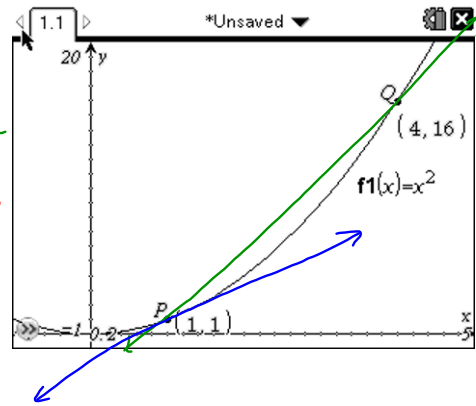### 2.4 Slope of a Tangent Line
Instantaneous Rate of Change

What is a <u>secant line</u>? What does the slope of the secant line represent?

- line intersecting 2 pts. on a curve
- <u>avg.</u> rate of change

What is a tangent line? What does the slope of the tangent line represent?

[graph: 1.1 *Unsaved — $f1(x)=x^2$, points $Q\,(4,16)$ and $P\,(1,1)$]

- line intersecting a curve @ 1 pt.

- instantaneous rate of change slope @ a given pt.

Green Sheet #11

$$\lim_{(x_2-x_1)\to 0}\left(\frac{y_2-y_1}{x_2-x_1}\right)$$

$$\lim_{h\to 0}\frac{f(1+h)-f(1)}{1+h-1}$$

$$\lim_{h\to 0}\frac{f(1+h)-f(1)}{h}$$

$$\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

Slope of a curve at x = a: $\lim\limits_{h \to 0} \dfrac{f(a+h) - f(a)}{h}$

provided the limit exists

Find the equation of the tangent line and the normal line to the parabola $y=x^2$ at $x=2$.

$(2,4)$

$\lim\limits_{h \to 0} \dfrac{f(2+h) - f(2)}{h}$

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

$\lim\limits_{h \to 0} \dfrac{4 + 4h + h^2 - (4)}{h}$

$\lim\limits_{h \to 0} \dfrac{4h + h^2}{h}$

$\lim\limits_{h \to 0} 4 + h = 4$

- slope of parabola @ x=2
- instantaneous rate of change @ x=2
- velocity @ x=2
- slope of the tangent line @ x=2

tangent line
Pt $(2,4)$
$m = 4$

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

normal line
Pt. $(2,4)$
Slope $= -\frac{1}{4}$ $y = -\frac{1}{4}(x-2) + 4$

$f(x) = x^2 - 3x \qquad x = 3$

$\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$\lim\limits_{h \to 0} \dfrac{(3+h)^2 - 3(3+h) - \left((3)^2 - 3(3)\right)}{h}$

$\lim\limits_{h \to 0} \dfrac{9 + 6h + h^2 - 9 - 3h - 9 + 9}{h}$

$\lim\limits_{h \to 0} \dfrac{3h + h^2}{h} = 3$

homework: 2.4a and 9,10,12 on 2.4b

Sketch the graph:

$$f(x) = \begin{cases} 3 - x, & x < 2 \\ \dfrac{x}{2} + 1, & x \geq 2 \end{cases}$$

does the curve have a tangent line at x = 2?

◁ | 1.1 | ▷   *Unsaved ▼

$$f1(x)=\begin{cases} 3-x, & x<2 \\ 0.5 \cdot x+1, & x\geq 2 \end{cases}$$

P

Q

$(4,3)$

$(1,2)$

5↑y

0.5

-1   0.2   5

x

-5