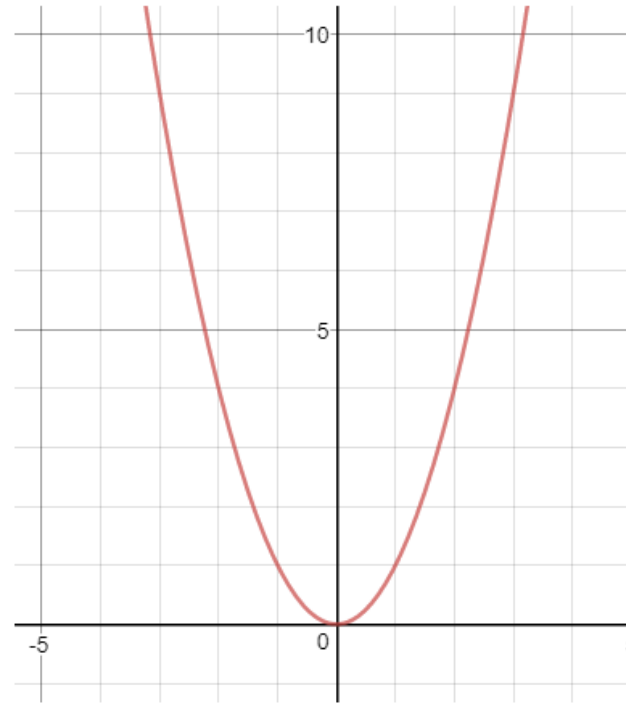


**Problem:** Find the rate of change (slope) of the parabola  $f(x) = x^2$  at the point  $(2, 4)$ .



We find the rate of change by a process called differentiation or by “finding the derivative”.

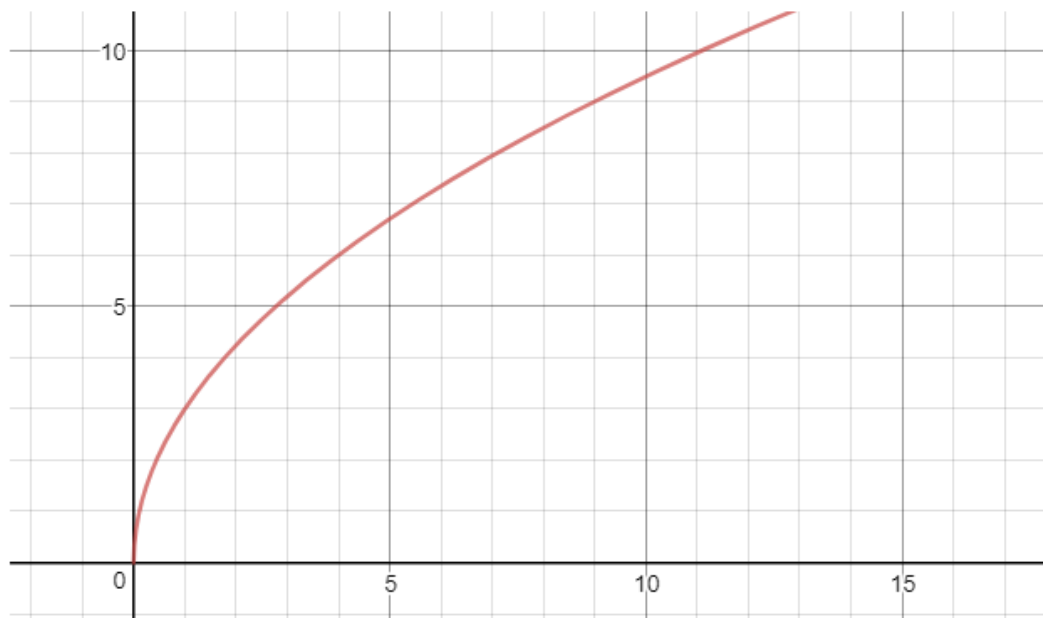
Two notations for the derivative:

$$\frac{dy}{dx}$$

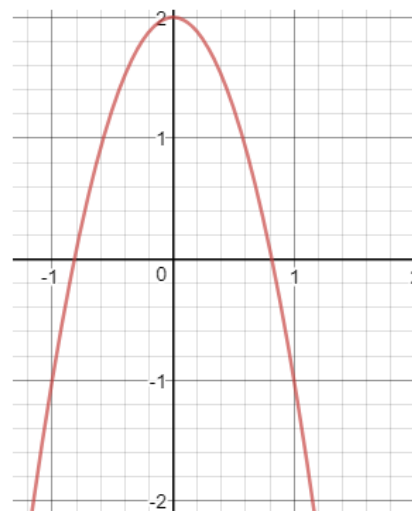
$$f'(x)$$

The derivative of  $f(x)$  at point  $(a, f(a))$  is given by:

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



Use the above definition to find the derivative of  $f(x) = -3x^2 + 2$  at  $x = 1$ .



Also the derivative of a function  $f(x)$  is a new function  $f'(x)$  where:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$f'(x)$  or  $\frac{dy}{dx}$  is called the derivative function. It allows you to calculate the derivative for any  $x$ -value. (i.e. you can substitute an 'a' value in afterwards)

Use the above definition to find the derivative function for the following.

a)  $f(x) = x^3$

b)  $f(x) = \sqrt{x+2}$

**The process above is often called "first principles" (we will soon learn shortcuts)**

page 49 #1cef, 2aeghi, 3f, 9, 10 (from first principles)