MA 121 − 002

Tuesday, January 29

- today: 1.5 ; TEST REVIEW
- THURSDAY (JAN. 31) TEST #1
  (R.1 → R.5 ; 1.1 → 1.5)

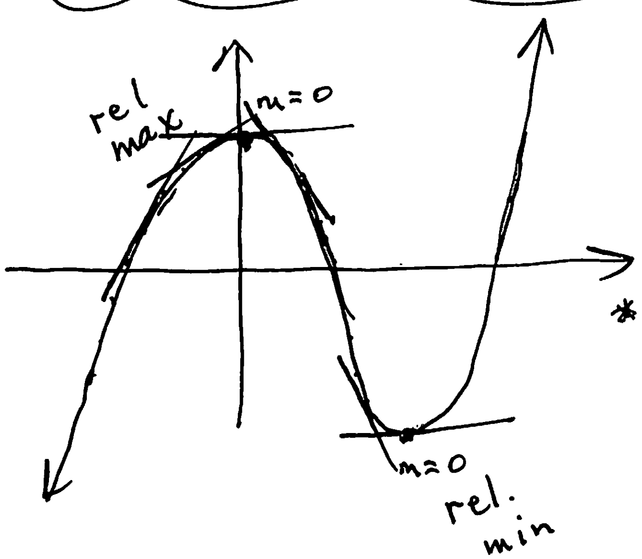
1.4:

DEF OF DERIV.

$f(x) =$ ~~~

find $f'(x)$ (m_{TAN} ; instantaneous rate of change)

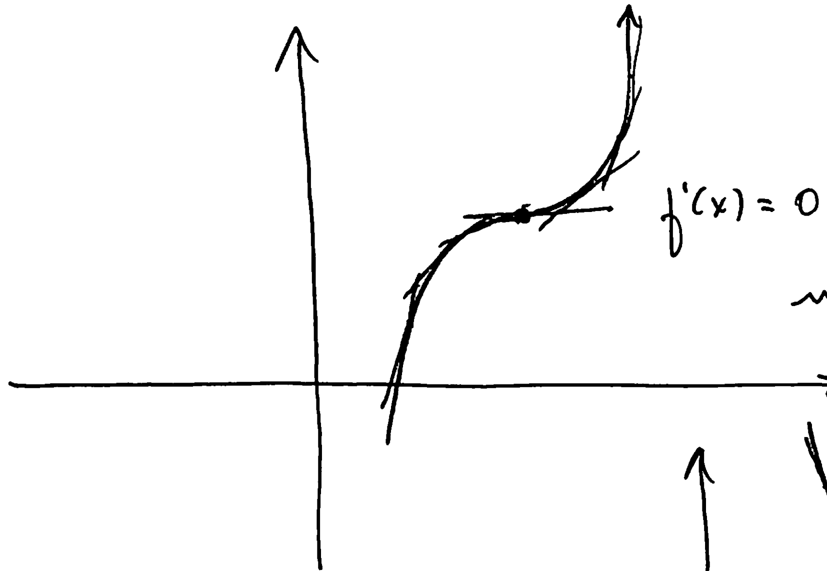
$$* \quad f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$



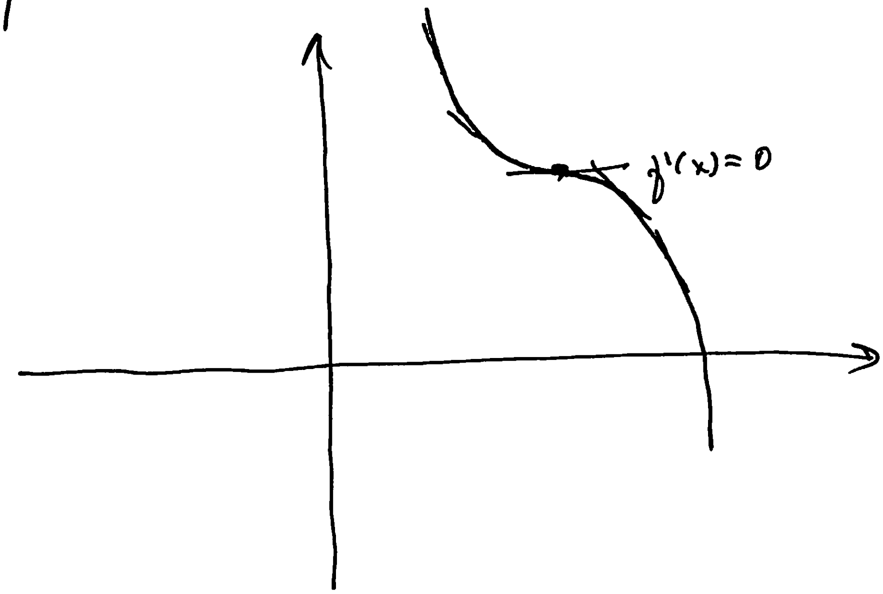
① $f'(x) = m_{TAN} = +$
($f(x)$ is INCR.)

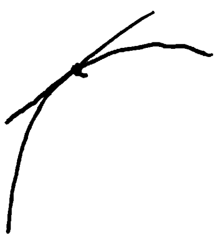
* ② $f'(x) = m_{TAN} = 0$
($f(x)$ is TRANS. from INCR to DECR or DECR to INCR)

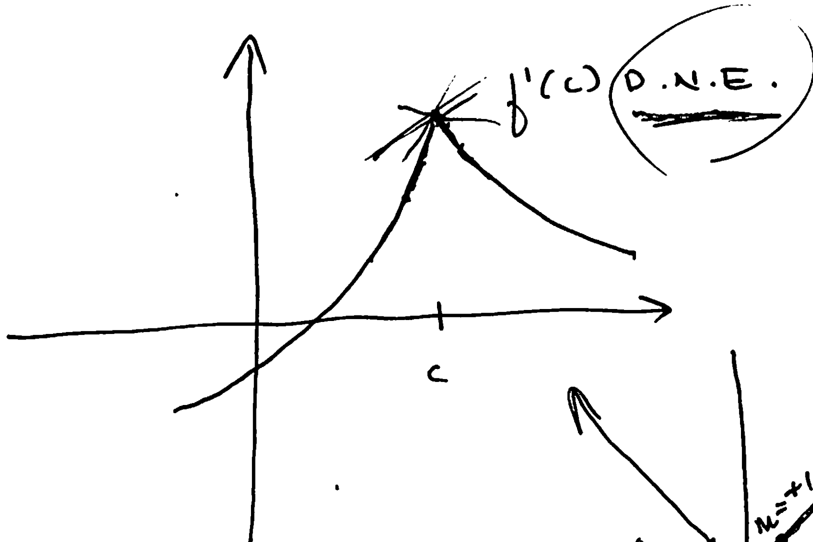
③ $f'(x) = m_{TAN} = -$
($f(x)$ is DECR.)



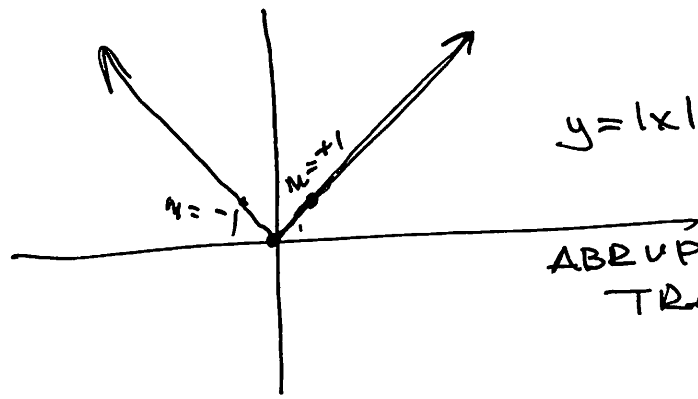
not rel max
nor rel min





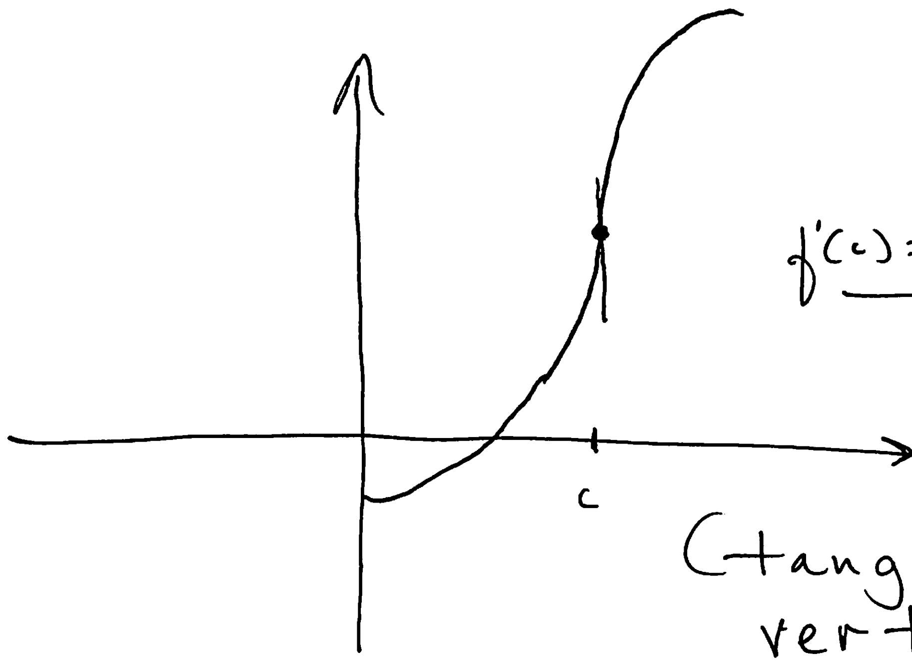


m of a vert line : undefined



$y = |x|$

ABRUPT TRANS.



$f'(c) = $ D.N.E.

(tangent line is vertical) slope is undef.

1.5:

NOTATION:

$f'(x)$; m_{TAN} ; $\dfrac{dy}{dx}$; $\dfrac{d(f(x))}{dx}$; $D_x y$

DERIV. OF Y WITH RESPECT TO X

power rule:

$f(x) = 5x^2$

① DEF: $f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$= \lim\limits_{h \to 0} \dfrac{5(x+h)^2 - 5x^2}{h}$

$= \lim\limits_{h \to 0} \dfrac{5(x^2+2xh+h^2) - 5x^2}{h}$

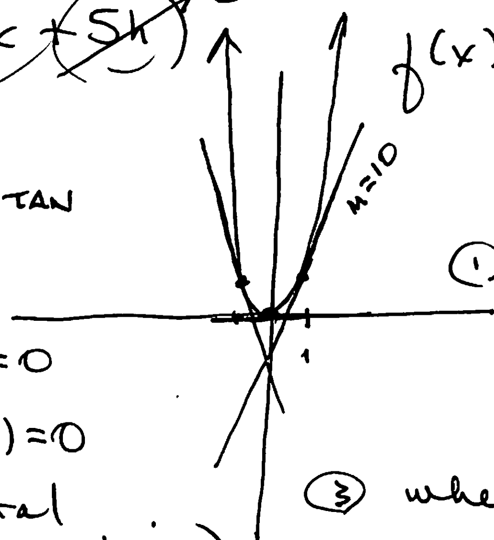
$$= \lim_{h \to 0} \frac{\cancel{5x^2} + 10xh + 5h^2 - \cancel{5x^2}}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(10x + 5h)}{\cancel{h}} \qquad (h \neq 0)$$

$$= \lim_{h \to 0} (10x + \cancel{5h}^{\,\to 0})$$

$$\boxed{f'(x) = 10x} = m_{TAN}$$

$f(x) = 5x^2$



① when $x = 1$

$f'(1) = 10(1)$

$= 10$

② when $x = 0$

$f'(0) = 10(0) = 0$

(horizontal tangent line)

③ when $x = -1$

$f'(-1) = 10(-1)$

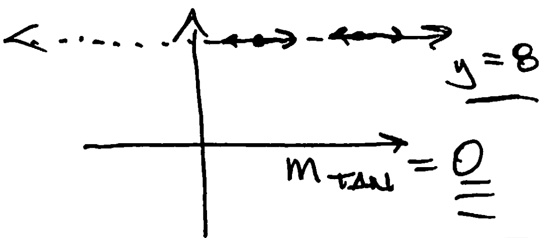
$= -10$

$f(x) = 5x^2 \qquad f'(x) = 5 \cdot (2x^{2-1}) = 10x$

power rule:

$f(x) = a \cdot x^k \qquad f'(x) = a \cdot (k \cdot x^{k-1})$

$$f'(x) = \lim_{h \to 0} \underbrace{\left[\frac{f(x+h) - f(x)}{h} \right]}_{\text{slope (2 pts)}}$$



$$f(x) = \underbrace{10x^3}_{} - \underbrace{8x^{-2}}_{} + \underbrace{5\sqrt[3]{x}}_{5x^{1/3}} + \underbrace{31x^{2/3}}_{} + \underbrace{8x^0}_{8(0)}$$

$$\frac{d\left(f(x) \pm g(x)\right)}{dx} = \frac{d\left(f(x)\right)}{dx} \pm \frac{d\left(g(x)\right)}{dx}$$

$$\frac{d(k)}{dx} = 0$$

DERIV OF A SUM IS THE SUM OF THE DERIVATIVES

$$f'(x) = 10(3x^2) - 8(-2x^{-3}) + 5\left(\tfrac{1}{3} x^{-2/3}\right) + 31\left(\tfrac{2}{3} x^{-1/3}\right)$$

$$f'(x) = 30x^2 + 16x^{-3} + \frac{5}{3} x^{-2/3} + \frac{62}{3} x^{-1/3} + 0$$

$$f'(x) = 30x^2 + \frac{16}{x^3} + \frac{5}{3x^{2/3}} + \frac{62}{3x^{1/3}}$$

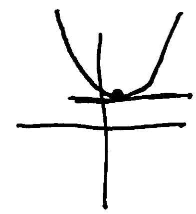
$$8^{2/3} = \left[\sqrt[3]{8}\right]^2 = 4$$

$$\sqrt[3]{8^2}$$

find the point(s) at which the tangent line is horizontal

$f'(x) = 0$

(VERTEX)



$$f(x) = 5x^2 - 3x + 8$$

$$f'(x) = \boxed{10x - 3 = 0}$$

$$\frac{\cancel{10}x}{\cancel{10}} = \frac{3}{10}$$

$$x = \frac{3}{10}$$

$$V\left(\frac{3}{10}, f\left(\frac{3}{10}\right)\right)$$

$$f(x) = ax^2 + bx + c$$

$$f'(x) = \boxed{2ax + b = 0}$$

$$\frac{\cancel{2a}x}{\cancel{2a}} = \frac{-b}{2a}$$

$$x = \frac{-b}{2a}$$

$$V\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$$