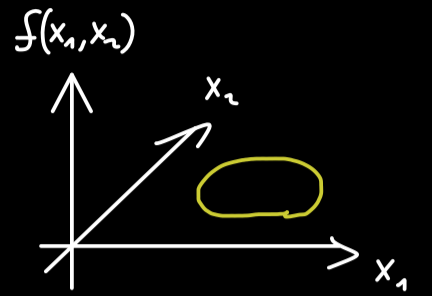
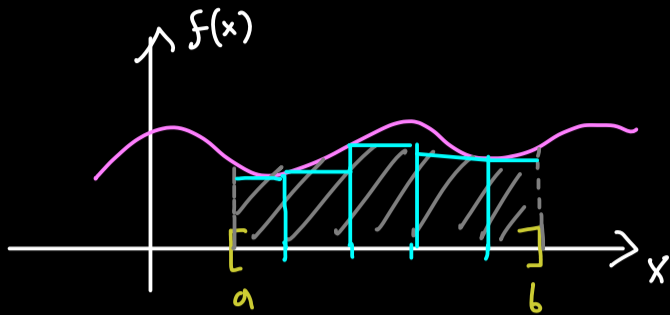


# Riemann integral vs. Lebesgue integral

Riemann integral:

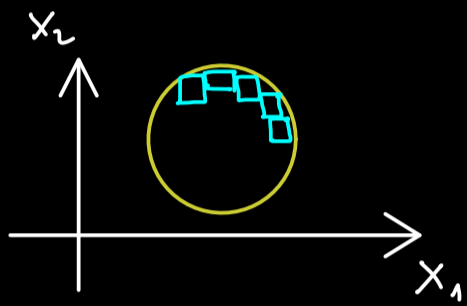
$$f: \mathbb{R}^2 \rightarrow \mathbb{R}$$



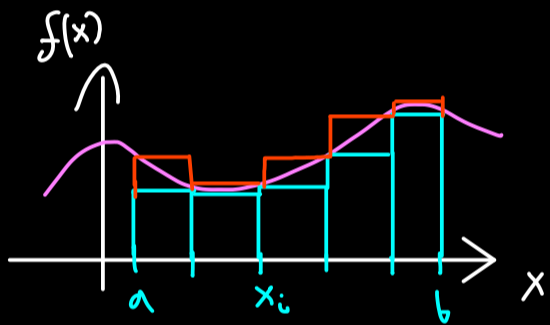
Problems of Riemann integral:

- difficult to expand to higher dimensions
- dependence on continuity
- limit processes

$$\lim_{n \rightarrow \infty} \int_a^b f_n(x) dx \stackrel{?}{=} \int_a^b \lim_{n \rightarrow \infty} f_n(x) dx$$



Riemann integral:



$$f: \mathbb{R} \rightarrow \mathbb{R}$$

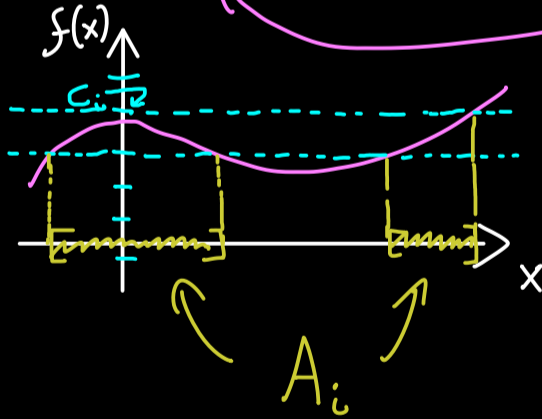
$$U(P) = \sum \sup f(x) \cdot \Delta x_i$$

$$L(P) = \sum \inf f(x) \cdot \Delta x_i$$

Lebesgue integral:

$$f: \Omega \rightarrow \mathbb{R}$$

$$f: \mathbb{R}^3 \rightarrow \mathbb{R}$$



measure (volumes?)  
 $\mu$

$$\sum_i c_i \cdot \mu(A_i) \rightsquigarrow \int f d\mu$$

Lebesgue integral