

# My $\text{\LaTeX}$ Playground

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## 1 Introduction to Double Integrals

The motivation of Double Integrals came from the notion of a "volume problem" which is to find the volume under a surface over a region. Similar to a single integral, the definition of a double integral is given as the limit of a Riemann Summation which is discussed below.

**Definition:** If  $f$  is a function of two variables that is continuous and nonnegative on a region  $R$  in the  $xy$ -plane, then the volume of the solid enclosed between the surface  $z = f(x, y)$  and the region  $R$  is defined by

$$V = \lim_{n \rightarrow \infty} \sum_{i=1}^m f(x_k^*, y_k^*) \Delta A_k = \iint_R f(x, y) dA \quad (1)$$

where  $R$  is a given region.

## 2 Iterated integrals

It's practically not possible to compute the volume every time using (1), However, the Fundamental Theorem of Calculus helps us to compute it as an iterated integral.

$$\int_a^b \int_c^d f(x, y) dx dy = \int_a^b \left[ \int_c^d f(x, y) dx \right] dy dx$$

### 2.1 Geometric Interpretation of an Iterated Integral; Volume by Slicing