Definition

If $a<b$,

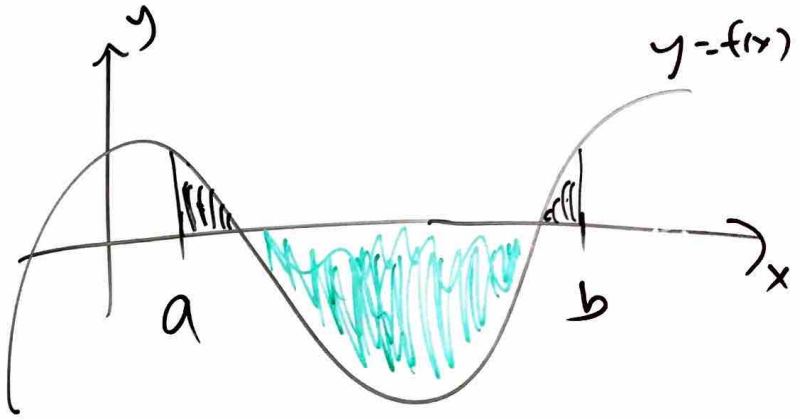
the integral of f from a to b is

$$\int_a^b f(x)\,dx = \text{Area of the region with } a\le x\le b \text{ and } 0\le y\le f(x)$$

$$- \text{Area of the the region with } a\le x\le b \text{ and } f(x)\le y\le 0$$

= "Area under the curve"

= "Signed area under the curve"



x-axis is $y=0$

= Area under curve and above x-axis minus area above the curve and below the x-axis, between $x=a$ and $x=b$.