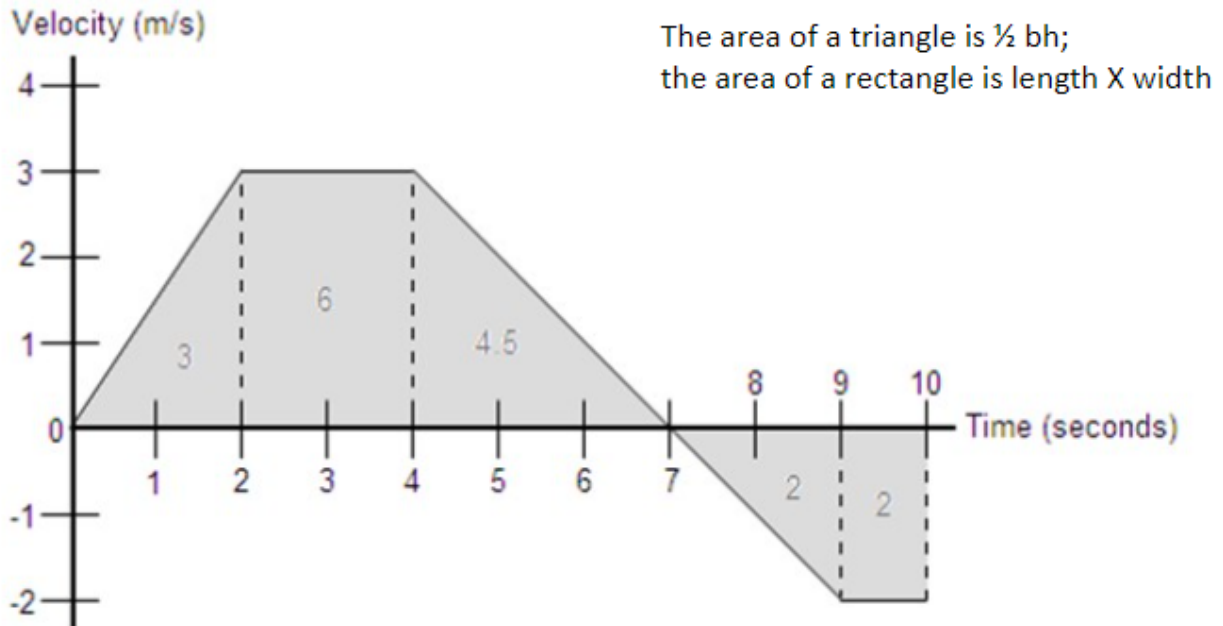


## Displacement from Velocity Graph

The displacement is found by taking the **area** of a velocity vs time graph.



The area under the x-axis must be subtracted from the areas above the x-axis.

**Adding the areas under the curve for each section gives the following:**

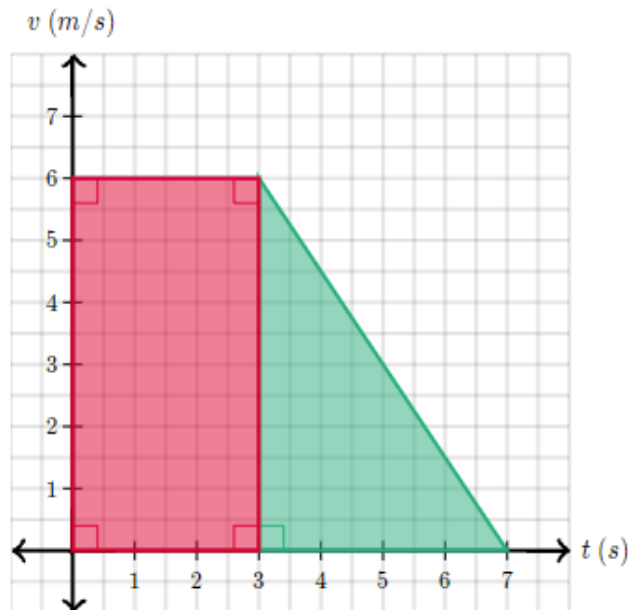
$$3\text{m} + 6\text{m} + 4.5\text{m} - 2\text{m} - 2\text{m} = +9.5\text{m}$$

**So the total displacement of the object from its original position is +9.5m.**

**Caution: An object does not always start its motion from the origin  $x=0$ !!!**

## B. Finding the displacement of the go-kart between $t = 0$ s and $t = 7$ s

We can find the displacement of the go-kart by finding the area under the velocity graph. The graph can be thought of as being a rectangle (between  $t = 0$  s and  $t = 3$  s) and a triangle (between  $t = 3$  s and  $t = 7$  s). Once we find the area of these shapes and add them, we will get the total displacement.



The area of the rectangle is found by

$$\text{area} = h \times w = 6 \text{ m/s} \times 3 \text{ s} = 18 \text{ m}$$

The area of the triangle is found by

$$\text{area} = \frac{1}{2}bh = \frac{1}{2}(4 \text{ s})(6 \text{ m/s}) = 12 \text{ m}$$

Adding these two areas together gives the total displacement.

$$\text{total area} = 18 \text{ m} + 12 \text{ m} = 30 \text{ m}$$

$$\text{total displacement} = 30 \text{ m}$$