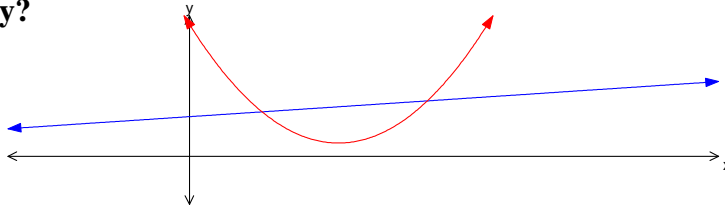


## Finding the Areas Between a Curves and a Line

The area between a line (equation  $y_1$ ) and a curve (equation  $y_2$ ) is given by

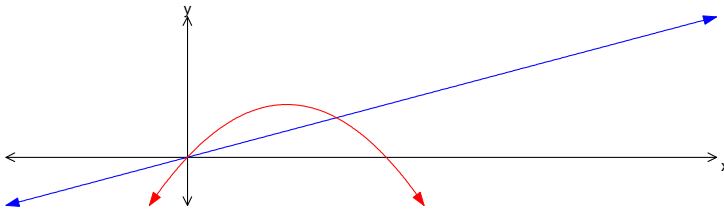
$$\text{Area} = \int_a^b (y_1 - y_2) dx$$

Why?



If you consider the area under the straight line ( $y_1$ ) and take away the answer to the area under the curve ( $y_2$ ) then you would be left with the area between them.

Example 1. Find the area of the region bounded by the curve  $y = x(4 - x)$  and the line  $y = x$ .



$$x = x(4 - x)$$

$$x = 4x - x^2$$

$$x^2 - 3x = 0$$

$$x(x - 3) = 0$$

$$\therefore x = 0 \text{ and } x = 3 \quad \text{this means the points of intersection are 0 and 3}$$

$$= \int_0^3 (y_2 - y_1) dx \quad y_2 - y_1 = x - x(4 - x) = x^2 - 3x$$

$$= \int_0^3 x^2 - 3x dx$$

$$= \left[ \frac{x^3}{3} - \frac{3x^2}{2} \right]_0^3$$

$$= \left( \frac{3^3}{3} - \frac{3 \times 3^2}{2} \right) - (0)$$

$$= -4.5 \quad \therefore \text{Area} = 4.5$$

You may also need to use other area formulas such as:-

$$\text{Triangle} = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$$

$$\text{Trapezium} = \frac{\text{sum of parallel sides}}{2} \times \text{height}$$

If you have an area that has part of it under the curve then you need to solve it in the same way.

