Section 1.2 Math 141
Partial Derivatives

Main ideas

Derivatives tell us how one values changes as its input changes, or to be more precise, if its input value increase by one unit. For example, for $f(x)$, a function of one variable $\frac{df}{dx}(3) = 5$ means that if currently $x = 3$, then increasing x by one unit (from 3 to 4) would cause f to change (to increase) by 5, that is, $df = 5\,dx$.

In finding a partial derivative with respect to a particular variable, think of that one variable as "the variable" and the other variables (temporarily) as constants.

For a function $f(x, y)$ of two variables x and y, $\frac{\partial f}{\partial x}(3,7) = 5$ that if currently $(x, y) = (3,7)$ then increasing x by one unit (from 3 to 4), but not changing y, would cause the value of f to increase by 5, that is, $df = 5\,dx$.

In general, for $f(x, y)$:

$\frac{\partial f}{\partial x}$ tells us how much f changes if x were to increase by 1 unit (and the value of y did not change)
$\frac{\partial f}{\partial y}$ tells us how much f changes if y were to increase by 1 unit (and the value of x did not change)

We can find second (and third and …) derivatives, including mixed derivatives, for example:

$$\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial}{\partial x}\left(\frac{\partial f}{\partial y}\right).$$

We can evaluate (find the value of) a derivative at a particular point, that is, at particular values of (x, y).

In Class

1. I will find some partial derivatives of $f(x, y, z) = xy^2 + x^3z + 5z + e^y + x$ in class. You can use various technology (e.g. the online calculator or Wolfram Alpha) to find partial derivatives.

In Groups

2. Find some partial derivatives: HW 1.2.16 and 17.

In Class

3. We will discuss exactly what derivatives tell us. (See more details described above.)