

Calculus Section 2.1 Definition of a Derivative

- Find the slope of the tangent line to a curve at a point.
- Use the limit definition to find the derivative of a function.

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Definition of the Derivative of a Function

The derivative of a function allows you to find the slope of the tangent line at a point.
The derivative of f is given by:

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

Provided the limit exists. For all x for which this limit exists, f' is a function of x .

Different ways to write the derivative:

1) $f'(x)$

2) $\frac{dy}{dx}$

3) y'

4) $\frac{d}{dx}[f(x)]$

5) $D_x[y]$

Finding the derivative of a function using limits:

Find the derivative of $f(x) = 2x - 3$

(The answer should be 2 because it is the slope of $y = mx + b$)

$$\lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{2(x + \Delta x) - 3 - (2x - 3)}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{2x + 2\Delta x - 3 - 2x + 3}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{2\Delta x}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} 2$$

2

$$f'(x) = 2$$