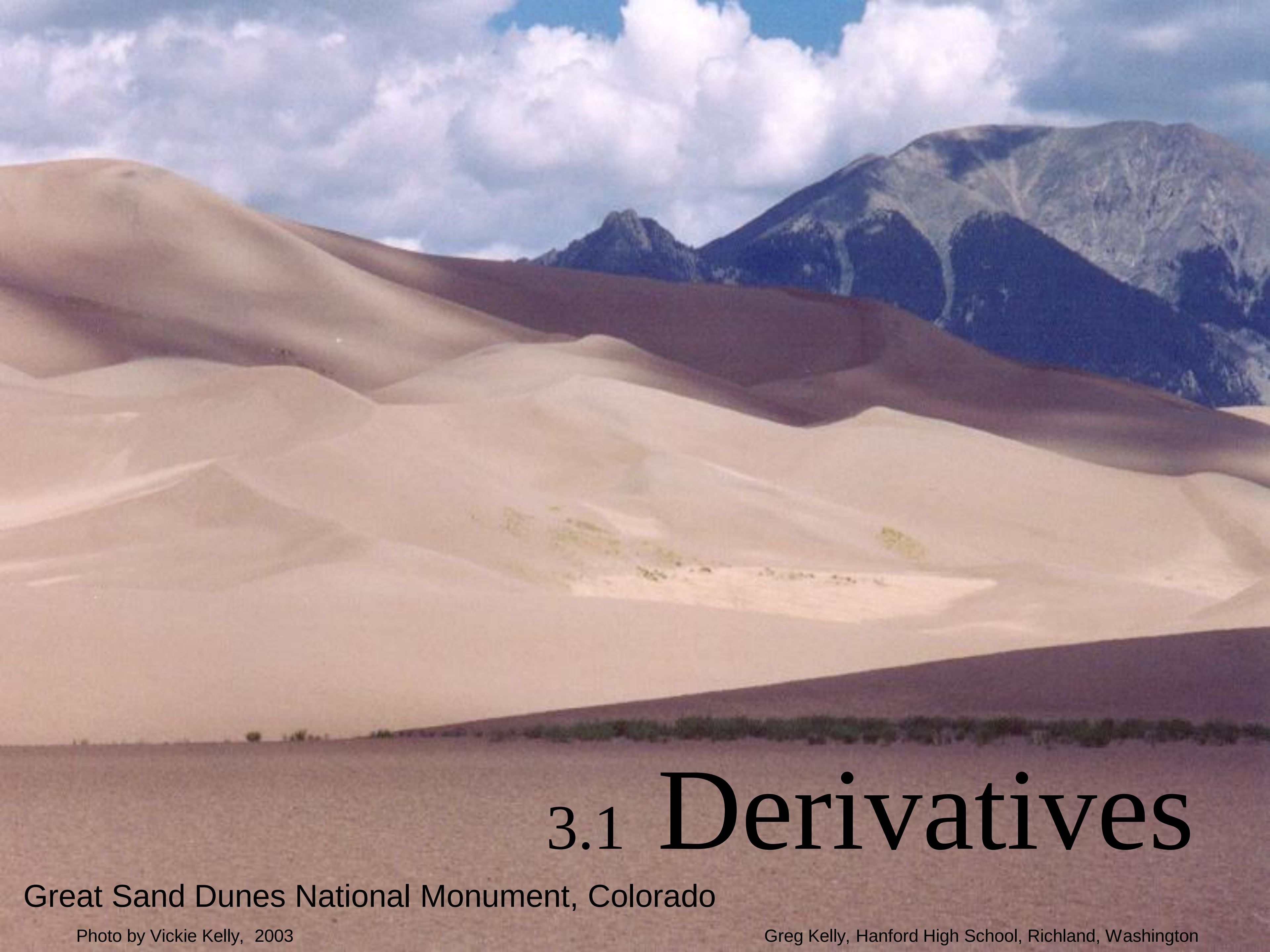


3.1 Derivatives

Great Sand Dunes National Monument, Colorado

Photo by Vickie Kelly, 2003

Greg Kelly, Hanford High School, Richland, Washington

$$\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$ is called the derivative of f at a.

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

"The derivative of f with respect to x is …"

There are many ways to write the derivative of $y=f(x)$

→

$f'(x)$ “f prime x” or “the derivative of f with respect to x”

y' “y prime”

$\frac{dy}{dx}$ “dee why dee ecks” or “the derivative of y with respect to x”

$\frac{df}{dx}$ “dee eff dee ecks” or “the derivative of f with respect to x”

$\frac{d}{dx} f(x)$ “dee dee ecks uv eff uv ecks” or “the derivative of f of x”

(d dx of f of x)

Note:

dx does not mean d times x !

dy does not mean d times y !

Note:

$\frac{dy}{dx}$ does not mean $dy \div dx$!

(except when it is convenient to think of it as division.)

$\frac{df}{dx}$ does not mean $df \div dx$!

(except when it is convenient to think of it as division.)

→

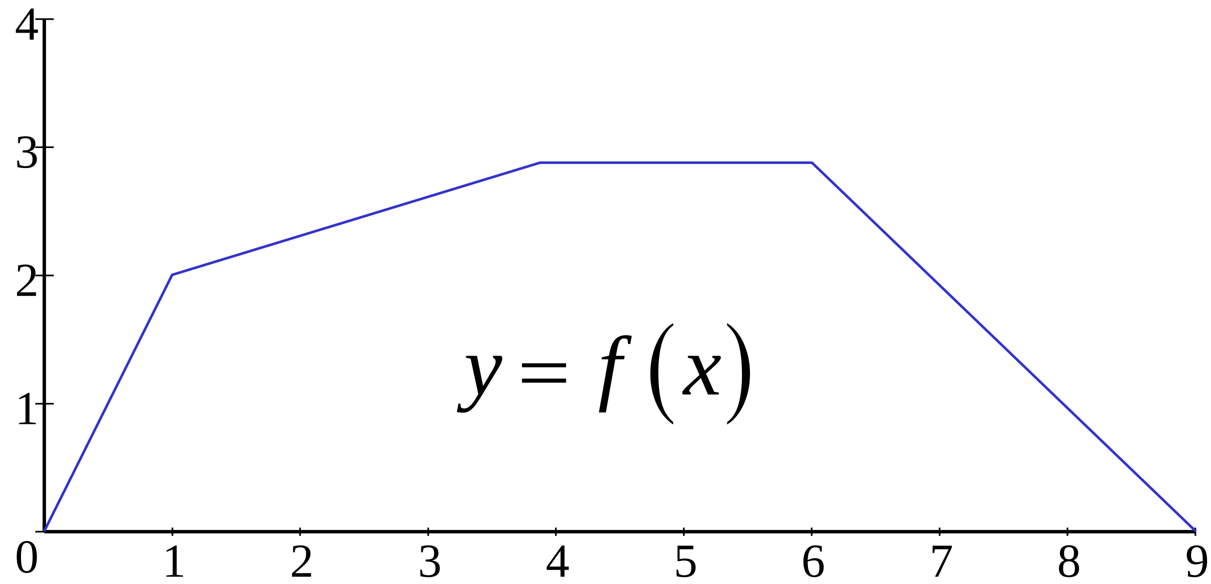
Note:

$\frac{d}{dx} f\left(x\right)$ does <u>not</u> mean $\frac{d}{dx}$ times $f\left(x\right)$!

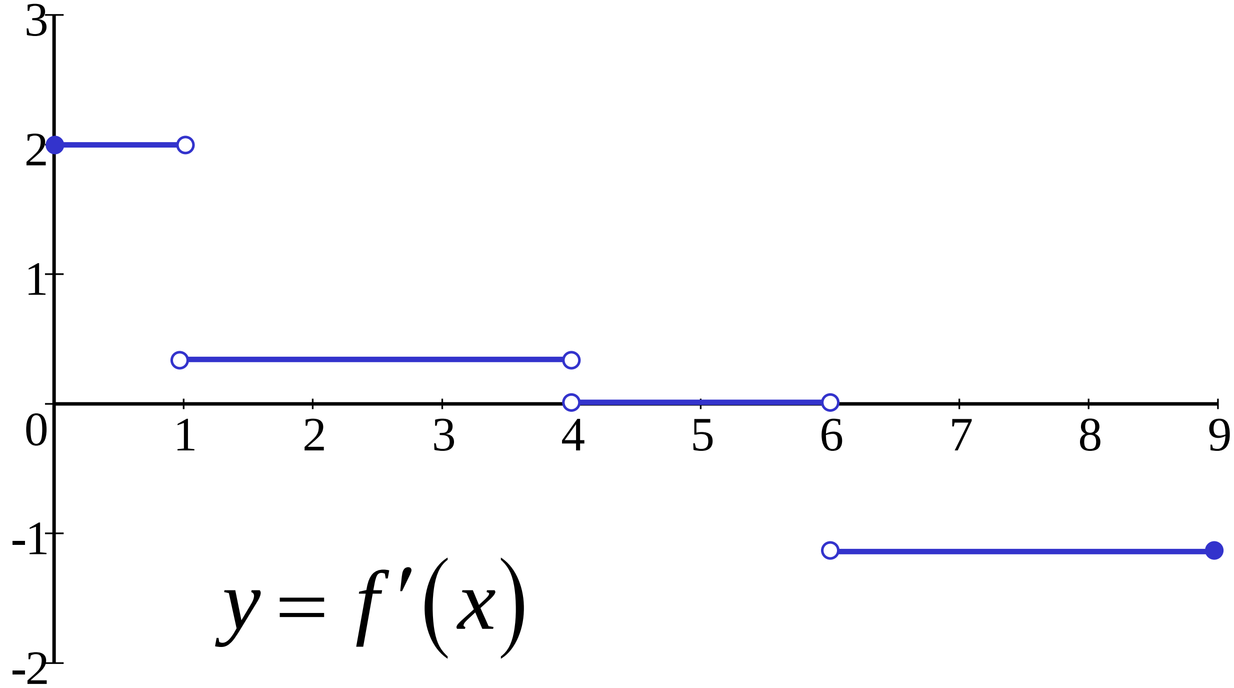
(except when it is convenient to treat it that way.)

→


In the future, all will become clear.



The derivative is the slope of the original function.



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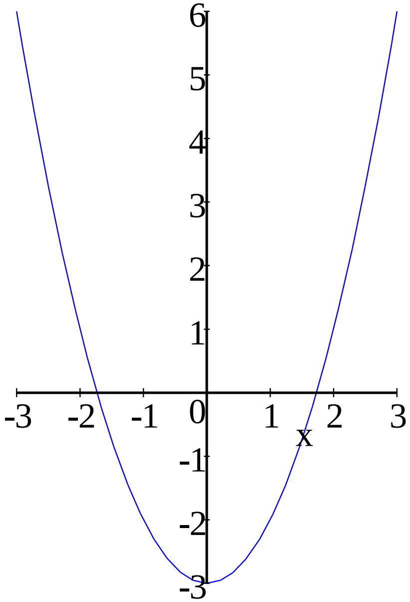
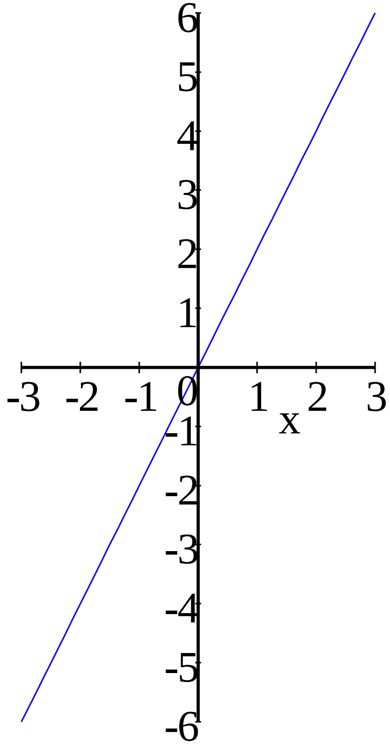


$$y = x^2 - 3$$

$$y' = \lim_{h \to 0} \frac{(x+h)^2 - 3 - (x^2 - 3)}{h}$$



$$y' = \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$

$$y' = \lim_{h \to 0} 2x + h$$

0

$$y' = 2x$$

→

A function is differentiable if it has a derivative everywhere in its domain. It must be continuous and smooth. Functions on closed intervals must have one-sided derivatives defined at the end points.

π

Assignment p.105 # 1-4, 13-16