Calculus II

\[ \int_a^b f(x) \, dx = \lim_{n \to \infty} \sum_{i=1}^{n} f(x_i) \Delta x \]

If \( f \geq 0 \) (at least on \([a, b]\))
then the integral gives the area under the graph and above the x-axis.
Integration of $f(x,y)$ over rectangles

For functions of two variables, we again partition the domain $R = [a, b] \times [c, d]$.

$$\sum_{k=1}^{n} f(x_k, y_k) \Delta A_k$$

$$\int_{R} f(x,y) \, dA$$
If \( f(x,y) \geq 0 \) for 
\[ a \leq x \leq b \text{ and } c \leq y \leq d, \]
then \( \iint_R f(x,y) \, dA \) is the 
volume between the surface 
\( z = f(x,y) \) and region \( R \).