

If  $f(x, y)$  is a function, where  $f$  partially depends on  $x$  and  $y$  and if we differentiate  $f$  with respect to  $x$  and  $y$  then the derivatives are called the partial derivative of  $f$ . The formula for partial derivative of  $f$  with respect to  $x$  taking  $y$  as a constant is given by:

$$f_x = \frac{\partial f}{\partial x} = \lim_{h \rightarrow 0} \frac{f(x+h, y) - f(x, y)}{h}$$

and partial derivative of  $f$  with respect to  $y$  taking  $x$  as a constant is given by:

$$f_y = \frac{\partial f}{\partial y} = \lim_{h \rightarrow 0} \frac{f(x, y+h) - f(x, y)}{h}$$

Consider the following function:  $f(x, y) = x^2y$  Then the partial derivative of  $f$  with respect to  $x$  is given by:

$$\begin{aligned} f_x &= \frac{\partial f}{\partial x} \\ &= \frac{\partial}{\partial x}(x^2y) \\ &= 2xy \end{aligned}$$

$$\begin{aligned} f_y &= \frac{\partial f}{\partial y} \\ &= \frac{\partial}{\partial y}(x^2y) \\ &= x^2 \end{aligned}$$