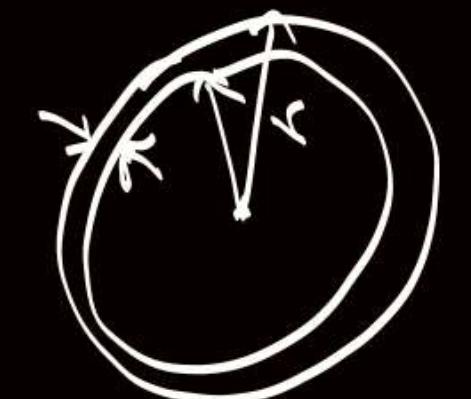


$$\sin \theta(y - a(\sin \theta - \theta \cos \theta)) = -\cos \theta(x - a(\cos \theta + \theta \sin \theta))$$

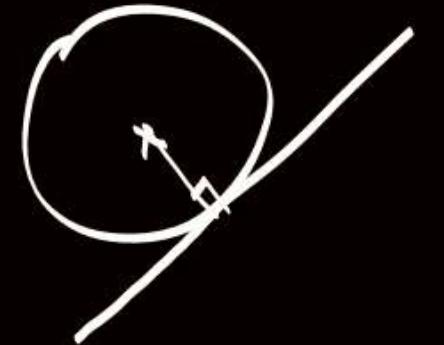
$$y \sin \theta + x \cos \theta = a$$

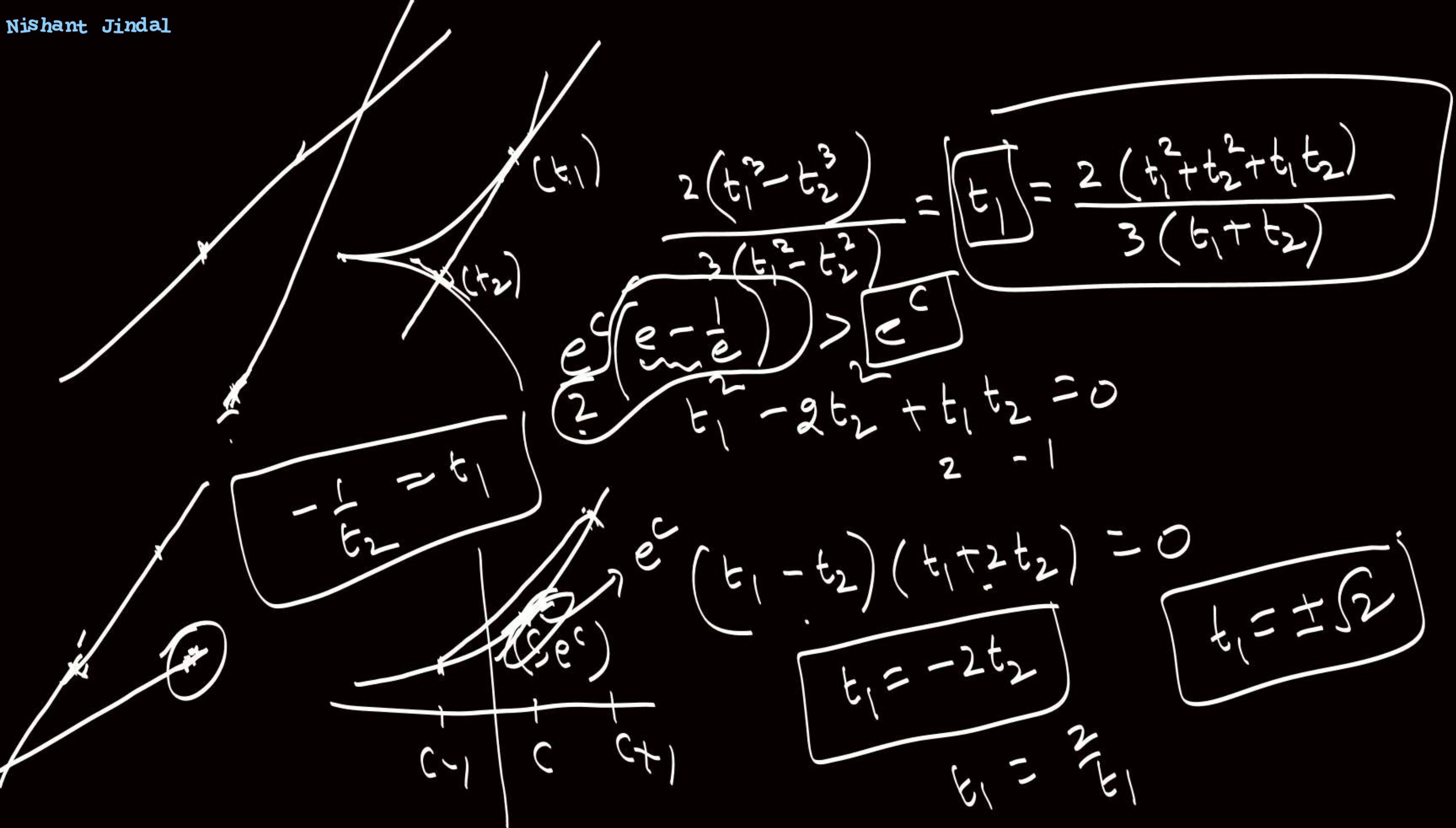


$$V = \frac{4}{3} \pi (r^3 - 10^3)$$

$$r-10 = 5' \\ r = 15'$$

$$\kappa = \frac{y+2}{2} - 6 = \frac{y-5}{2}$$

$$2\kappa = y-5$$
$$\frac{|-16+6+5|}{\sqrt{5}} = \sqrt{100-C}$$

$$C = ?$$



$$\frac{\sin \theta}{1 + \cos \theta} = \tan \frac{\theta}{2}$$

$$\frac{d\theta}{dt} = \frac{1}{2} \sec^2 \frac{\theta}{2} \boxed{\frac{d\theta}{dt}}$$

Fundamental theorem of Calculus

Let $f(x)$ be continuous in $[a, b]$, $F'(x) = f(x)$,

then

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

$\int_a^b f(x) dx$
upper limit
lower limit

$$y = f(x)$$

$$\Delta A = f(x) \Delta x$$

$y = f(x)$



$$\Delta A = f(x + \Delta x) \Delta x$$

$$\Delta A = \left(\frac{f(x) + f(x + \Delta x)}{2} \right) \Delta x$$

$$f(x) \Delta x$$

$$\lim_{\Delta x \rightarrow 0} \frac{\Delta A}{\Delta x} = \boxed{f(x) = \frac{dA}{dx}}$$

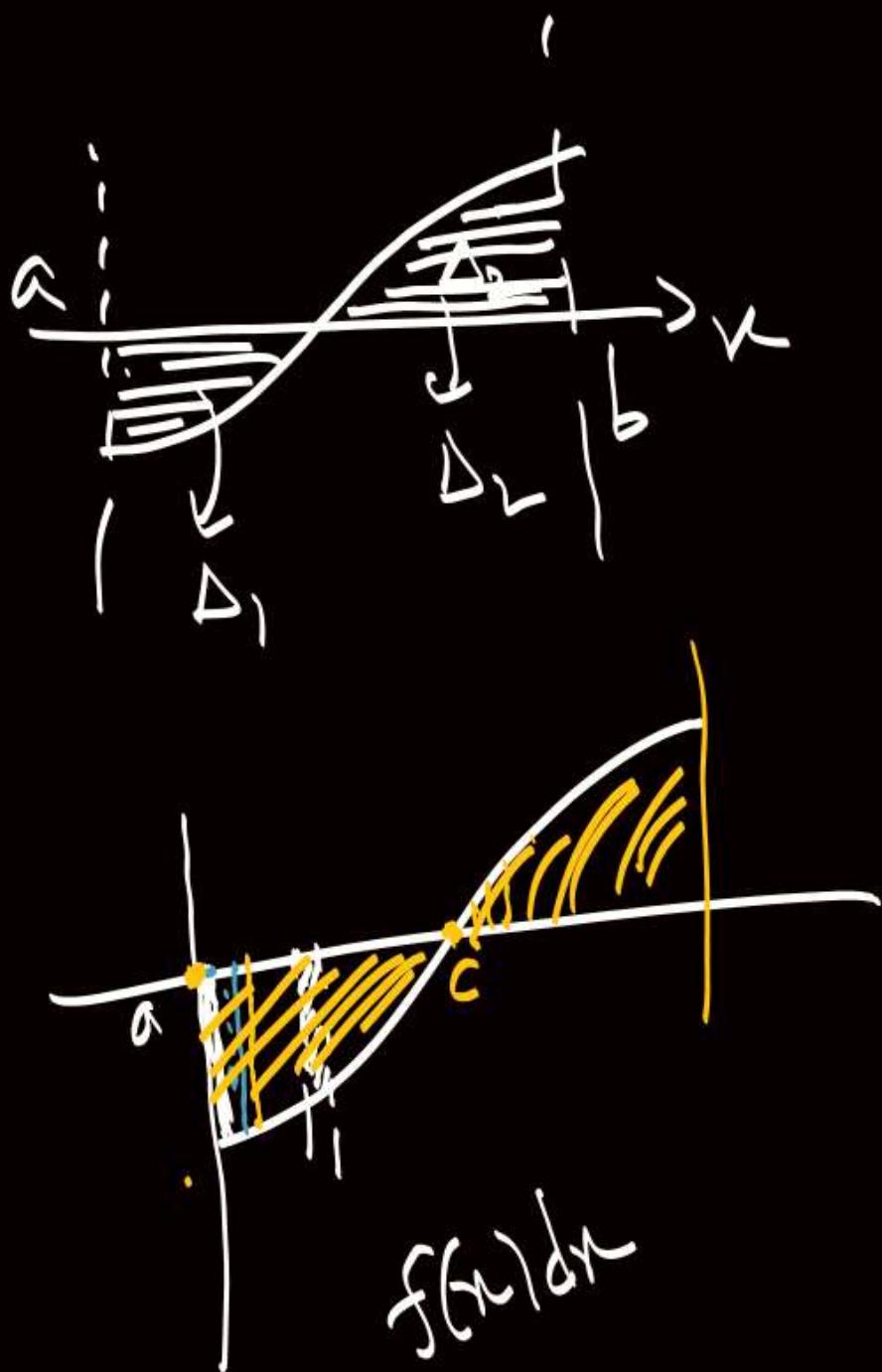
$$\frac{\Delta A}{\Delta x} = f(x)$$

$$= f(x + \Delta x)$$

$$= \frac{f(x) + f(x + \Delta x)}{2}$$

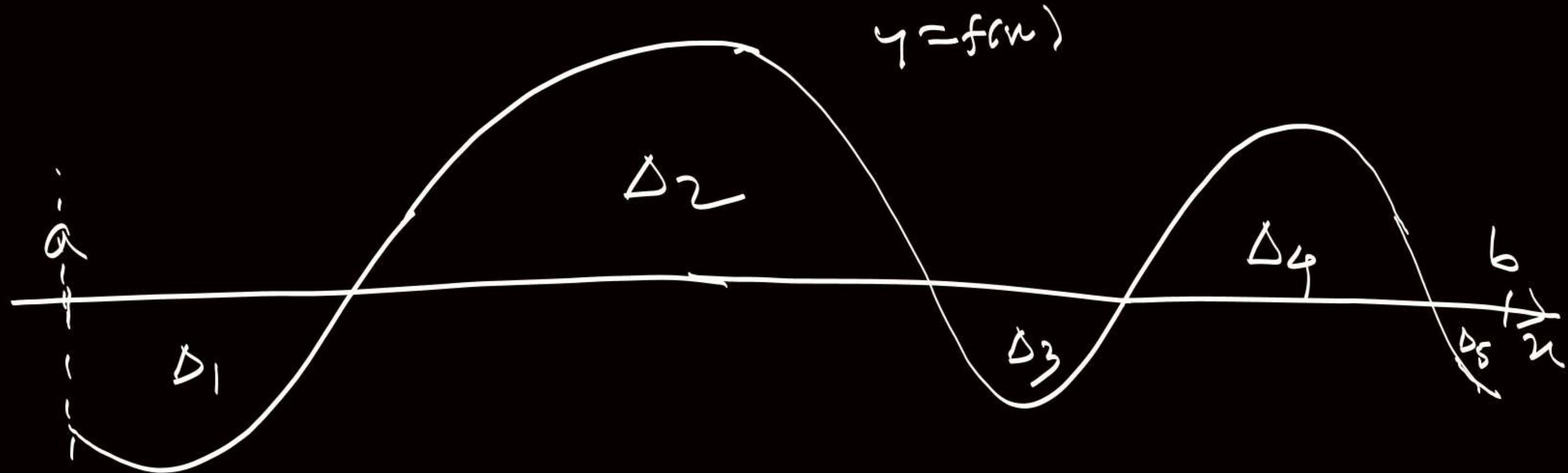
$$dA = f(x) dx$$

$$\int_a^b dA = \int_a^b f(x) dx$$



$$\int_a^b f(x)dx = -\Delta_1 + \Delta_2$$

$\int_a^b f(x)dx$ means



$$a < b \quad , \quad \int_a^b f(x) dx = -\Delta_1 + \Delta_2 - \Delta_3 + \Delta_4 - \Delta_5$$

Area bounded by $f(x)$ with x -axis
between $x=a$ & $x=b$ = $\Delta_1 + \Delta_2 + \Delta_3 + \Delta_4 + \Delta_5$

Definite Integral as limit of Sum

$$f(a)h + f(a+h)h + f(a+2h)h + \dots + f(a+(n-1)h)h \approx \int_a^b f(x)dx$$

$$b = a + nh$$

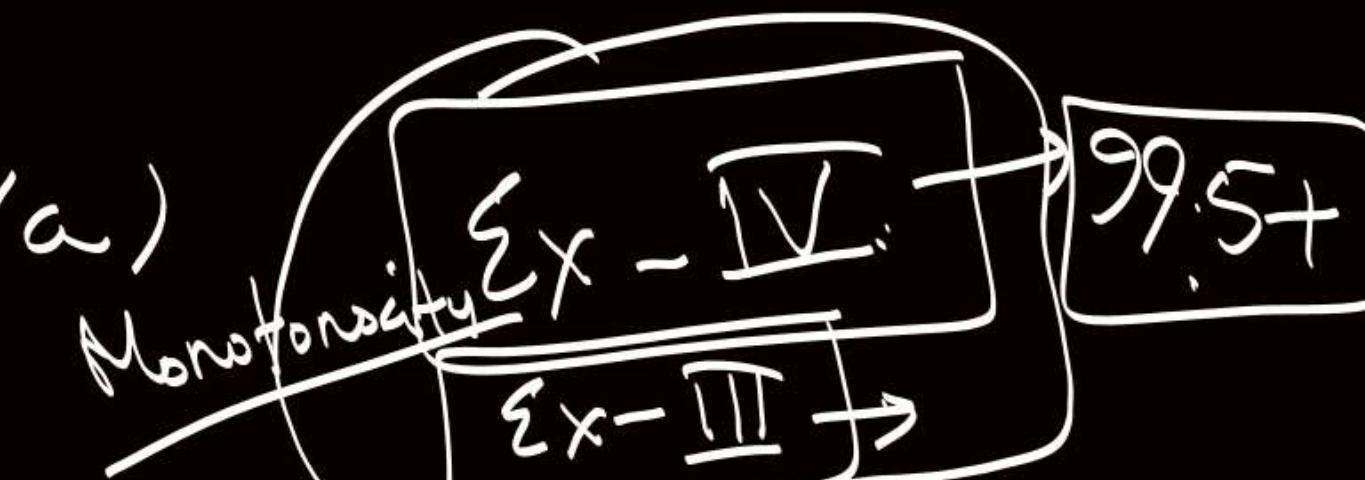


$$\lim_{n \rightarrow \infty} \sum_{r=1}^n f(a+(r-1)h)h = \int_a^b f(x)dx$$

$$\lim_{n \rightarrow \infty} \sum_{r=1}^n \left(\frac{b-a}{n} \right) f\left(a+(r-1)\left(\frac{b-a}{n}\right)\right) = \int_a^b f(x)dx'$$

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

$F'(x) = f(x) \rightarrow \text{cont.}$



$$F(x)$$

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n h f(c_i)$$

$$= \int_a^b f(x) dx$$

$$c_1 \in (a, a+h), \quad h F'(c_1) = F(a+h) - \underline{F(a)}$$

$$c_2 \in (a+h, a+2h), \quad h F'(c_2) = F(a+2h) - \underline{F(a+h)}$$

$$c_3 \in (a+2h, a+3h), \quad h F'(c_3) = F(a+3h) - \underline{F(a+2h)}$$

$$= F(b) - F(a)$$

$$c_n \in (a+(n-1)h, a+nh)$$

$$h F'(c_n) = F(\underline{a+nh}) - F(a+(n-1)h)$$

$$\sum_{i=1}^n h f(c_i) = F(b) - F(a)$$