Warmup:

1. Find a value for a so that f(x) is continuous.

$$f(x) = \begin{cases} 2x+3, & x \le 2 \\ ax+1, & x > 2 \end{cases}$$

$3x+1$

$a = 3$

2. Does f(x) have a tan line at $x=2$?

LH RH

$2 \neq 3$

p92: 17,

p84:

3.1 Derivatives

Derivative of $f(x)$ is $f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$

as long as lim exists.

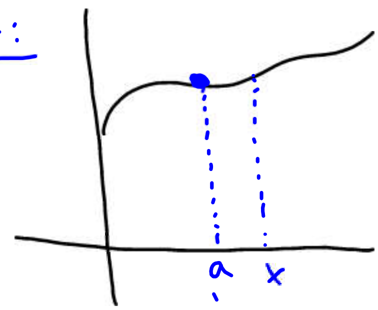
If $f(x)$ has a derivative at a point, it is "differentiable."

Slope of secant line: $\frac{f(x+h)-f(x)}{(x+h)-x}$ average rate of change

Slope of tangent line: $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$ instantaneous rate of change

Alternate definition of derivative:

$$\lim_{x\to a} \frac{f(x)-f(a)}{x-a}$$



Ex) $f(x) = \sqrt{x}$ $x^{\frac{1}{2}}$ Find f' using alternate definition.

$$f' = \boxed{\lim_{x\to a} \frac{\sqrt{x}-\sqrt{a}}{x-a}} = \lim_{x\to a} \frac{\cancel{\sqrt{x}-\sqrt{a}}}{\cancel{(\sqrt{x}-\sqrt{a})}(\sqrt{x}+\sqrt{a})}$$

$$= \lim_{x\to a} \frac{1}{\sqrt{x}+\sqrt{a}} = \frac{1}{\sqrt{a}+\sqrt{a}} = \frac{1}{2\sqrt{a}} = \frac{1}{2}a^{-\frac{1}{2}}$$

Notation for derivatives

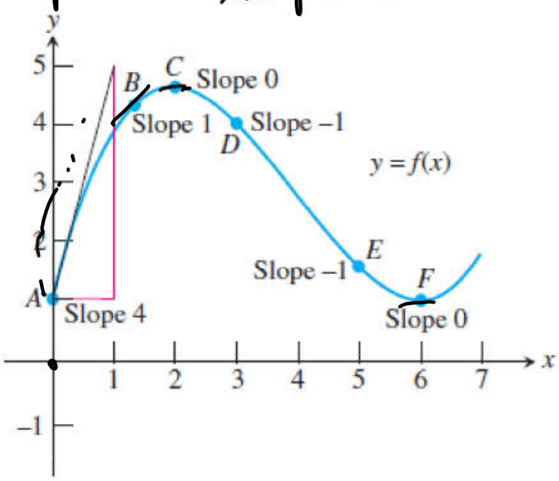
y' short, easy

$\frac{df}{dx}$ which function

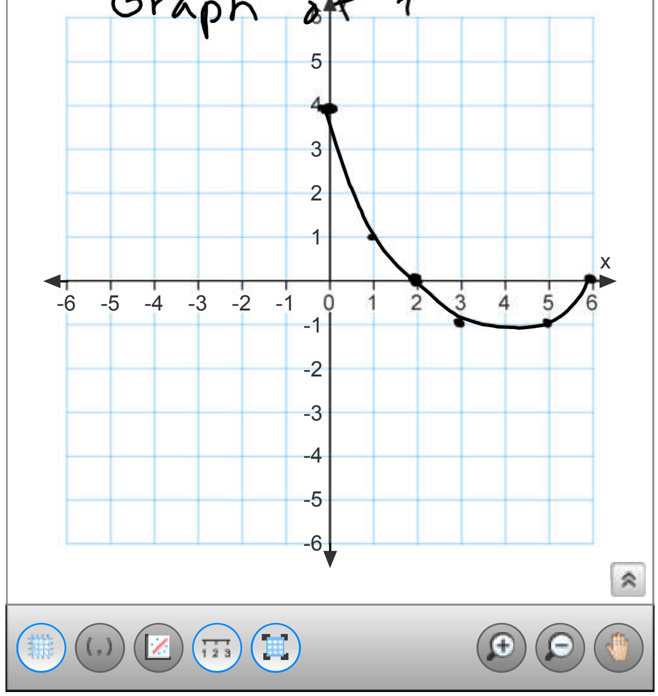
$\frac{dy}{dx}$ names both variables

$\frac{d}{dx} f(x)$ implicit differentiation.

p101 Example 3



Graph of f'



HW: p 96 #28, 29, 31, 33, 34, 39, 41, 43, 47-49, 51, 52, 54

p 56 #45-48

Worksheet: Graphs of f and f'