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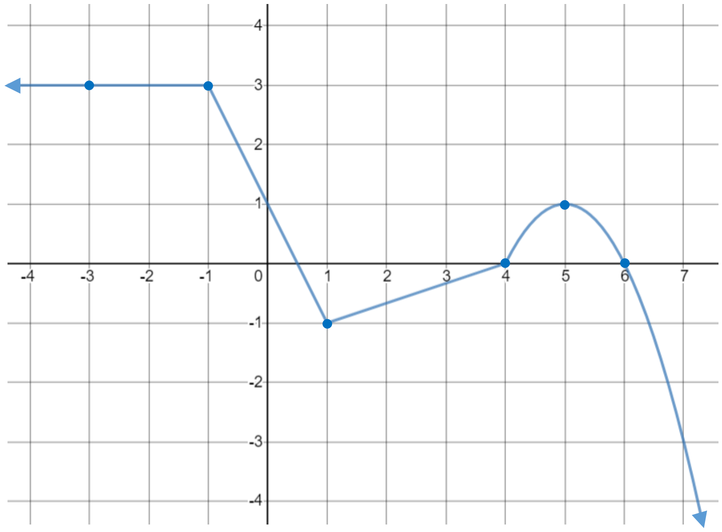
3.1 Definition of a Derivative

Slope of a Function at a Point



Graph of $f(x)$

a) Using the graph of $f(x)$ given above, find the slope of $f(x)$ at $x = -3$.

b) Using the graph of $f(x)$ given above, find the slope of $f(x)$ at $x = 0$.

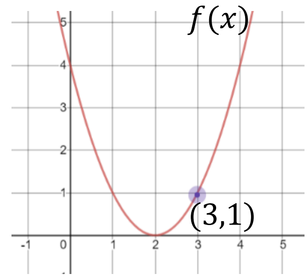
c) Using the graph of $f(x)$ given above, find the slope of $f(x)$ at $x = 2$.

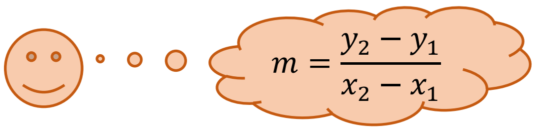
d) Using the graph of $f(x)$ given above, estimate the slope of $f(x)$ at $x = 6$.

Finding the Slope of a Function at a Point

Visualization at Desmos: https://www.desmos.com/calculator/8ubngtz3ei

Given function, $f(x) = x^2 - 4x + 4$, find the slope of the function at the point $(3,1)$.

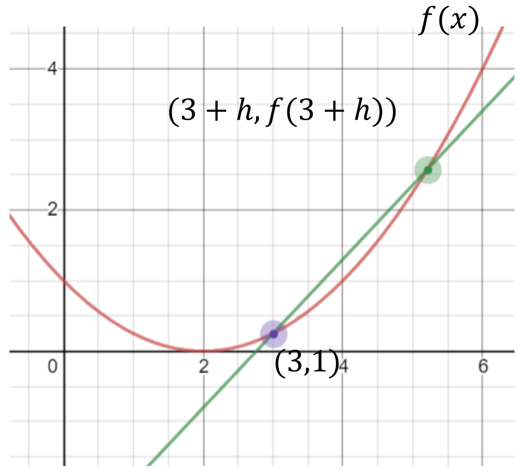




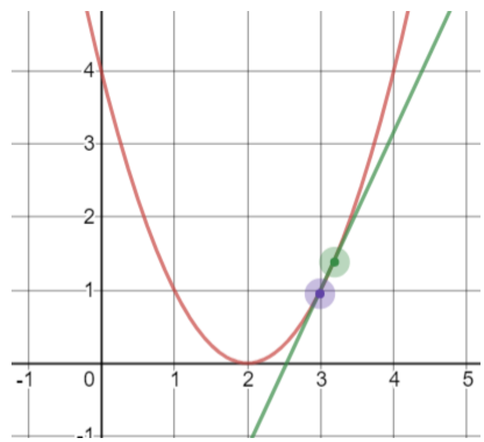
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

where the 2nd point is h units away from $x = 3$.

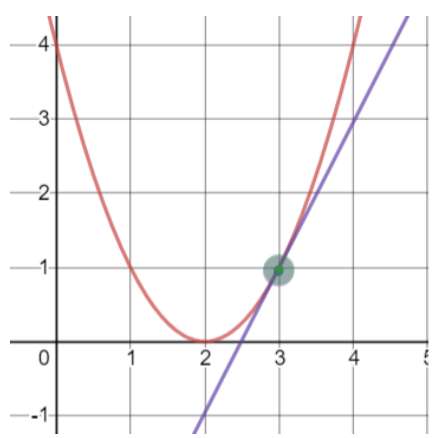
$m =$ ________________________________



Moving the 2nd point closer to $(3,1)$ makes h get closer to zero.



and the slope of the function at the point is the same as the slope of the line tangent to the function at that point.



Definition of the Derivative

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

- slope of a tangent line to a function/curve
- slope of a function/curve
- slope of a function/curve at a point
- instantaneous rate of change

Notation for the Derivative	Read As
$f'(x)$	f prime of x
$y'(x)$ or y'	y prime of x or y prime
$\frac{d}{dx}(f(x))$	derivative of $f(x)$ with respect to x
$\frac{dy}{dx}$	derivative of y with respect to x

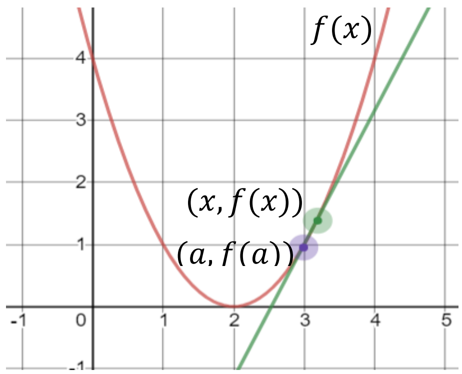
Example 1: Find the derivative of $f(x) = x^2 - 4x + 4$

Example 2: A train is traveling back and forth on an east-west section of a railroad track. The train's position, measured in feet, is gi $x(t) = 5t^2 - 3t$. Find the instantaneous rate of change of this train at 2 seconds.

Alternate Form of the Derivative

The slope of a function, $f(x)$, at a given point, $x = a$, is:

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



Example: Given $f(x) = x^2 - 4x + 4$, find $f'(3)$.

Need to do or see more practice?
Go to https://www.mathkanection.com/bc-unit-2-derivatives.html#definitionderivative