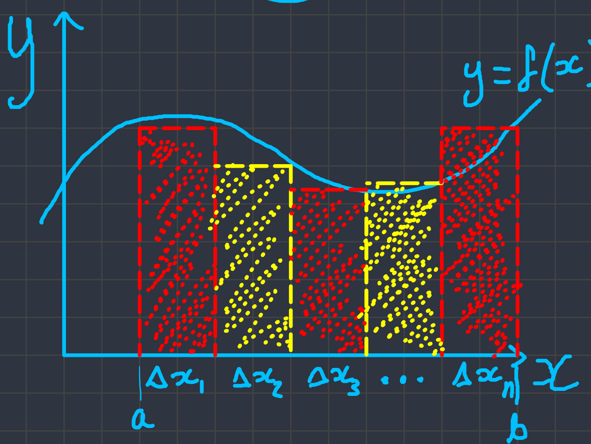
Integration:

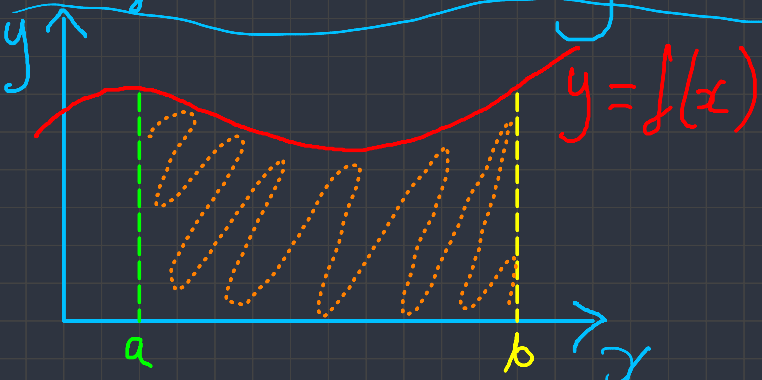


'find the area between the curve and x-axis'

$$\lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\,\Delta x_i = \int_a^b f(x)\,dx$$

This idea of using 'as n approaches infinity' / as Δx_i becomes smaller is the core idea behind integral calculus

Definite Integrals:



$$\text{area} = \int_a^b f(x)\,dx$$

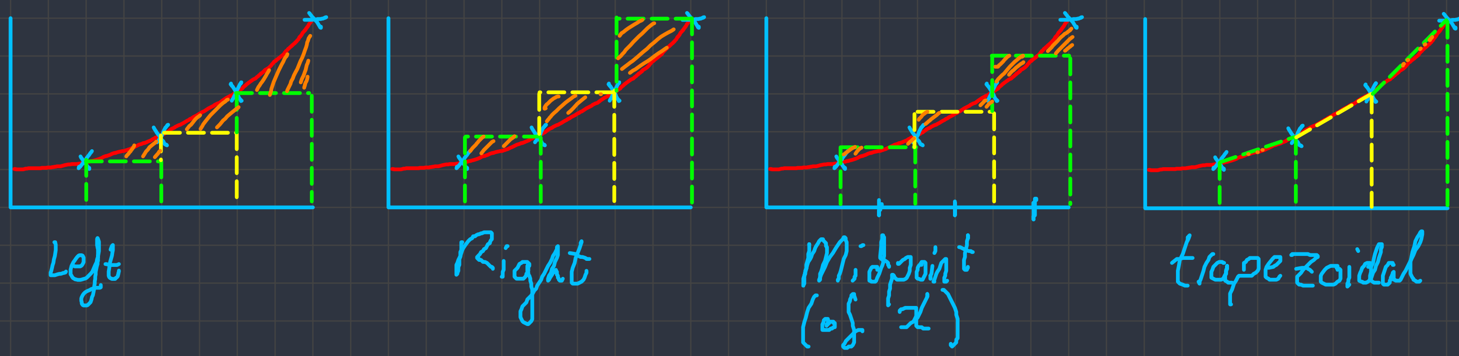
The definite integral of the rate of change of a quantity gives the net change in that quantity.

for example if you had velocity (rate of change in displacement) plotted against time, the definite integral would be the total displacement. (It is just $\frac{m}{s} \times s = m$ pretty much)

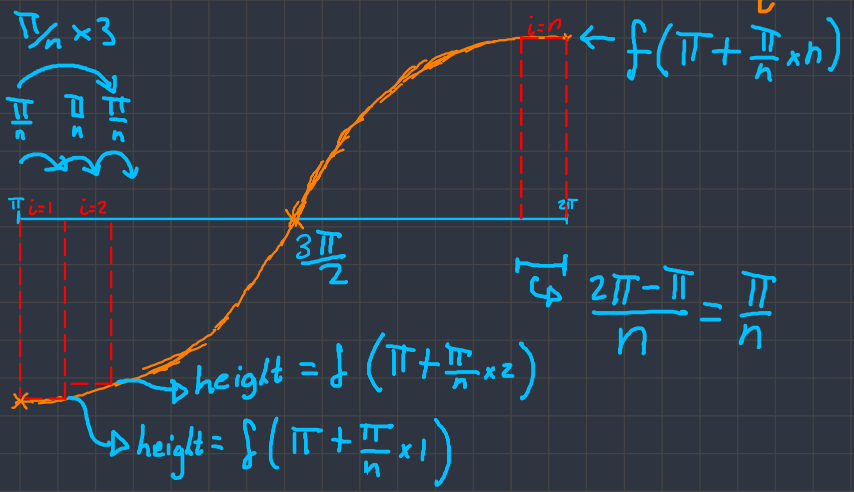
Also note that it is the Net Change in the interval. It is like the accumulation of a quantity, So if you wanted the total between $t=0$ & $t=6$, do {Volume at $t=0$} + $\int_0^6 f(t)\,dt$

Riemann sums

There are left, right, midpoint and trapezoidal Riemann sums.



$$\int_{\pi}^{2\pi} \cos(x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} \left(\cos\left(\pi + \frac{\pi}{n} i\right) \times \frac{\pi}{n}\right)$$



$$\frac{2\pi - \pi}{n} = \frac{\pi}{n}$$

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left(\ln\left(2 + \frac{5i}{n}\right) \times \frac{5}{n}\right)$$

$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(a + \Delta x\, i)\Delta x$$

$f(x) = \ln(x)$

$a = 2$

$\Delta x = \frac{5}{n} = \frac{b-a}{n} \Rightarrow b = 5 + a$
$= 7$

$$\int_2^7 \ln(x)\,dx$$

Fundamental Theorem of Calculus

f continuous on [a,b]

$F(x)=\int_a^x f(t)\,dt$, where x in [a,b]

$$\frac{dF}{dx}=\frac{d}{dx}\int_a^x f(t)\,dt=f(x)$$

- Every continuous f has an antiderivative $F(x)$
- Connection between integration/derivatives