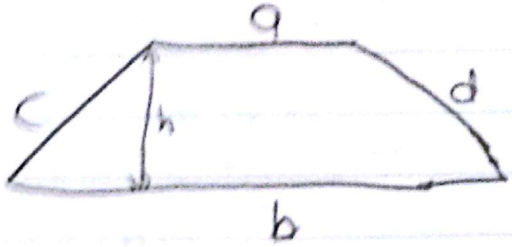
Parallel Trapezoidal Integration

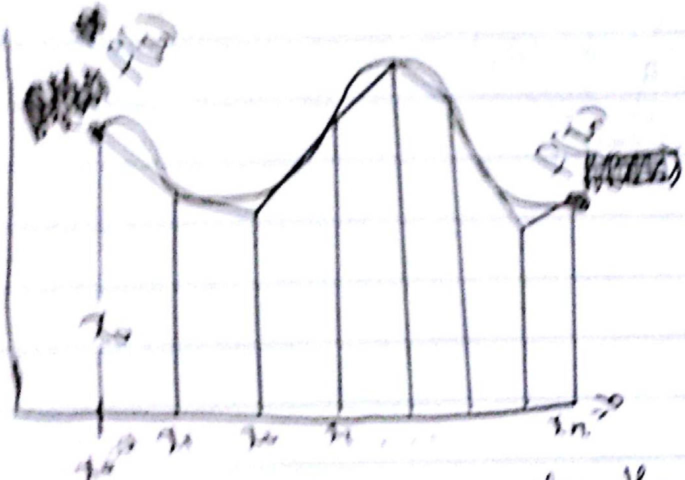
Derivation

area of Trapezoid: $A = \frac{a+b}{2} h$

a: base
b: base
h: height



$h = x_{i+1} - x_i \quad \forall i \geq 0 \; [0, n-1]$



approximating each area under the graph using trapezoids.

the area of each trapezoid in the interval $[x_i, x_{i+1}]$

$$A_i = \frac{f(x_i) + f(x_{i+1})}{2} h$$

$$= \frac{f(x_i) + f(x_{i+1})}{2} (x_{i+1} - x_i)$$

$$= \frac{f(x_i) + f(x_{i+1})}{2} \Delta x$$

Δx is fixed

To improve our approximation we have to refine of partition to have

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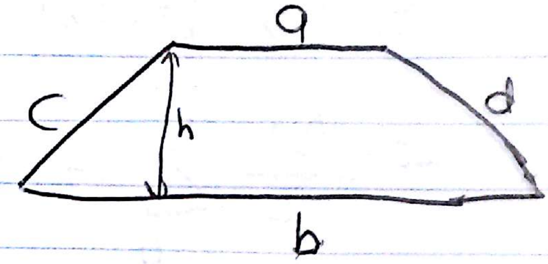
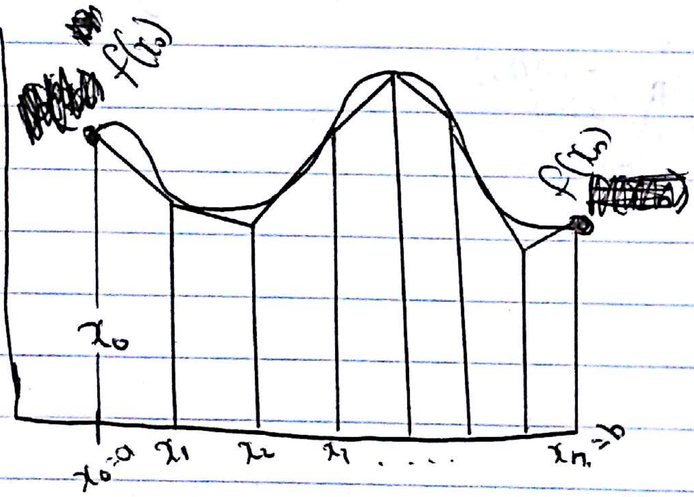


a : base
b : base
h : height

$h = x_{i+1} - x_i \quad \forall i > 0 \quad [0, n-1]$



approximating each area under the graph using trapezoids.

~~So each shape~~

the area of each trapezoid in the interval $[x_i, x_{i+1}]$.

$$A_i = \frac{f(x_i) + f(x_{i+1})}{2} h$$

$$= \frac{f(x_i) + f(x_{i+1})}{2} (x_{i+1} - x_i)$$

$$= \frac{f(x_i) + f(x_{i+1})}{2} \Delta x$$

Δx is fixed

To improve our approximation we have to refine of partition to have n partitions.

The integral from a to b

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

$$\approx \frac{\Delta x}{2}\left(f(x_0)+f(x_1)\right) + \dots + \frac{\Delta x}{2}\left(f(x_{n-1})+f(x_n)\right)$$

$$= \frac{\Delta x}{2}\sum_{i=0}^{n-1} f(x_i)+f(x_{i+1})$$

where delta x is given by $\frac{b-a}{n}$