

## Distance travelled under constant Acceleration

Acceleration can be defined to be the rate of change of velocity with respect to time. If the acceleration is zero then there is no change in velocity; the velocity is constant<sup>1</sup>.

If an object has an initial velocity  $u$  and at a time  $t$  has a final velocity  $v$ , and during that time has travelled a distance  $s$ , then  $u$ ,  $t$ ,  $v$ ,  $s$  are related by the following equations

$$v = u + at,$$

$$v^2 = u^2 + 2as,$$

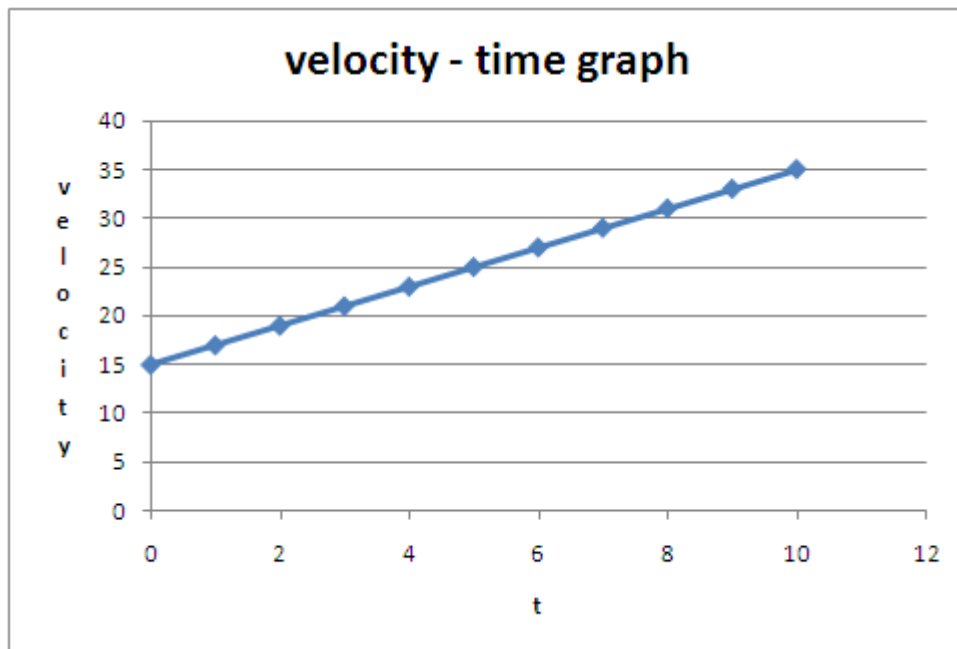
$$s = ut + \frac{1}{2}at^2.$$

### Example 1

A car has an initial velocity of  $15 \text{ ms}^{-1}$  and a constant acceleration of  $2 \text{ ms}^{-2}$ . What is the velocity of the car after  $10 \text{ s}$ ?

$$v = u + at = 15 + 2 \times 10 = 35 \text{ ms}^{-1}.$$

The final velocity of the car is  $35 \text{ ms}^{-1}$ . A velocity-time graph illustrates the change in velocity.



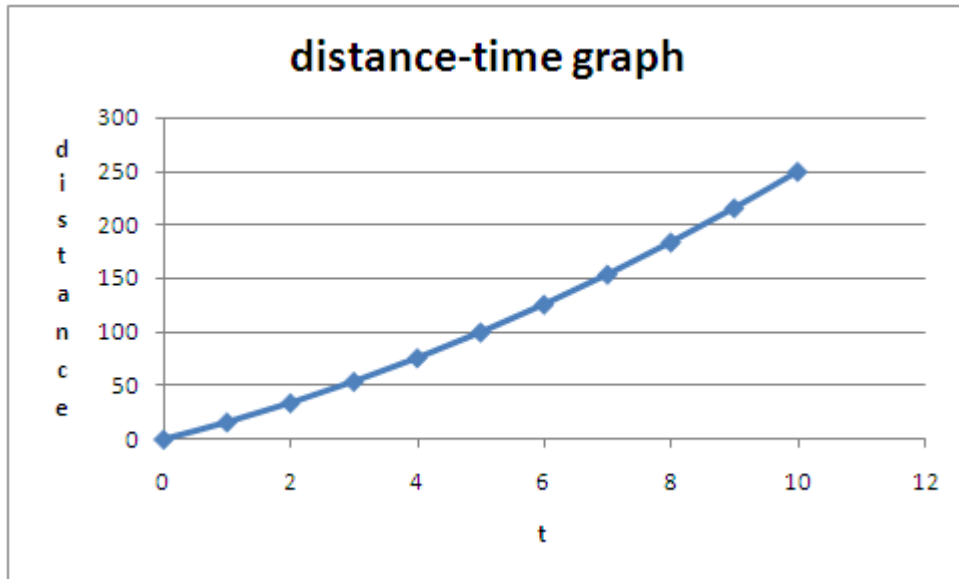
<sup>1</sup> [Distance travelled under constant Velocity](#)

Example 2

A car has an initial velocity of  $15 \text{ ms}^{-1}$  and a constant acceleration of  $2 \text{ ms}^{-2}$ . What is the distance travelled after 10s?

$$s = ut + \frac{1}{2}at^2 = 15 \times 10 + \frac{1}{2} \times 2 \times 10^2 = 250\text{m.}$$

The distance travelled is 250m. A distance-time graph illustrates how the distance travelled changes with time.



Example 3

Show that the Example 1/2 satisfies the equation  $v^2 = u^2 + 2as$ .

Check  $35^2 = 15^2 + 2 \times 2 \times 250$  ?

$1225 = 225 + 1000$  correct!