

Theorem — Area as a limit

Suppose f is a nonnegative, continuous function on $[a, b]$. Partition $[a, b]$ into n subintervals of equal length, $\Delta x = (b - a)/n$. For each k from 1 to n , let c_k be any point in the k th subinterval. The area of the region bounded by the graph of f , the x -axis, and the vertical lines $x = a$ and $x = b$ is given by

$$\text{Area} = \lim_{n \rightarrow \infty} \sum_{k=1}^n f(c_k) \Delta x.$$