MA 121 - 002

Tuesday, September 11

1.5:

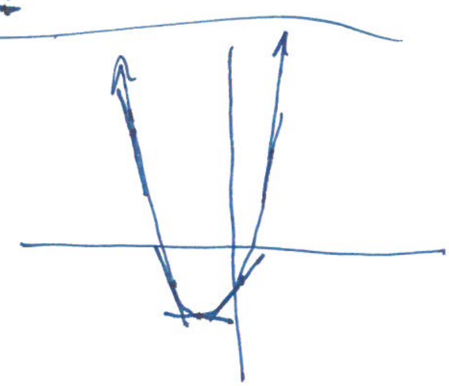
$f(x) = 3x^2 - 5x + 7$ ← parabola

$y = mx + b$

DEF. OF DERIV.

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

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



power rule (exponent rule)

$f(x) = a \cdot x^n$

$f'(x) = a \cdot [n \cdot x^{n-1}] = m_{TAN}$

polynomial: n is a non-neg. integer

$f(x) = 8x^5$

$f'(x) = 8 \cdot [5 \cdot x^{5-1}]$

$f'(x) = 8 \cdot (5x^4)$

$f'(x) = 40x^4$

$f'(2) = 40(2)^4 =$ ___

sum/difference rule

$y = f(x) \pm g(x)$

$y' = f'(x) \pm g'(x) = m_{TAN}$

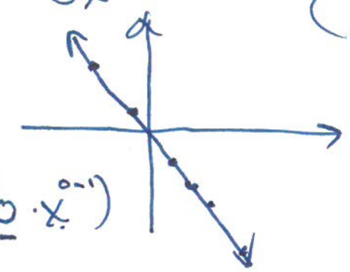
$$f(x) = 3x^2 - 5x^1 + 7x^0$$

$$f'(x) = 3(2\cdot x^{2-1}) - 5(1\cdot x^{1-1}) \quad 7(\underline{0}\cdot x^{0-1})$$

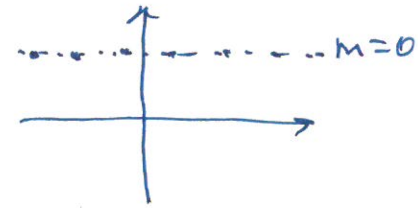
$$f'(x) = 6x^1 \ \underline{-5} + \underline{0}$$

$$\underline{f'(x) = 6x - 5}$$

$y = -5x$



$y = 7$



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

not power rule ....
LATER

$$f(x) = 4\cdot x^{-2}$$ not polynom....

$$f'(x) = 4\cdot\left[-2\cdot x^{-2-1}\right]$$

$$f'(x) = -8x^{-3} = \frac{-8}{x^3} = m_{TAN}$$

$$f'(0) = \text{D.N.E.}$$

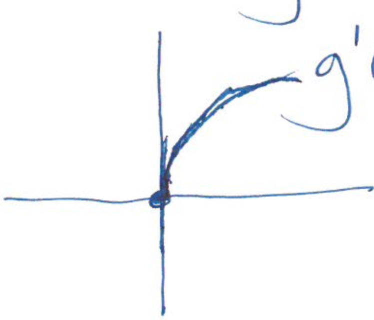
$g(0) = 0$

$(0,0)$

$$\boxed{g(x) = \frac{13}{7}x^{2/3}}$$ not polynom,

$$g'(x) = \frac{13}{7}\cdot\left[\frac{2}{3}\cdot x^{2/3-1}\right]$$

$$g'(x) = \frac{26}{21}x^{-1/3} = \boxed{\frac{26}{21\cdot\sqrt[3]{x}} = g'(x)}$$



$g'(\underline{0}) \Rightarrow$ D.N.E.

VERTICAL TANGENT LINE AT $(0,0)$

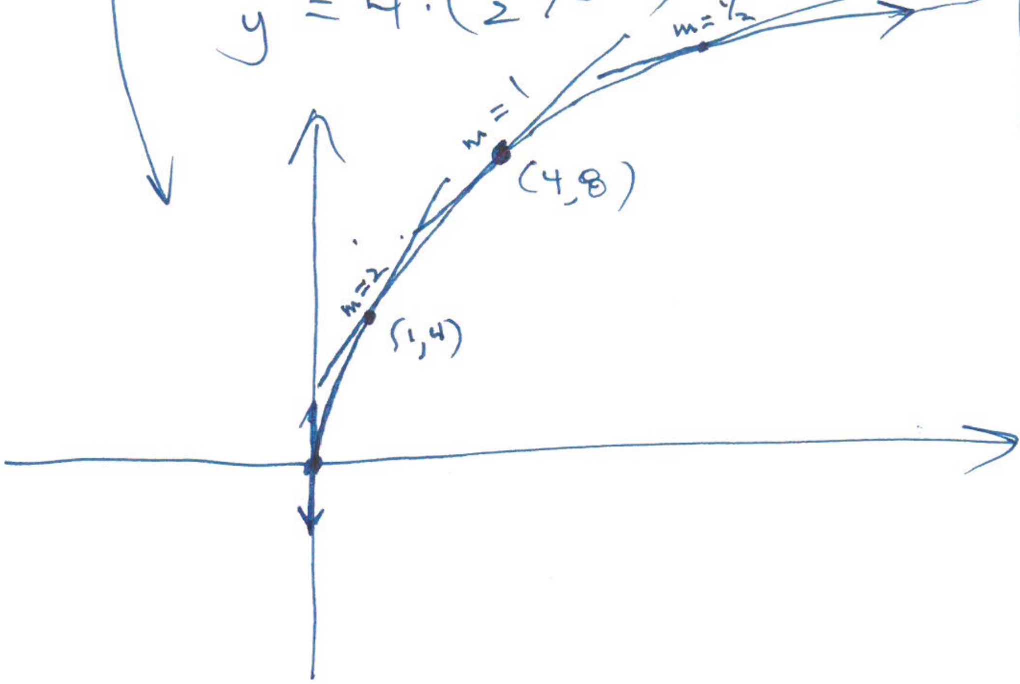
$$y = 4\sqrt{x}$$

x	y	
0	0	$\to (0,0)$ VERTICAL TANGENT LINE
1	4	$\to (1,4)$
4	8	$\to (4,8)$

rewrite:

$$y = 4 \cdot x^{1/2}$$

$$y' = 4 \cdot \left(\frac{1}{2} x^{1/2 - 1}\right) = 2x^{-1/2} = \boxed{\frac{2}{\sqrt{x}} = y'}$$



y' when $x = 1$:

$$y' = \frac{2}{1} = 2$$

y' when $x = 4$:

$$y' = \frac{2}{\sqrt{4}} = 1$$

$$f(x) = ax^2 + bx + c \quad \text{parabola} \; (a \neq 0)$$

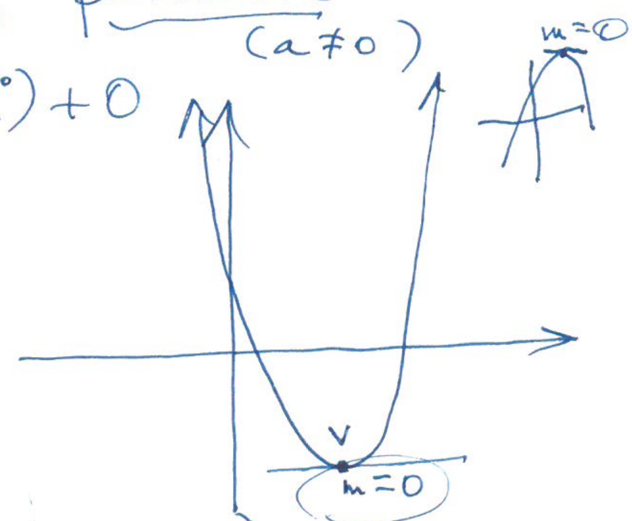
$$f'(x) = a \cdot (2x) + b(1 \cdot x^0) + 0$$

$$f'(x) = 2ax + b$$

$$2ax + b = 0$$

$$2ax = -b$$

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



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

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

find the equation of the tangent line to this curve at the point $(4, 14)$

$y - y_1 = m(x - x_1)$ ✓

$y - 14 = m(x - 4)$

slope of the tangent line

$m_{TAN} = g'(x) = 2x - \frac{1}{2}x^{-1/2}$

$\boxed{g'(x) = 2x - \frac{1}{2\sqrt{x}}}$

$g'(4) = 2(4) - \frac{1}{2\sqrt{4}} = 8 - \frac{1}{4}$

$g'(4) = \frac{32}{4} - \frac{1}{4} = \frac{31}{4}$

$* \boxed{y - 14 = \frac{31}{4}(x - 4)} *$

$y = \frac{31}{4}(x-4) + 14$

$y = \frac{31}{4}x - \frac{31}{4} \cdot 4 + 14$

$y = \frac{31}{4}x$ ______

1.6:

product rule & quotient rule:

$y = x^2$

$y' = 2x$

$y = x^2 = x \cdot x$

$y' \neq 1 \cdot 1 \neq 1$

$y = x \cdot x$

$y' \overset{??}{=} x \cdot (1) + x(1)$

$y' = 2x$

$y = f(x) \cdot g(x)$

$$\boxed{y' = f(x) \cdot g'(x) + g(x) \cdot f'(x)}$$

ex:

$y = (3 \cdot x + 1)(4 \cdot x - 5)$

$y' = (3x+1) \cdot 4 + (4x-5) \cdot 3$

$y' = 12x + 4 + 12x - 15$

$y' = 24x - 11$

$y = 12x^2 - 11x - 5$

$\boxed{y' = 24x - 1}$

quotient rule:

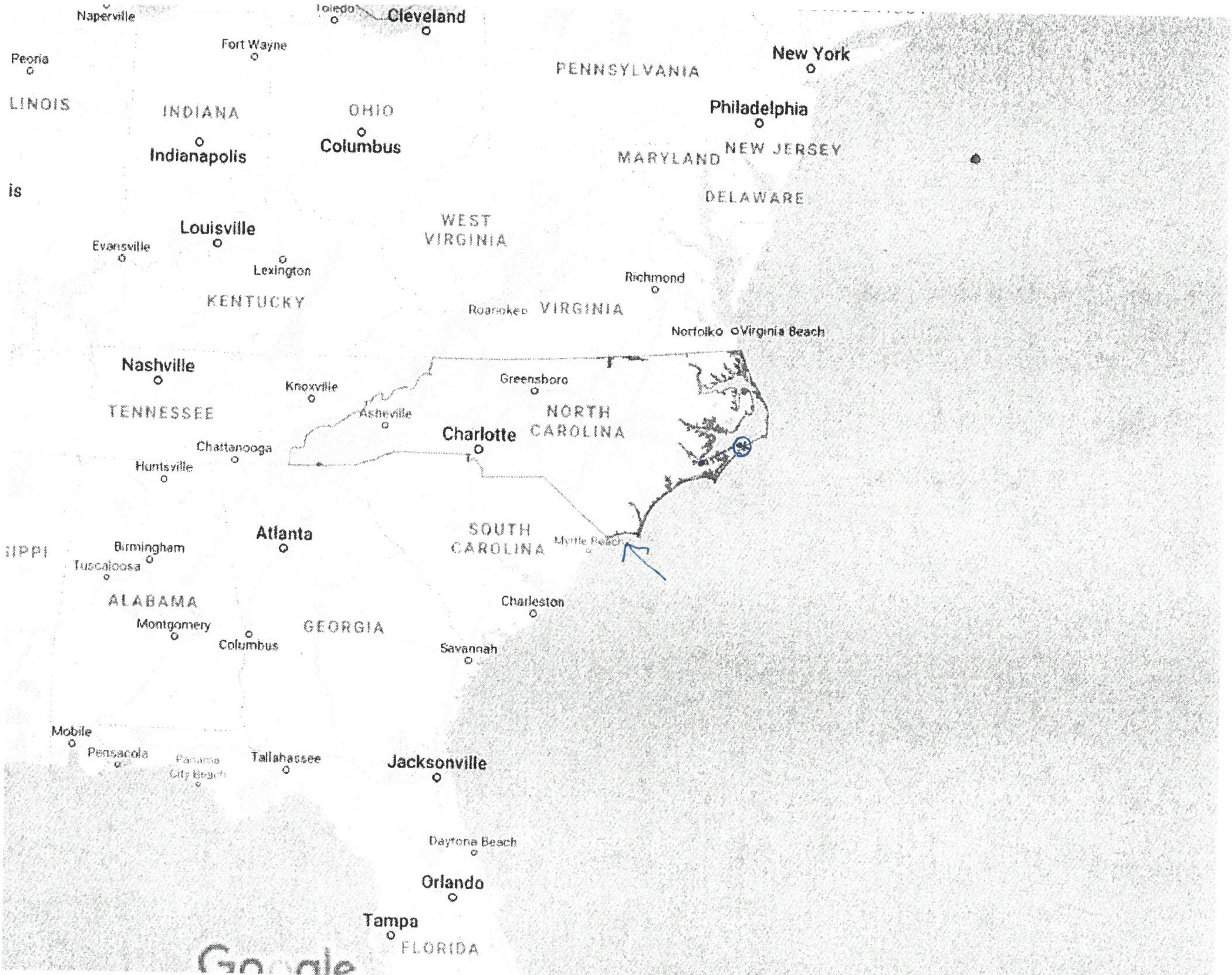
$$y = \frac{f(x)}{g(x)}$$

$$y' = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$$

ex: $$y = \frac{2x+1}{5x-4}$$

$$y' = \frac{(5x-4) \cdot (2) - (2x+1) \cdot 5}{(5x-4)^2}$$

$$y' = \frac{\cancel{10x} - 8 - \cancel{10x} - 5}{(5x-4)^2} = \frac{-13}{(5x-4)^2} = m_{TAN}$$



Naperville
Toledo
Cleveland
Fort Wayne
Peoria
PENNSYLVANIA
New York
Philadelphia
LINOIS
INDIANA
OHIO
Indianapolis
Columbus
MARYLAND
NEW JERSEY
DELAWARE
is
Louisville
WEST VIRGINIA
Evansville
Lexington
Richmond
KENTUCKY
Roanoke
VIRGINIA
Norfolk
Virginia Beach
Nashville
Greensboro
Knoxville
NORTH CAROLINA
TENNESSEE
Asheville
Charlotte
Chattanooga
Huntsville
SOUTH CAROLINA
Atlanta
Myrtle Beach
Birmingham
Tuscaloosa
ALABAMA
Charleston
Montgomery
Columbus
GEORGIA
Savannah
Mobile
Pensacola
Panama City Beach
Tallahassee
Jacksonville
Daytona Beach
Orlando
Tampa
FLORIDA