



## Partial Derivatives

### 1 Why

We want to talk about a function of multiple real-valued arguments changes with respect to changes in its arguments.

### 2 Definition

Consider a real-valued function on  $d$ -dimensional space. For  $i = 1, \dots, d$ , Fix a point  $x$ . consider the limit of a sequence of quotients of the difference of the result of that function at a point the consider the limit of a sequence of quotients of the value changed at component The *partial derivative* of the function with respect to the  $i$ th the function which maps  $d$ -dimensional vectors of real numbers to the limit of a seq of all of the quotient between the point to argument is the limit of the rate with a The partial derivative of a

Let  $f : \mathbf{R}^d \rightarrow \mathbf{R}$  For  $i = 1, \dots, d$ , define Let  $g_i : \mathbf{R}^d \rightarrow \mathbf{R}$  by

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

for each  $x$