM

CARTER-FINLEY STADIUM

11:30 @ P.N.C.

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