2.7: Derivatives and R.O.C.

Recall secants & tangents.

The slope of the tangent line to $f(x)$ @ $x=a$

is:
$$m = \lim_{x \to a} \frac{f(x) - f(a)}{x - a} \qquad (1)$$

or
$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} \qquad (2)$$

ex1: find the eqt. of the tangent line to

$f(x) = 2x^3 - 5x$ @ $(-1, 3)$ (use formula 2)

$g(x) = \dfrac{2x}{(x+1)^2}$ @ $(0,0)$ (use formula 1)

If $s(t)$ is a position fct along a straight line.

$$\text{Ave vel.} = \frac{\text{displacement}}{\text{time}}$$

$$= \frac{s(a+h) - s(a)}{h}$$

and $v(a) = \lim_{h \to 0} \dfrac{s(a+h) - s(a)}{h}$

We call the slope of the tangent line the <u>derivative</u>.

Dfn: The derivative of a fct f at a, denoted $f'(a)$ is

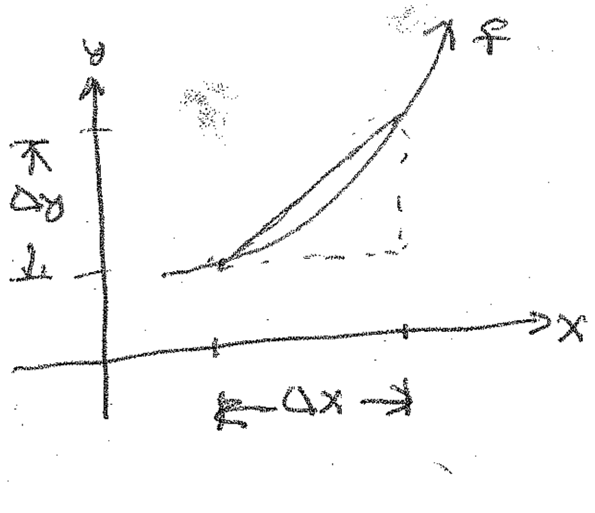
$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

if the limit exists.

Alternately. $$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

ex2: Find $f'(a)$ if $f(x) = 2x^3 + 3x - 7$

then find the eqt. of the tangent line @ $(1, -2)$.



Ave ROC $= \frac{\Delta y}{\Delta x}$

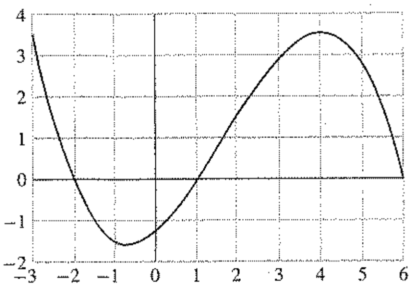
Inst ROC $= \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x}$

This is the slope of the tangent line.

Here $f'(a)$ is the inst. ROC of $y = f(x)$ WRT x @ $x = a$.

ex 3:

The graph of a function f is shown below.



(a) Fill in the missing entries in the table below.

x	-3	-2	-1	0	1
$f'(x)$	-4.9			0.8	

x	2	3	4	5	6
$f'(x)$		1.1			-4.0

(b) Sketch a graph of f'.

ex 4: A roast turkey is taken from the oven @ $185^\circ F$ & placed on a tray in a $75^\circ F$ room.

(a) sketch a curve to describe $T(t)$.

(b) estimate & interpret $T'(30)$