

# Average value of a function

In discrete terms, add up all the items and divide by  $n$ , the number of items

$$\frac{y_1 + y_2 + \dots + y_n}{n} = \frac{\sum_{i=1}^n f(c_i)}{n}$$

mult + divide by  $b-a$

$$= \frac{1}{b-a} \cdot \sum_{i=1}^n f(c_i) \cdot \frac{b-a}{n}$$

$$= \frac{1}{b-a} \sum_{i=1}^n f(c_i) \cdot \Delta x_i$$

We want the continuous case, where  $n \rightarrow \infty$ ,

$$\text{avg value} = \lim_{n \rightarrow \infty} \frac{1}{b-a} \sum_{i=1}^n f(c_i) \cdot \Delta x_i$$

$$= \frac{1}{b-a} \sum_{i=1}^n f(c_i) \Delta x_i$$

$$= \frac{1}{b-a} \int_a^b f(x) dx$$