

find the slope of f(x) a x = 2.

Finding the Slope of a Function at a Point

h 70

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).

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

where the 2^{nd} point is *h* units away from x = 3.

$$m = \frac{f(3\pi h) - f(3)}{3\pi h - 3}$$

= $(3+h)^{2} - 4(3+h)\pi 4 - 1$
= $\frac{f(4h)^{2} - 4(3+h)\pi 4 - 1}{h}$
= $\frac{h^{2} + 2h}{h} = \frac{h(h+2)}{h} = h+2$



f(x)

Moving the 2^{nd} point closer to (3,1) makes *h* get closer to zero. -3 -2 0 3 4 5 -1 2



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.

$$m_{\text{tengentaline}} = \frac{2}{1} = 2$$

(h+2) 0+2

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

• slope of a tangent line to a function/curve

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- 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
$$f(x) = (x^2 - 4x) + 4$$

 $f'(x) = \lim_{h \to 0} \frac{f(x+h) - F(x)}{h} = f(x+h) = (x+h)^2 - 4(x+h) + 4$
 $= \lim_{h \to 0} \frac{(x+h)^2 - 4(x+h) - 4 - (x^2 - 4x + 4)}{h}$
 $= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - 4x - 4h + 44 - 4x + 44x - 44}{h}$
 $= \lim_{h \to 0} \frac{2xh + h^2 - 4h}{h}$
 $= \lim_{h \to 0} \frac{h(2x+h - 4)}{h}$
 $= \lim_{h \to 0} \frac{h(2x+h - 4)}{h}$
 $= 2x + 0 - 4$
 $(F'(x) = 2x - 4)$

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Need to do or see more practice?

Go to https://www.mathkanection.com/bc-unit-2-derivatives.html#definitionderivative