



## HIGHER ORDER DERIVATIVES

### Why

The second derivative (if it exists) is the derivative of the derivative of a function. Can we continue in this way?

### Definition

Let  $A \subset \mathbf{R}$ . Let  $f : A \rightarrow \mathbf{R}$  be twice differentiable. We call  $f$  *three times differentiable* (or *thrice differentiable*) if its second derivative is differentiable. We call the derivative of the second derivative of  $f$  the *third derivative* of  $f$ .

Generally, for  $n \geq 3$ , we call  $f$   *$n+1$ -times differentiable* if  $f$  is  $n$ -times differentiable. The  *$n+1$ th derivative* of a  $n+1$ -times differentiable function is the derivative the  $n$ th derivative of the function.

### Notation

The  $n$ th derivative of a function  $f : A \rightarrow \mathbf{R}$  is sometimes denoted  $f^{(n)} : A \rightarrow \mathbf{R}$ .



