MA121 – 002

Tuesday, February 5

- tests returned on Thursday, 2/7
- today (1.6; 1.7) chain rule

(1.6: product rule, quotient rule)

1.6:

DERIV: (m_{tan}; INST. RATE OF CHANGE)

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

2.) ~~DEF~~ DERIV OF A SUM / DIFF. ✓

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

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

3.) DERIV OF A CONSTANT: ✓

$f(x) = K \qquad f'(x) = 0$

4.) POWER RULE:

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

$f'(x) = \underline{a \cdot (n} \cdot x^{n-1})$

ex: $f(x) = 13x^5 - 11x^2 + 2x - 3\sqrt{x} + \frac{5}{x} - 7$

$-3x^{1/2} \qquad +5x^{-1}$

$f'(x) = 13(5x^4) - 11(2 \cdot x) + 2(1 \cdot x^0) - 3(\frac{1}{2}x^{-1/2})$
$+ 5(-1 \cdot x^{-2}) - 0$

5.) product rule

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

ex: $y = (3x+1)(5x-4)$

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

DERIV

or $\left[y' = f(x) \cdot g'(x) + g(x) \cdot f'(x) \right]$

ex: $y = (3x+1)(5x-4)$ ✓

$y' = (3x+1) \cdot \frac{d[5x-4]}{dx} + (5x-4) \cdot \frac{d[3x+1]}{dx}$

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

$y' = 15x + 5 + 15x - 12$

$\boxed{y' = 30x - 7} = m_{TAN}$

check: $y = (3x+1)(5x-4)$

$y = 15x^2 + 5x - 12x - 4$

$y = 15x^2 - 7x - 4$

$y' = 15(2x) - 7(1) - 0$

$y' = 30x - 7$

$$y = \left(15x - \frac{5}{x} + 11\right)\left(32x^4 \cdot \cdot \cdot \cdot\right)$$

6.) quotient rule:

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

* order imp. *

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

ex: $y = \dfrac{(3x+4)}{(5x-1)}$

$$y' = m_{TAN} = \frac{(5x-1) \cdot 3 - (3x+4) \cdot 5}{[5x-1]^2}$$

$$y' = \frac{15x - 3 - (15x + 20)}{(5x-1)^2}$$

$$y' = \frac{\cancel{15x} - 3 - \cancel{15x} - 20}{(5x-1)^2} = \frac{-23}{(5x-1)^2}$$

$$y' = m_{TAN} = \frac{-23}{(5x-1)^2}$$

$f'(2) =$

ORIG $y = \dfrac{3x+4}{5x-1}$

$$y = \frac{3x+4}{5x-1}$$

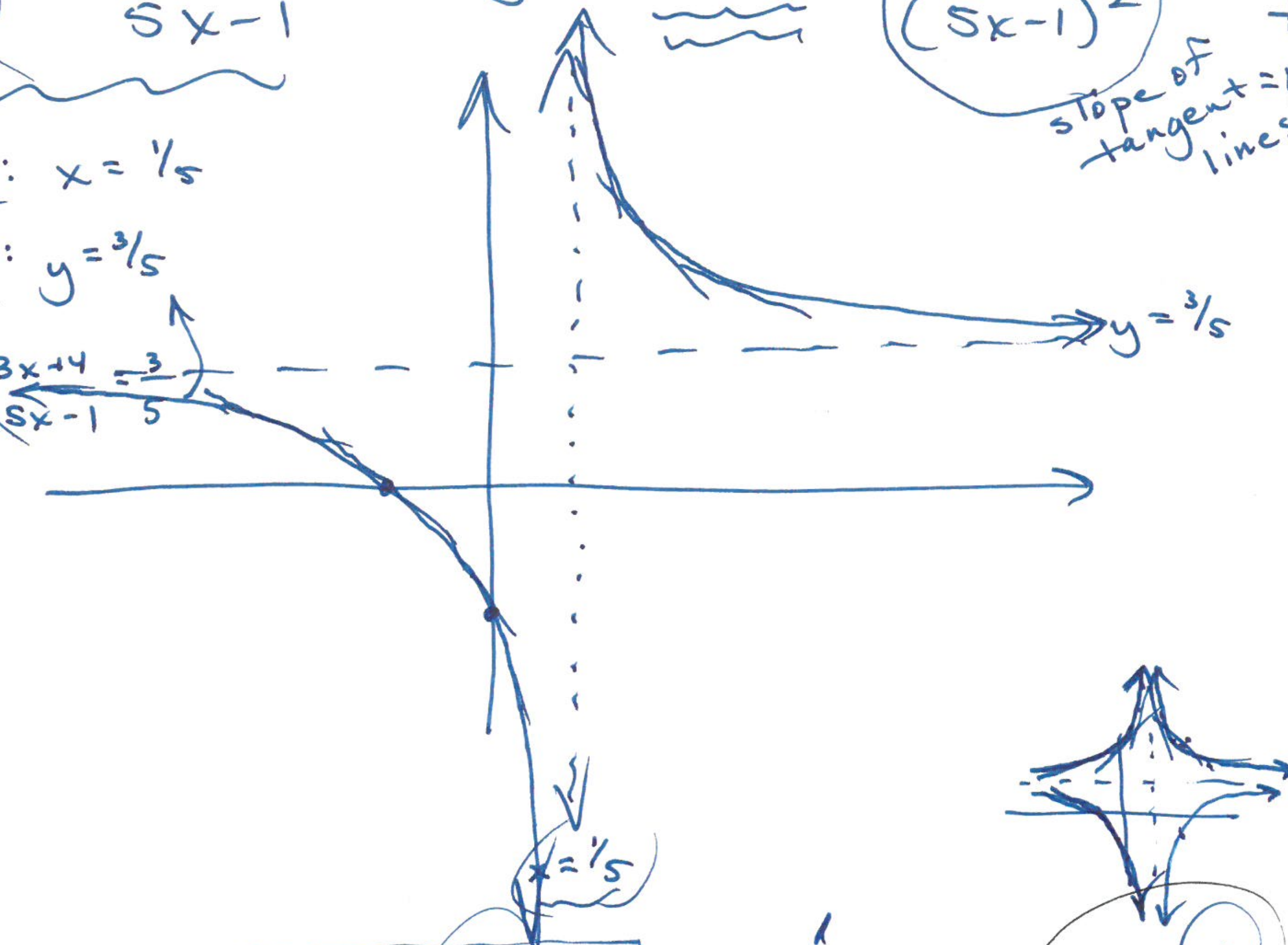
$$y' = m_{TAN} = \frac{-23}{(5x-1)^2} = \frac{-}{+}$$

slope of tangent lines = NEG

V.A.: $x = 1/5$

H.A.: $y = 3/5$

$$\lim_{x \to \infty} \frac{3x+4}{5x-1} = \frac{3}{5}$$



$$\boxed{y' = \frac{-23}{(5x-1)^2}}$$

$$y' = -23(5x-1)^{-2}$$

chain rule

$y'' = ??$

$(5x-1)^2 = 25x^2 - 10x + 1$

$$y'' = \frac{(5x-1)^2 \cdot (0) - (-23) \cdot (50x-10)}{\left[(5x-1)^2\right]^2}$$

ex: quotient rule

$$y = \frac{3 - x^3}{x^5}$$

$$y' = m_{TAN} = \frac{(x^5)\cdot(-3x^2) - (3 - x^3)(5x^4)}{(x^5)^2}$$

$$y' = \frac{-3x^7 - (15x^4 - 5x^7)}{x^{10}}$$

$$y' = \frac{-3x^7 - 15x^4 + 5x^7}{x^{10}}$$

$$y' = \frac{2x^7 - 15x^4}{x^{10}} = \frac{2x^7}{x^{10}} - \frac{15x^4}{x^{10}}$$

$$\boxed{y' = \frac{2}{x^3} - \frac{15}{x^6}}$$

$$y = \frac{3 - x^3}{x^5} = \frac{3}{x^5} - \frac{x^3}{x^5}$$

$$y = 3x^{-5} - 1 \cdot x^{-2}$$

$$y' = -15x^{-6} - (-2)x^{-3}$$

$$y' = -15x^{-6} + 2x^{-3}$$

7.) chain rule:

$y = 11x^5 \quad y' = 11(5 \cdot x^4)$

$y = 11\underline{(2x-1)^5} \quad y' = ??$ need a $\underline{\text{NEW}}$ rule

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$y = (2x-1)^2$

power rule $y' \neq 2(2x-1)^1 = 4x-2$

$y = (2x-1)^2 = 4x^2 - 4x + 1$

$\boxed{y' = 8x - 4}$

not equal

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chain rule:

$y = [f(x)]^n$

① EXTENDED POWER RULE: $y' = \underbrace{n \cdot [f(x)]^{n-1}} \cdot \underline{f'(x)}$

ex: $y = 11\underline{(2x-1)}^5$

$y' = 11[5(2x-1)^4]\,2$ chain rule part

$\boxed{y' = 110(2x-1)^4}$