multivariate/multivariable/multidimensional calculus

$$f(x) \quad \text{vs.} \quad f(x, y), f(x, y, z), f(x, y, z, \ldots)$$

Multivariable (or multivariate) calculus extends single-variable calculus to functions of multiple variables. It includes:

- **Partial derivatives:** Differentiation with respect to one variable while keeping others constant.
- **Multiple integrals:** Double and triple integrals for computing areas, volumes, and more.
- **Vector calculus:** Topics like gradient, line/surface integrals.
- **Optimization:** Finding local maxima/minima of functions with/without constraints

$$f(x, y) = x^2 - y^2 \longrightarrow$$

surface plot

3D visualization showing how a function behaves