

Volumes by Slicing

Suppose you have a loaf of bread and you want to find the volume of the loaf. One way to do this is to find the volume of each slice and then add up their volumes.

The volume of a slice of bread is its thickness dx times the area a of the face of the slice (the part you spread butter on). So $\Delta V \approx A \Delta x$. In the limit, $dV = A(x) dx$. (If your loaf of bread is not perfectly regular, the area of a face might change from slice to slice.) To get the entire volume, sum the volumes of all the slices:

$$V = \int A(x) dx \quad \text{Proof of the second fundamental theorem}$$

The Riemann sum approximating this volume looks like $\sum_{i=1}^n A_i \Delta x$ if the loaf has n slices.

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