Exact Equations

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- Recall that the **differential** is defined as:

$$dz = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$$

- $f(x, y) = c$ is said to be a solution of the differential equation:

$$dz = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$$

- A differential expression $M(x, y)\,dx + N(x, y)\,dy$ is an exact differential if it corresponds to the differential of some function $f(x, y)$.

- $M(x, y)\,dx + N(x, y)\,dy$ is said to be an exact equation if the expression on the left-hand side is an exact differential

- If $M(x, y)$ and $N(x, y)$ are continuous and have continuous first partial derivatives, then, to be an exact differential:

$$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$$

- If the equality above holds true, then a solution exists for a function f for which:

$$\frac{\partial f}{\partial x} = M(x, y)$$