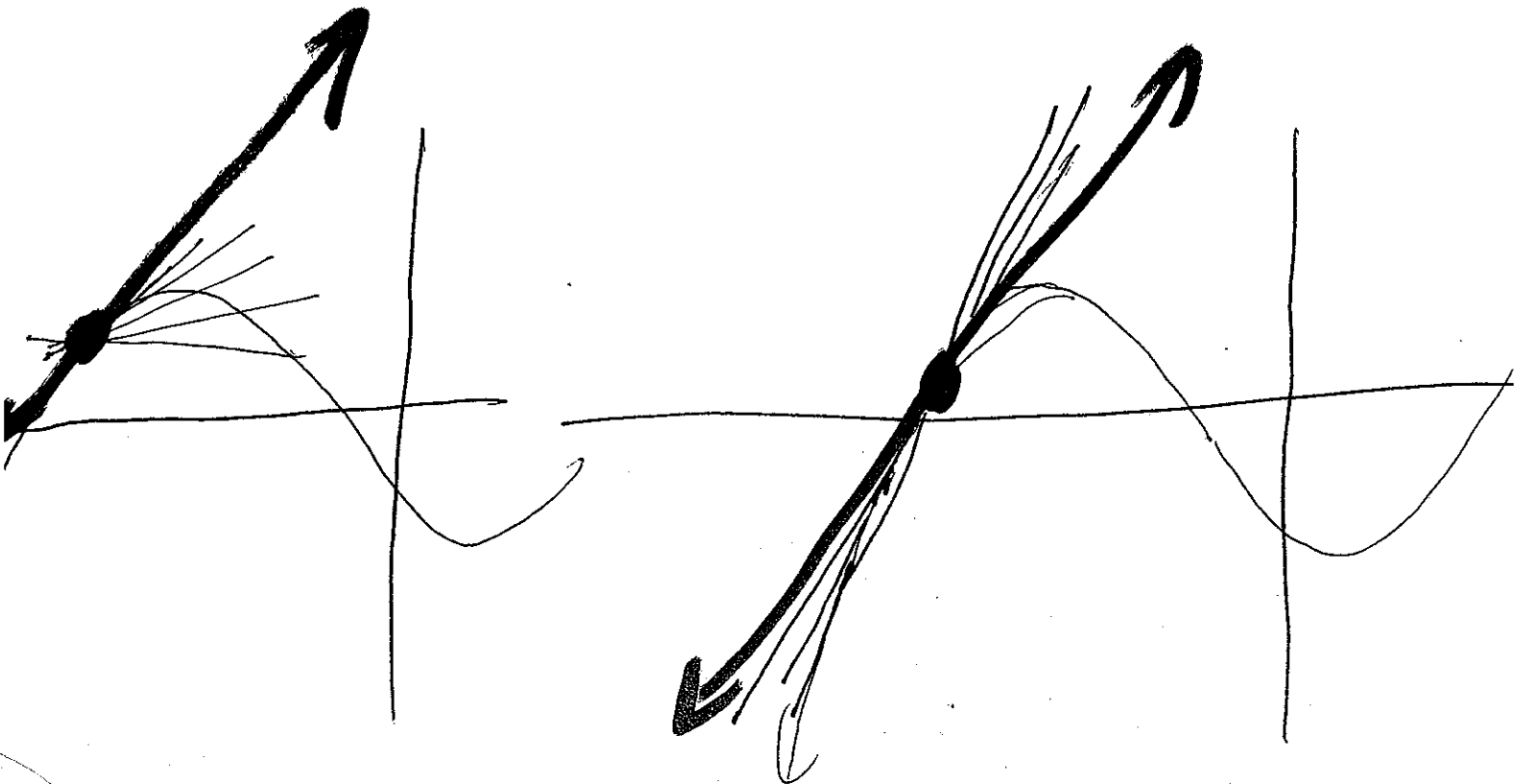
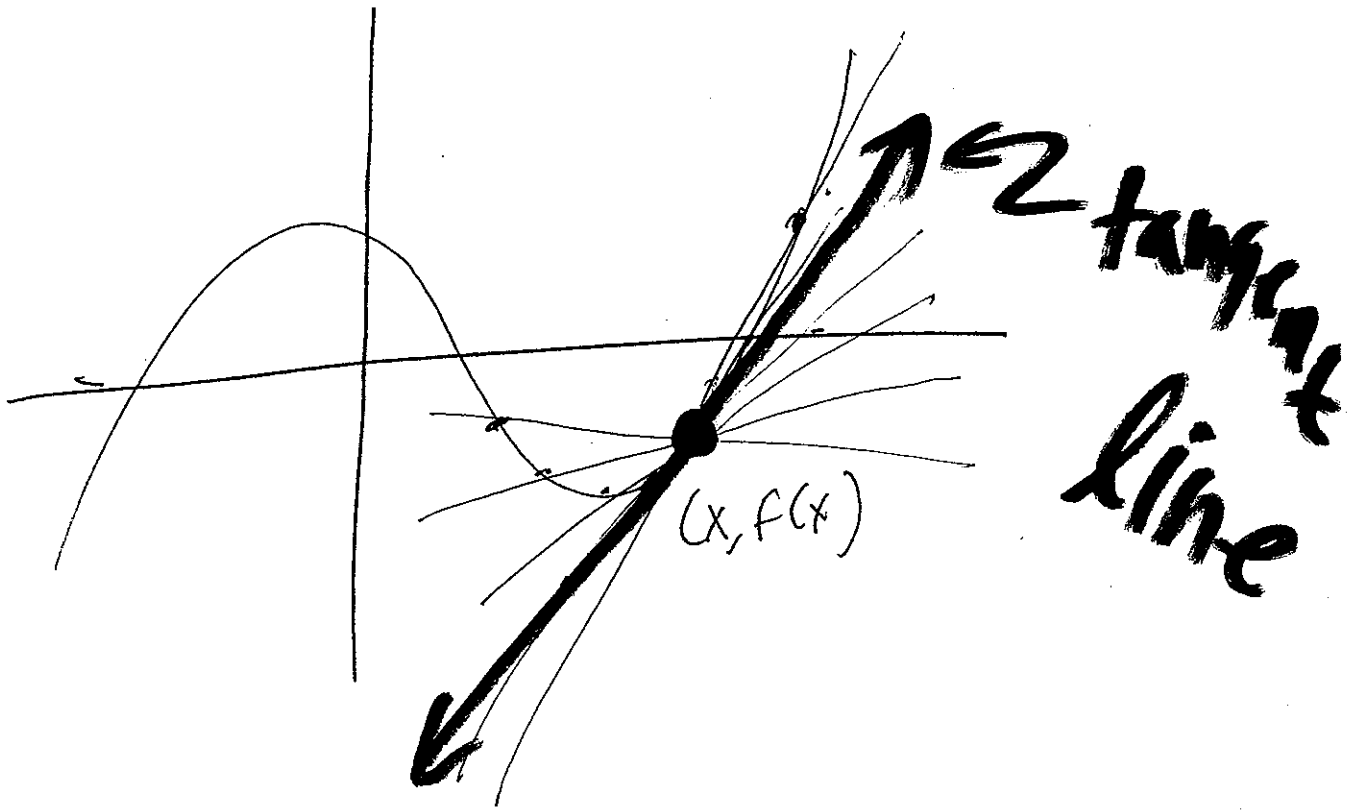
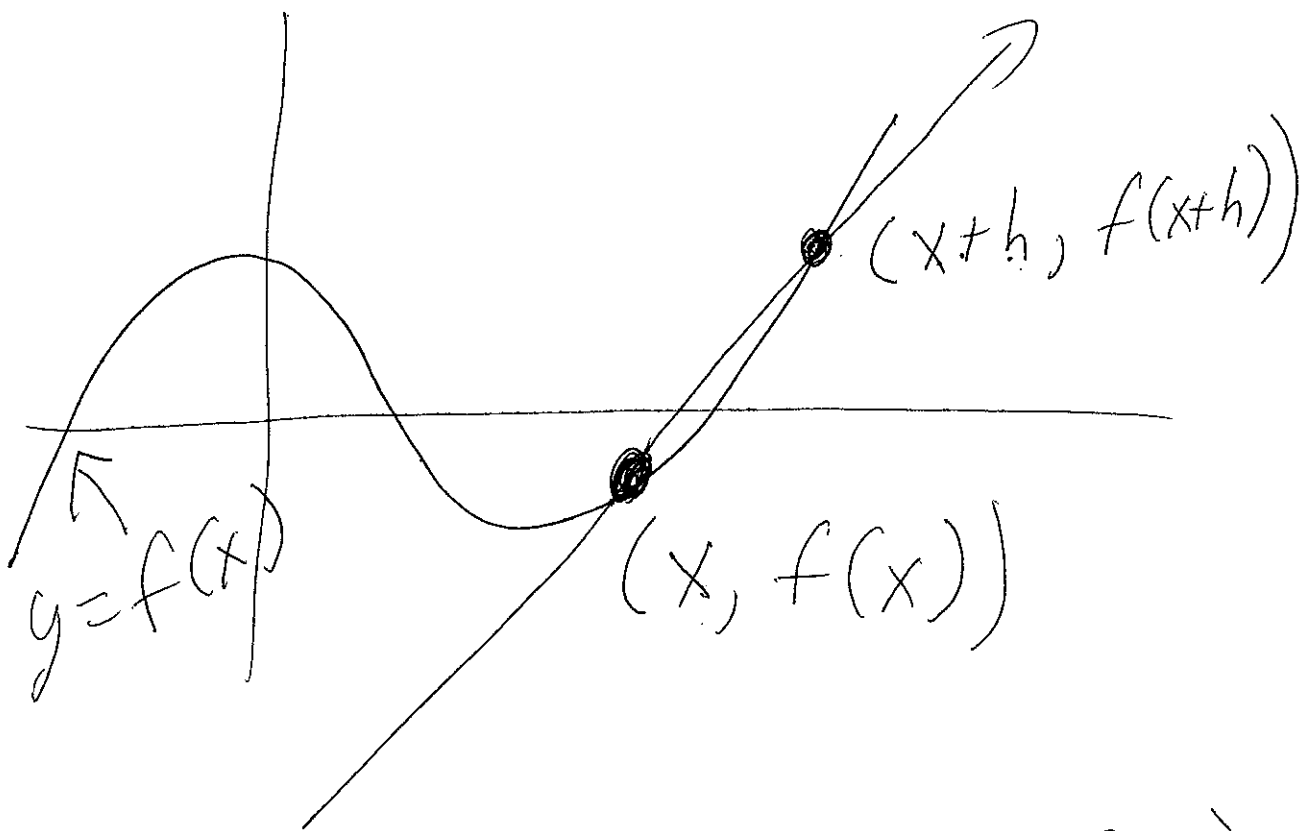


2.4 tangent lines





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

= slope of tangent
 line at x to $y = f(x)$
 = instantaneous rate of change
 derivative of f

Find ~~the~~ $f'(x)$

[= find slope of tangent line
at x to $y = f(x)$
= find instantaneous rate of change
at x]

where $f(x) = \frac{x+3}{4x+1} + 2$

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

$$= \lim_{h \rightarrow 0} \left[\frac{(x+h+3)(4x+1)}{(4(x+h)+1)(4x+1)} - \frac{(x+3)(4(x+h)+1)}{(4x+1)(4(x+h)+1)} \right] \cdot \frac{1}{h}$$

← "0/0"
Simplify

$$= \lim_{h \rightarrow 0} \left[\frac{(x+h+3)(4x+1) - (x+3)(4(x+h)+1)}{(4(x+h)+1)(4x+1)} \right] \cdot \frac{1}{h}$$

$$\lim_{h \rightarrow 0} \left[\frac{(x+3+h)(4x+1) - (x+3)(4x+1+h)}{h} \right] \cdot \frac{1}{h}$$

$$\lim_{h \rightarrow 0} \left[\frac{\cancel{(x+3)}(4x+1) + h(4x+1) - \cancel{(x+3)}(4x+1) - \cancel{(x+3)}h}{(4(x+h)+1)(4x+1)h} \right]$$

$$= \lim_{h \rightarrow 0} \left[\frac{\cancel{4xh} + h - \cancel{4xh} - 12h}{(4(x+h)+1)(4x+1)h} \right]$$

$$= \lim_{h \rightarrow 0} \left[\frac{-11h}{(4(x+h)+1)(4x+1)h} \right]$$

$$= \frac{-11}{(4x+1)^2} = f'(x)$$

Find the slope of tangent line to $y = f(x)$ at $x = 0$

$$= f'(0) = \lim_{h \rightarrow 0} \frac{f(0+h) - f(0)}{h}$$

But in this case we already

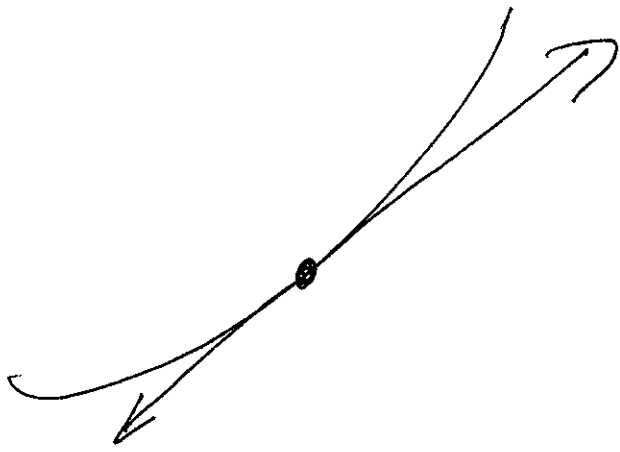
Know $f'(x) = \frac{-11}{(4x+1)^2}$

$$\Rightarrow f'(0) = \frac{-11}{1^2} = \boxed{-11}$$

$$f'(-1) = \frac{-11}{(4(-1)+1)^2} = \boxed{\frac{-11}{9}}$$

Slope = rate of
change

$f'(x)$ = instantaneous
rate of change
at x



Find tangent line to
 $y = f(x)$ at $x = 0$

- slope = $f'(0) = -11$
- pt on line: $(0, f(0))$
 $f(x) = \frac{x+3}{4x+1} + 2$ $= (0, 5)$
 $f(0) = 3 + 2 = 5$

$$\text{slope} = -11 = \frac{y - 5}{x - 0}$$

$$-11x + 5 = y - 5 + 5 \Rightarrow \boxed{y = -11x + 5}$$

Find tangent line to
 $y = f(x)$ at $x = -1$

• Slope: $f'(-1) = -11/9$ ← see earlier notes for today

• pt. on line: $(-1, f(-1))$

$$= \left(-1, \frac{-1+3}{-4+1} + 2\right)$$

$$= \left(-1, \frac{2}{-3} + 2\right)$$

$$= \left(-1, \frac{4}{3}\right)$$

$$\text{slope} = \frac{-11}{9} = \frac{y - \frac{4}{3}}{x - (-1)}$$

~~$$A(x+1) = y - \frac{4}{3}$$~~

$$-\frac{11}{9}(x+1)^{\frac{4}{3}} = y - \frac{4}{3} + \frac{4}{3}$$

$$-\frac{11}{9}x - \frac{11}{9} + \frac{12}{9} = y$$

$$y = -\frac{11}{9}x + \frac{1}{9}$$

$$\frac{b}{11} + \frac{b}{11} -$$

tangent line at $x = 0$ to $y = (x+3)/(4x+1) + 2$ - Wolfram|Alpha - Windows Internet Explorer

http://www.wolframalpha.com/input/?i=tangent+line+at+x=0+to+y=(x+3)/(4x+1)+2

tan... wolfram alpha

tan... tangent line at x = 0 to y = (x+3)/(4x+1) + 2 - Wolf...

This website wants to run the following add-on: 'Wolfram Mathematica Control' from 'Wolfram Research'. If you trust the website and the add-on and want to allow it to run, click here...

tangent line at $x = 0$ to $y = (x+3)/(4x+1) + 2$

Examples Random

Input interpretation:

tangent line to $y = \frac{x+3}{4x+1} + 2$ at $x = 0$

Result:

$y = 5 - 11x$

Plot:

(x from -0.4 to 0.4)

— $y = \frac{x+3}{4x+1} + 2$

— tangent

Computed by Wolfram|Mathematica

Download page

wolfram alpha

tangent line at $x = 0$ to $y = (x+3)/(4x+1) + 2$

Examples Random

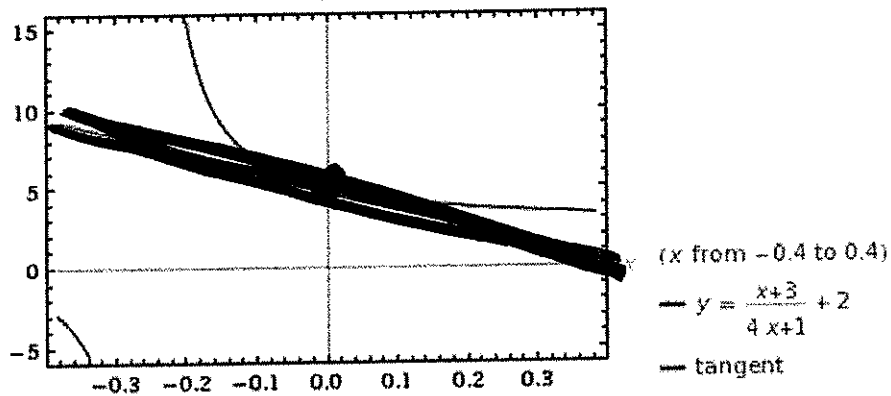
Input interpretation:

tangent line to $y = \frac{x+3}{4x+1} + 2$ at $x = 0$

Result:

$$y = 5 - 11x$$

Plot:



Computed by Wolfram Mathematica

Download name

tangent line at $x = -1$ to $y = (x+3)/(4x+1) + 2$

Input interpretation:

tangent line

to

$$y = \frac{x+3}{4x+1} + 2$$

at

$$x = -1$$

Result:

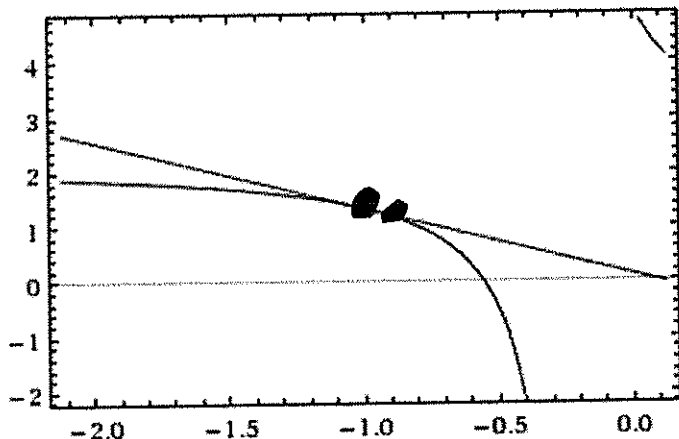
$$y = \frac{1}{9} - \frac{11x}{9}$$

Approximate form

$$f(-1.001) \sim$$

$$\frac{1}{9} - \frac{11(-1.001)}{9}$$

Plot:



(x from -2 to 0)

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

- tangent