MA121 – ♥♥2

Thursday, February 14

- quiz #1 due
- 2.1: FIRST DERIV

  1. find y'
  2. $y' = 0$; y' UNDEF
     (critical values ... critical points) → $(x_1, f(x_1))$ $(x_2, f(x_2))$
  3. $f'(x)$: (SIGN CHART)

     $f'(x) = +$ | $f'(x) =$ | $f'(x) =$

     $f(x)$ INCR. x_1 $f(x)$ .... x_2 $f(x)$....
  4. REL MAX/MIN ; ABSOLUTE MAX/MIN

- 2.2: SECOND DERIV

  1. find y''
  2. $y'' = 0$; y'' UNDEF
  3. $f''(x)$: (SIGN CHART)

     $\boxed{f''(x):}$

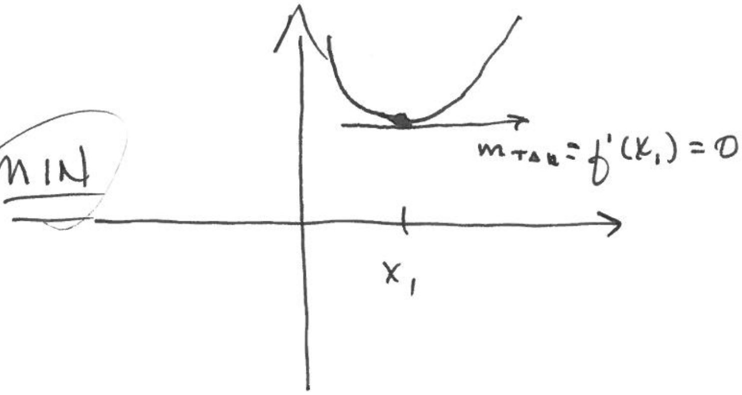
     $f''(x) =$ | $f''(x) = +$ | $f''(x) =$ ...

     $f(x)$ .... x_3 $f(x)$ C. UP x_4 $f(x)$....
  4. POINTS OF INFLECTION ??
     changes concavity there

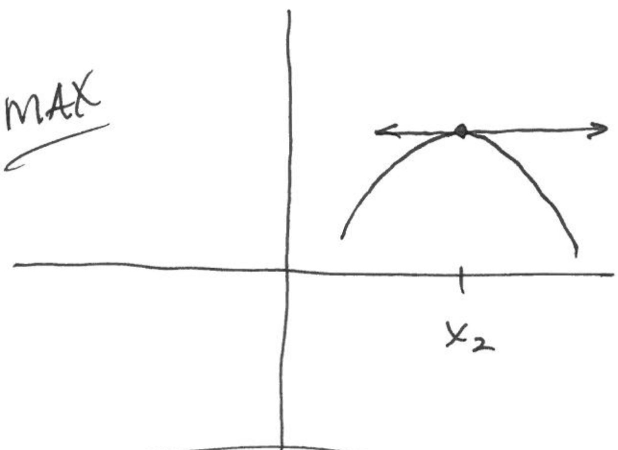
- today (2.3 ; 2.4)

2.1 & 2.2:

$$\left.\begin{array}{l} f'(x_1) = 0 \\ f''(x_1) = + \end{array}\right\} \text{MIN}$$



$$\left\{\begin{array}{l} f'(x_2) = 0 \\ f''(x_2) = - \end{array}\right\} \text{MAX}$$



2.3: Comprehensive Graphing $y = \frac{f(x)}{g(x)}$

1.) vertical asymptotes

$g(x) = 0$ $\quad x = K$

2.) horizontal asymptotes

$y = K$ $\quad \lim\limits_{x\to\infty} \frac{f(x)}{g(x)} = \_\_\_$

3.) "hole" in the graph:

$y = \frac{\cancel{(x-4)}(x+1)}{\cancel{(x-4)}(x-5)}$ $\quad x \neq 4$

$\boxed{y = \frac{1 \cdot x + 1}{1 \cdot x - 5}}$

VA: $x = 5$

HA: $y = 1$

hole: $(4, \frac{5}{-1}) = (4, -5)$

4.) slant or oblique asymptote

oblique asymp:

$$y = \frac{x^2+4x-3}{x+5}$$

H.A.: $\lim_{x\to\infty} \frac{x^2+4x-3}{x+5}$ = NO LIM

(no H.A.)

$$\begin{array}{r} x - 1 + \frac{2}{x+5} \\ x+5 \overline{)\, x^2+4x-3} \\ -(x^2+5x) \\ \hline -1x-3 \\ -(-1x-5) \\ \hline +2 \end{array}$$

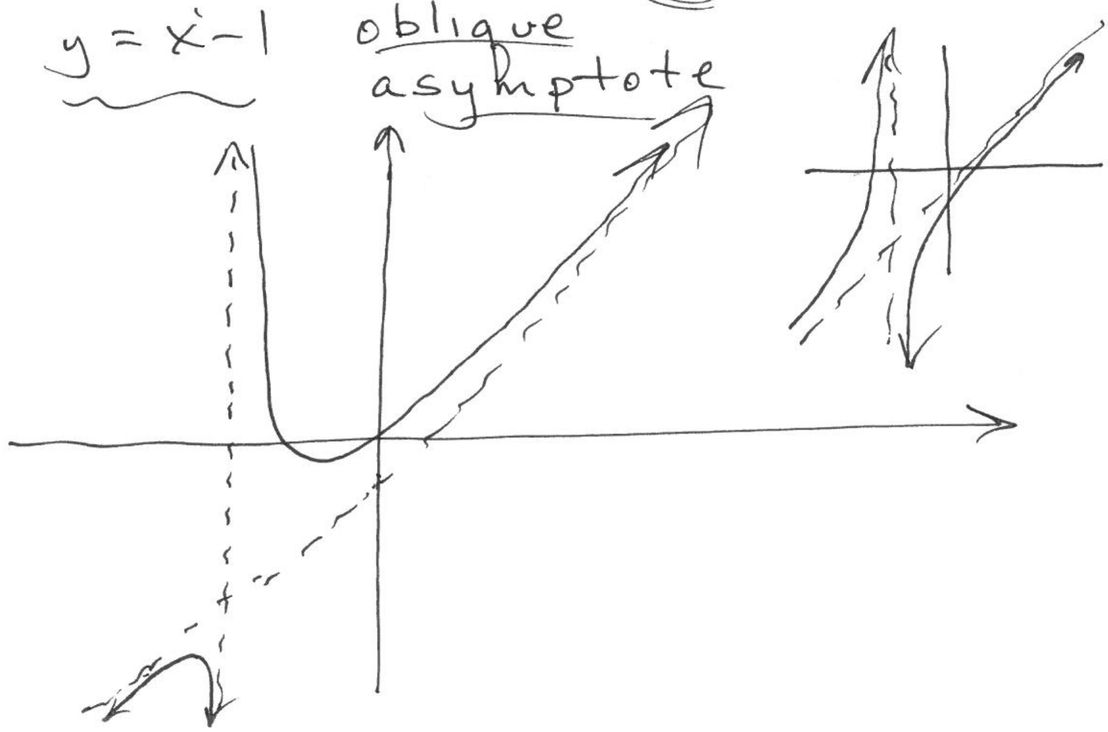
$$\boxed{y = \frac{x^2+4x-3}{x+5}} = x - 1 + \frac{2}{x+5}$$

V.A.: $x = -5$

H.A.: none

$$y = \boxed{x-1} + \frac{2}{x+5} \qquad x \to \infty,\ \frac{2}{x+5} \to 0$$

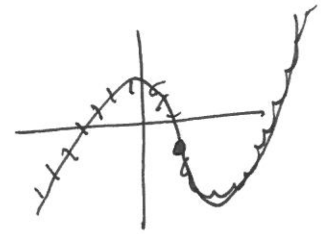
$y = x - 1$ oblique asymptote



interceptS

① x-int: (set $y=0$)

② y-int: (set $x=0$)



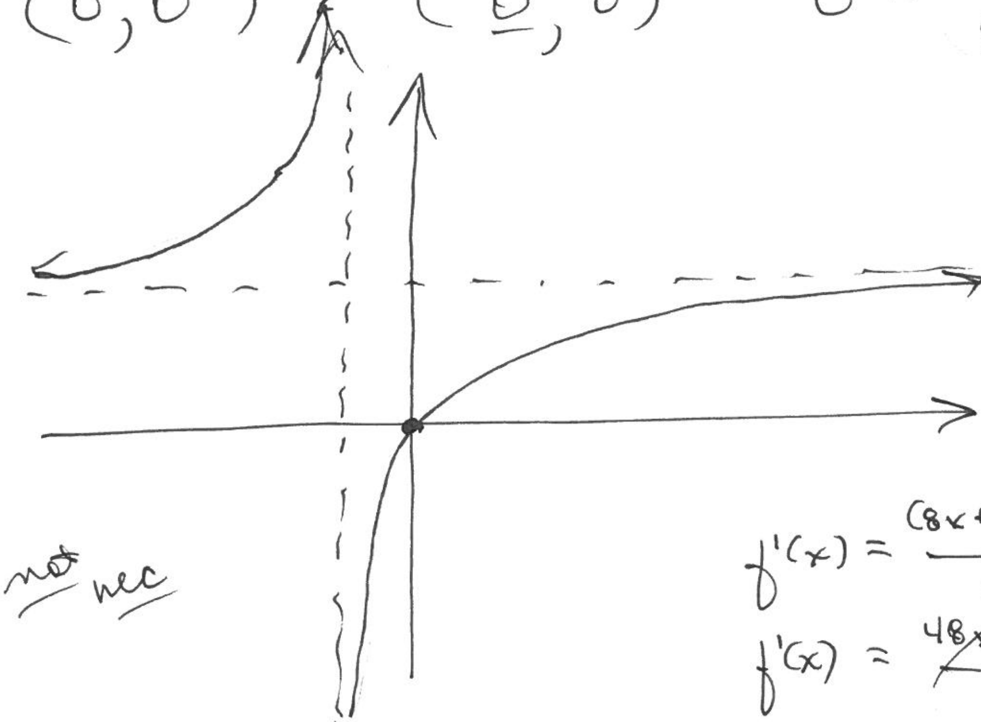
y' & y'' information

ex: $f(x) = \dfrac{6x}{8x+3}$

V.A.: $x = -3/8$

H.A.: $y = 3/4$

int: $(0,0)$ & $(0,0)$ $0 = \dfrac{6x}{8x+3}$ $6x=0$ $x=0$



$f''(x) =$ not nec

$$f'(x) = \frac{(8x+3)(6)-(6x)(8)}{(8x+3)^2}$$

$$f'(x) = \frac{\cancel{48x}+18-\cancel{48x}}{(8x+3)^2}$$

$$f'(x) = \frac{18}{(8x+3)^2} = \frac{+}{+} = +$$

INCR entire graph)

ex:

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

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

$x=1$ "hole"

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

V.A.: $x=-1$

H.A.: $y=\frac{1}{2}$

int: $(0, 2)$

$(-2, 0)$

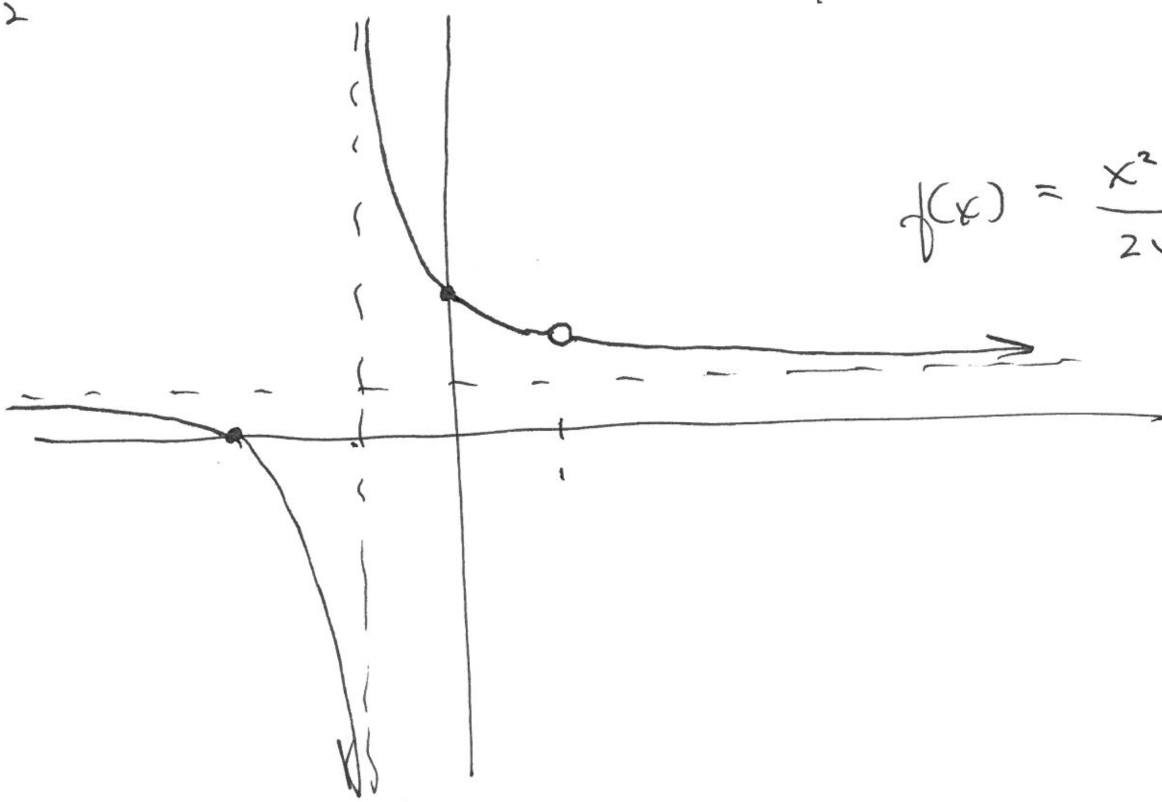
$\frac{0}{4}$ $\frac{0}{11}$

$\frac{0}{52}$

$$0 = \frac{(x+2)}{2(x+1)}$$

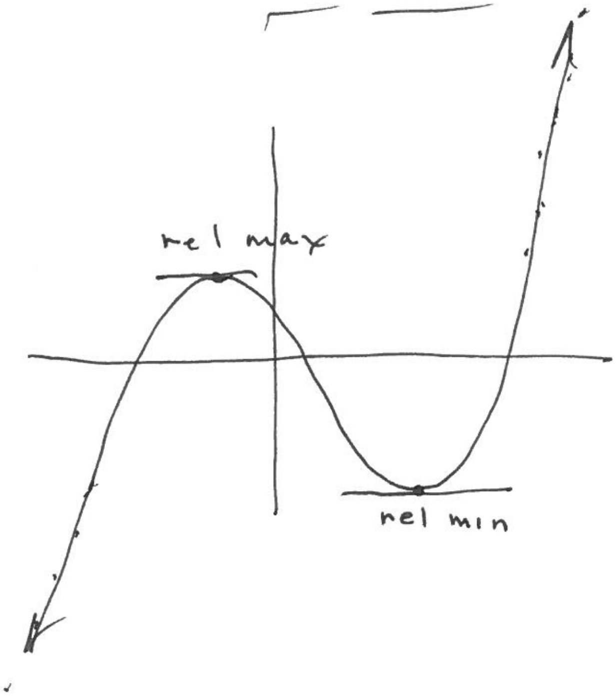
$x+2=0$

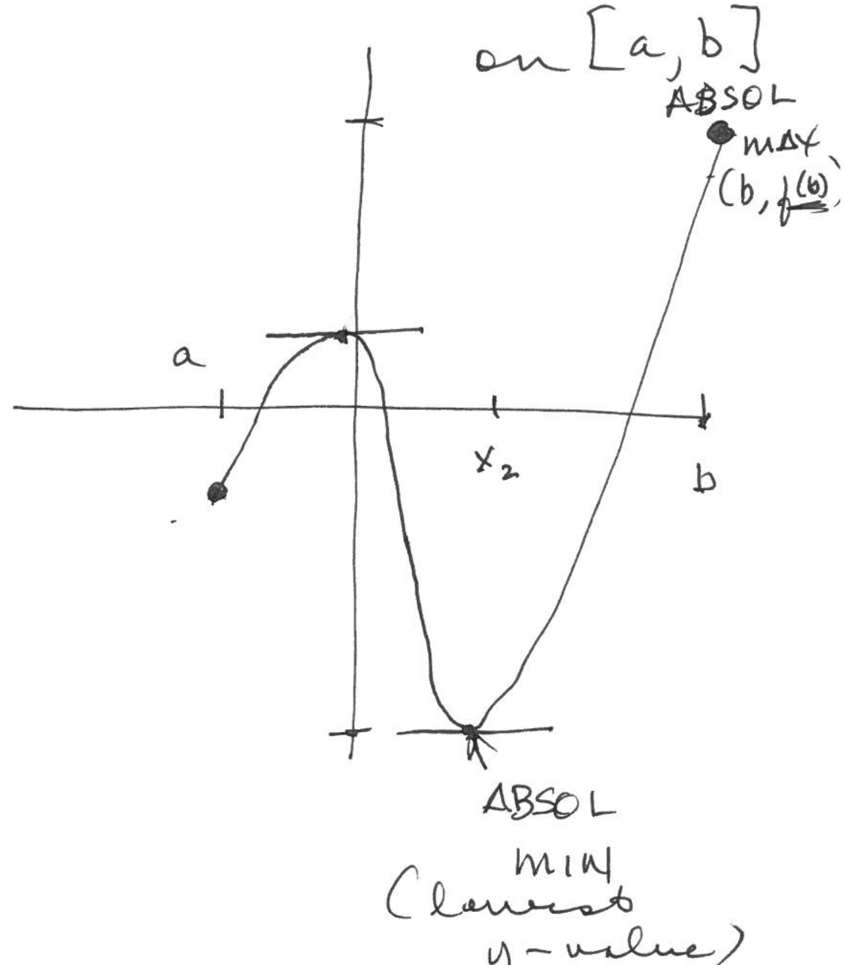
$x=-2$



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

2.4: ABSOLUTE MAX/MINS ON A CLOSED INTERVAL (ENDPTS)





find the absolute max/min value of the function

(highest y-value)

(lowest y-value)

ex: $f(x) = x^3 - 3x$ ✓ on $[-5, 2]$ ✓

$f'(x) = 3x^2 - 3$

$f'(x) = 3(x^2 - 1)$

$f'(x) = 3(x-1)(x+1)$

① endpts ✓

② critical pts

① $f'(x) = 0$ ② ~~$f'(x)$ undef.~~

$0 = 3(x-1)(x+1)$

$x = 1$; $x = -1$

$(1, -2)$ & $(-1, +2)$

$1^3 - 3(1)$ $(-1)^3 - 3(-1)$

$-1 + 3$

endpts

$(-5, -110)$

$(-5)^3 - 3(-5)$

$-125 + 15$

$(2, 2)$

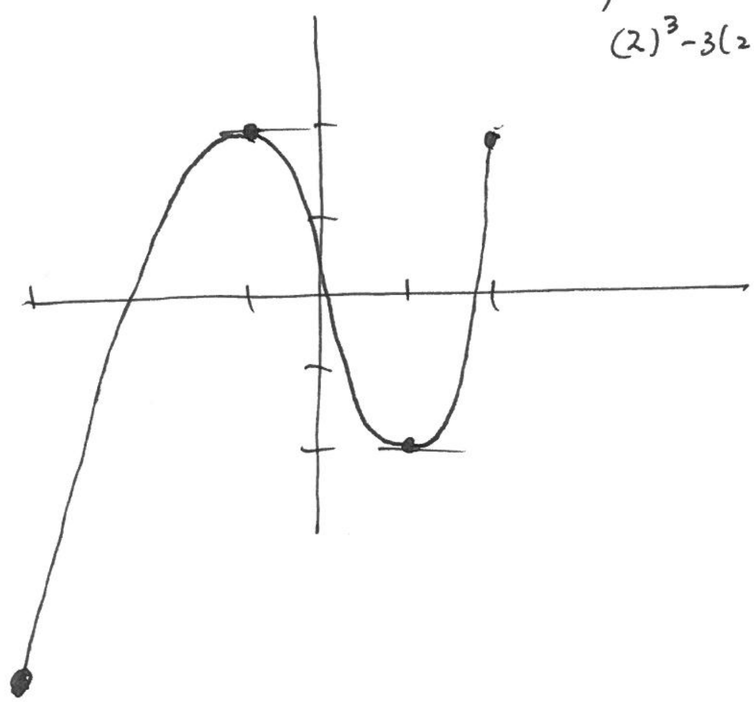
$(2)^3 - 3(2)$

max. value of the function

$\underline{2}$

min value of the function

$\underline{-110}$



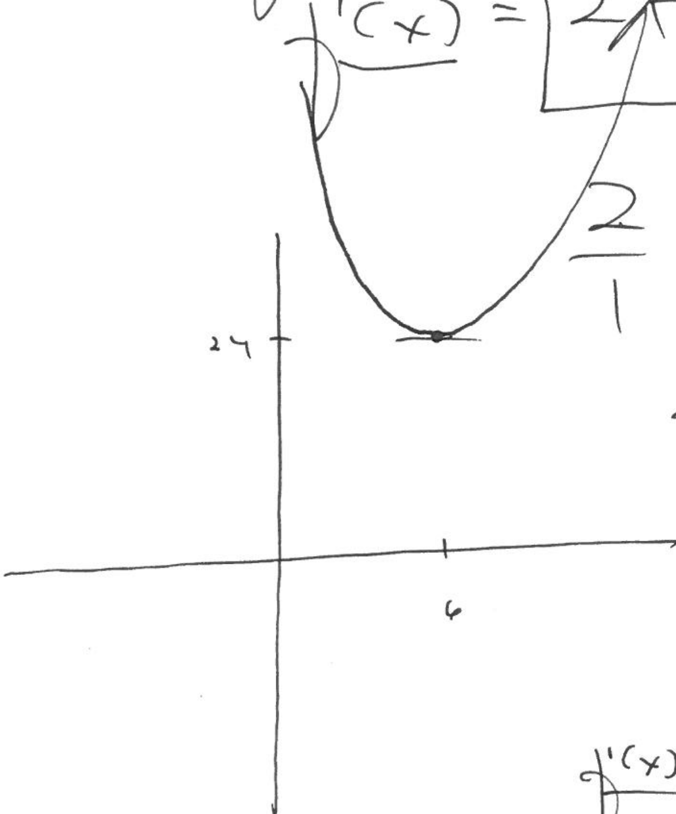
$72x^{-1}$

$f(x) = 2x + \frac{72}{x}$ $\qquad (0, +\infty)$

$f'(x) = 2 + 72(-1 \cdot x^{-2})$

$f'(x) = \boxed{2 - \frac{72}{x^2} = 0}$

ABS MIN
24



$\frac{2}{1} = \frac{72}{x^2}$

$(6, 24)$

$2(6) + \frac{72}{6}$

$\frac{2x^2}{2} = \frac{72}{2}$

$x^2 = 36 \qquad x = \pm 6 \to +6$

$f'(x)$:

$f'(1) = -$ $\qquad f'(7) = +$

0 $\quad f(x)$ DECR. $\quad$ 6 $\quad f(x)$ INCR

NORTH CAROLINA STATE UNIVERSITY Department of Mathematics

MA121-002 Quiz #1 Tuesday, February 12, 2019 Dr. J. Griggs

In each problem, find $f'(x)$ using the recommended technique; simplify completely. Due at the beginning of class on Thursday, February 14. You can use the book, your notes. You are to work **individually** on this quiz. Turn in this sheet with work and answers:

1.) $f(x)=8x^3+4\sqrt[3]{x}-\frac{5}{x^2}+17$ (power rule) $f(x)=8x^3+4x^{1/3}-5x^{-2}+17$

$f'(x)=8(3x^2)+4(\frac{1}{3}\cdot x^{-2/3})-5(-2\cdot x^{-3})+0$

$f'(x)=24x^2+\frac{4}{3}x^{-2/3}+10x^{-3}$

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

$f'(x)=\frac{(2x+1)\cdot(5)-(5x-3)\cdot(2)}{(2x+1)^2}=\frac{\cancel{10x}+5-\cancel{10x}+6}{(2x+1)^2}$

$f'(x)=\frac{11}{(2x+1)^2}$

3.) $f(x)=(2x+5)(3x^2-4x+1)$ (product rule)

$f'(x)=(2x+5)(6x-4)+(3x^2-4x+1)(2)$

$f'(x)=12x^2+30x-8x-20+6x^2-8x+2$

$f'(x)=18x^2+14x-18$

4.) $f(x)=\sqrt{3x^2+4x}$ (chain rule or extended power rule) $f(x)=(3x^2+4x)^{1/2}$

$f'(x)=\frac{1}{2}(3x^2+4x)^{-1/2}\cdot(6x+4)$

$f'(x)=(3x+2)(3x^2+4x)^{-1/2}$