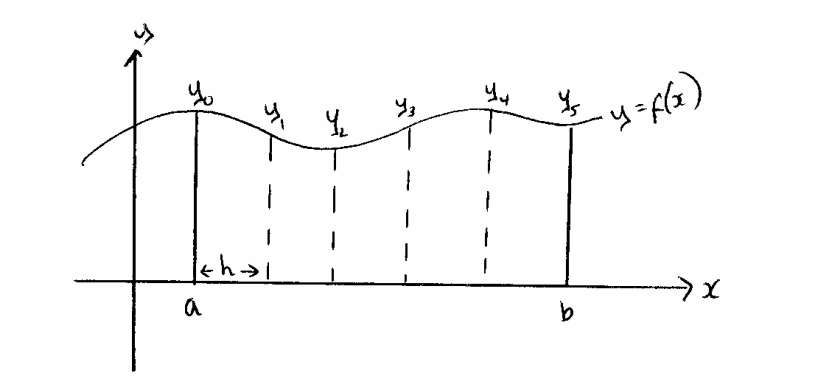
Trapezium Rules

If you want to find the area under a curve but you cannot integrate then you can use the trapezium rule

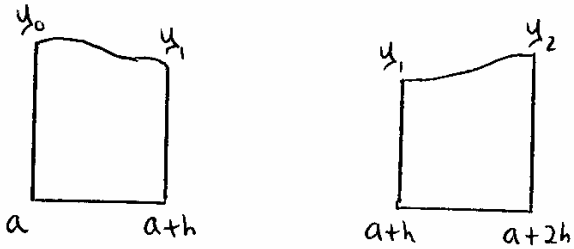


Normally to find the area we would $\int_a^b y\ dx$ instead we divide the area into lots of equal strips and then find the area of each by imagining that they are close to trapeziums.

Step 1. We decide what the width of each trapezium (h) will be by deciding how many strips we are going to have then using this formula

$$h = \frac{b-a}{n}$$ where n is the number of strips

Step 2. now we have the *x* values so we find the corresponding *y* values by substituting it into the original equations, these tell us the heights of the trapeziums.



Step 3. Use the formula to find the area.

Trapezium rule is:- $\int_a^b y\ dx = \frac{1}{2} h\,[y_0 + 2(y_1 + y_2 + \ldots\ldots y_{n-1}) + y_n]$

where $h = \frac{b-a}{n}$

Always remember the formula for a trapezium $A = \frac{1}{2}(a + b) \times h$

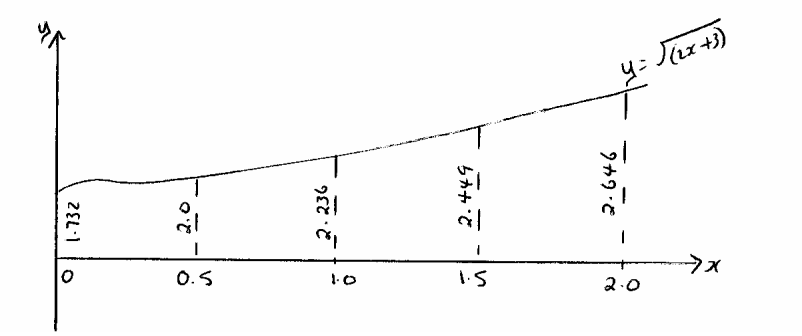
Example 1. Use the trapezium rule with 4 strips to estimate the area under the curve $y = \sqrt{2x + 3}$ between the lines $x = 0$ and $x = 2$

$$\text{strip width} = \frac{b - a}{n} \quad \text{where a} = 0,\ \text{b} = 2 \text{ and n} = 4$$

$$h = \frac{2 - 0}{4}$$

$$h = 0{\cdot}5$$

x	0	0.5	1	1.5	2
y	1.732	2	2.236	2.449	2.646



$$Area = \frac{1}{2} \times 0{\cdot}5 \times [1{\cdot}732 \times 2(2 + 2{\cdot}236 + 2{\cdot}449) + 2{\cdot}646\}$$

$$A = \frac{1}{2} \times 0{\cdot}5 \times 17{\cdot}748$$

$$A = 4{\cdot}437$$

So an estimate for the area is 4.437

(Remember the more strips the more accurate the area)