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Riemann integral functional $\int_{[a,b]} : \mathcal{C}[a,b] \to \mathbb{R}$

Definition. **The Riemann integral functional is the $\mathbb{R}$-vector space endomorphism**

$$\begin{aligned} \int_{[a,b]} : \mathcal{C}[a,b] &\to \mathbb{R} \\ f &\mapsto \int_{[a,b]} f \end{aligned}$$

- By

$$\left| \int_{[a,b]} f \right| \leq \int_{[a,b]} |f| \leq (\sup_{[a,b]} |f|) \int_{[a,b]} = (b-a)\|f\|_\infty$$

  so the integral operator is bounded $\iff$ continuous on $\mathcal{C}[a,b]$.
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- stamp stamp
  - Rf subobjects of and functions on $\mathbb{R}^n, T^n, S^n, \mathbb{C}^n$
    - cont Continuous functions on $\mathbb{R}^d$
      - space cpt $\mathcal{C}[0,1]$
        - int to R Riemann integral functional $\int_{[a,b]} : \mathcal{C}[a,b] \to \mathbb{R}$

And it has 2 siblings.

- stamp stamp
  - Rf subobjects of and functions on $\mathbb{R}^n, T^n, S^n, \mathbb{C}^n$
    - cont Continuous functions on $\mathbb{R}^d$

- space cpt $\mathcal{C}[0,1]$
  - dual Dual space of $\mathcal{C}[0,1]$
  - int to R Riemann integral functional $\int_{[a,b]} : \mathcal{C}[a,b] \to \mathbb{R}$