Suggested HW pdf is on D2L
- List of problems is @ front of pdf file
- Full solutions on website

Open-Book Quiz (Bring phone/tablet/notes)
Wed Sept 13 Section 23.1

23.1 Limits Cont'd

Ex: $\lim_{x \to 0} \frac{x^2 - 3x}{x^2 + x}$ $\left(\frac{0}{0}\text{ no info}\right)$

$$= \lim_{x \to 0} \frac{x(x-3)}{x(x+1)}$$

$$= \frac{-3}{1}$$

$$= -3$$

Ex: $\lim_{x \to 2} \frac{x^2 + 24}{x + 11}$

$$= \frac{28}{13}$$

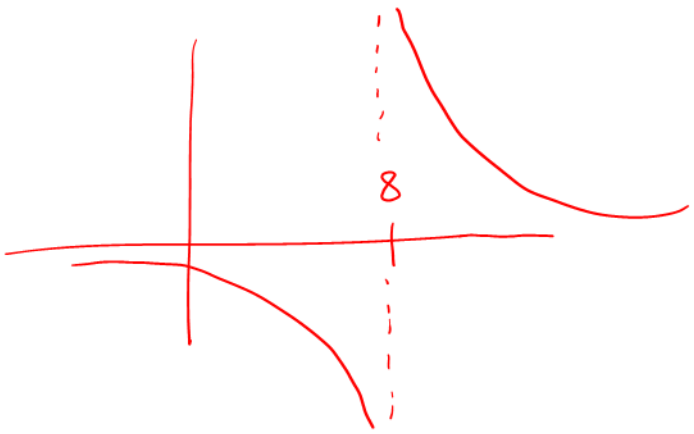
Ex: $\lim_{x \to 8} \frac{1}{x - 8}$

Can't sub in (function is undefined.)
Can't factor.

Last Resort: Table of Values.

x	7.9	7.99	8.01	8.1
$f(x) = \frac{1}{(x-8)}$	-10	-100	100	10

$\lim_{x \to 8} \frac{1}{x-8}$ does not exist



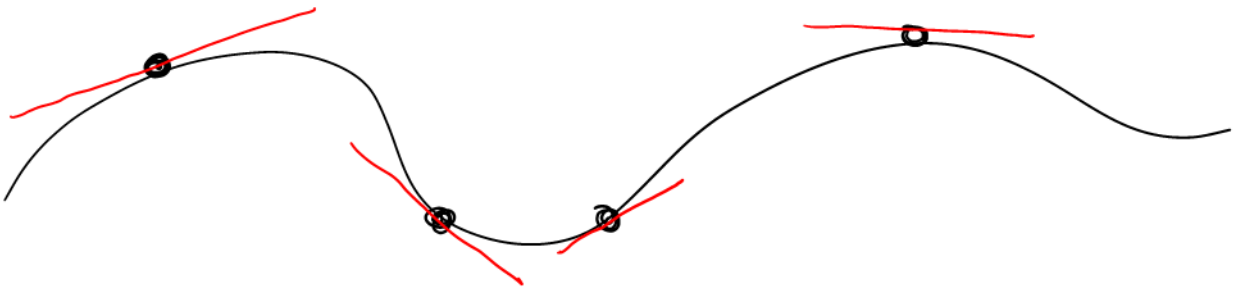
Aside:

The limit does not exist.

OR The limit is $+\infty$.

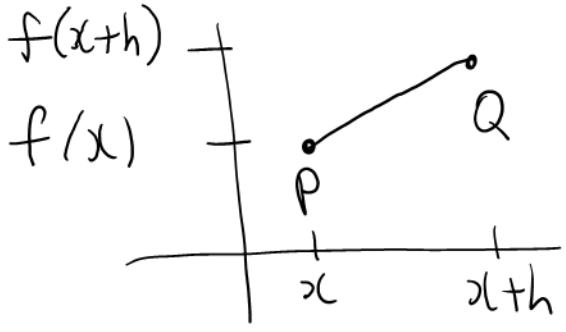
23.2 The Slope of a Tangent Line

Tangent line to a curve: touches the curve at a single point.



Slope of the tangent line is written m_{tan}

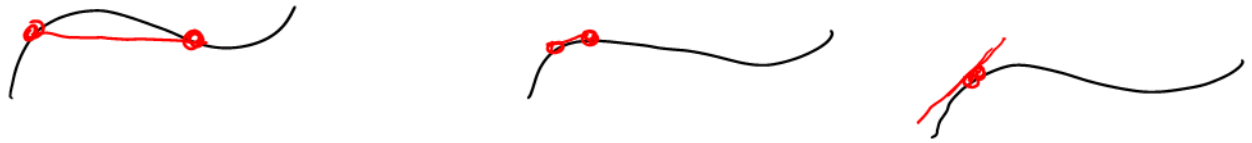
Consider a short line segment PQ.
Let h = small positive number (e.g. h = 0.1)



Slope of PQ: $m_{PQ} = \frac{\text{rise}}{\text{run}}$

$$m_{PQ} = \frac{\text{rise}}{\text{run}} = \frac{f(x+h) - f(x)}{h}$$

As $h \to 0$, $m_{PQ} \to m_{tan}$



$$\boxed{m_{tan} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}} \quad \bigstar$$

Ex: Find m_{tan} to $y = x^2 + 5$ at the point $(x, y) = (1, 6)$.

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

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

$f(x) = x^2 + 5$

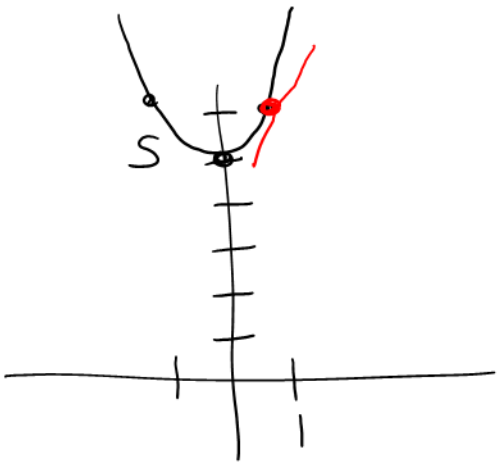
$$= \lim_{h \to 0} \frac{(1+h)^2 + 5 - 6}{h}$$

$$= \lim_{h \to 0} \frac{1 + 2h + h^2 + 5 - 6}{h}$$

$$= \lim_{h \to 0} \frac{2h + h^2}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(2+h)}{\cancel{h}}$$

$$= 2$$



$y = x^2 + 5$