6.4 The Fundamental Theorem of Calculus (FTC)

Let f be continuous on $[a,b]$. Then

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

where F is any anti-derivative of f; i.e. $F'(x) = f(x)$.

Notation If $F'(x) = f(x)$, then we usually write

$$\int_a^b f(x)\,dx = F(x)\Big|_a^b = F(b) - F(a).$$

e.g. $F(x)\Big|_3^4$ means $F(4) - F(3)$.

Thus, in order to find $\int_a^b f(x)\,dx$, we can
- first find $\int f(x)\,dx$ which gives a family of functions $F(x) + C$.
- then find $(F(b) + C) - (F(a) + C) = F(b) - F(a)$

(thus can get rid of C and only compute this)