AREA UNDER THE GRAPH

When the velocity of the object is graphed as a function of time, the slope of the graph is the object's average acceleration. However, there is another useful quantity that can be derived from the area bound by the graph in a velocity-time graph. This quantity is called displacement.

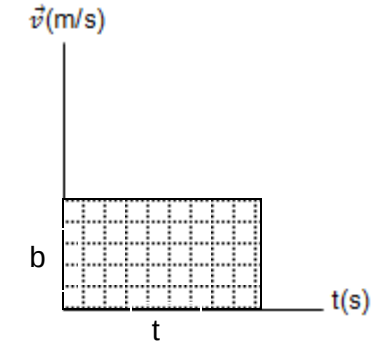
The examples below show velocity-time graphs for an object with uniform acceleration. The shaded area on the graph reveals shapes of a rectangle, triangle and a trapezoid where the usual area formulas apply.

Area of a Rectangle

The shape of the velocity-time graph at the right is a rectangle. To calculate the area of a rectangle, use A = bh where A is the displacement, b is velocity and h is time. Therefore,

displacement = velocity x time

$\vec{d} = \vec{v}t$

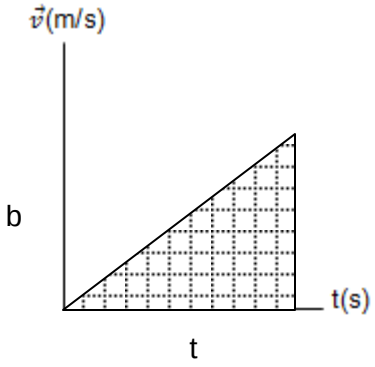


Area of a Triangle

The shape of the velocity-time graph at the right is a triangle. To calculate the area of a triangle, use A = (bh)/2 where A is displacement, b is velocity and t is time.

displacement = 1/2 (velocity x time)

$\vec{d}$ = 1/2$\vec{v}t$

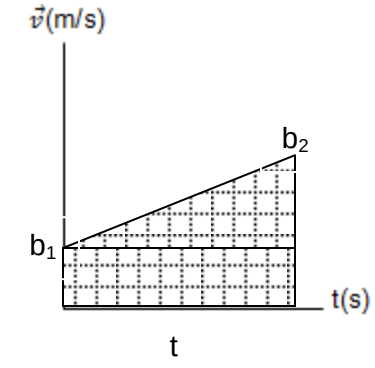


Area of a Trapezoid

The shape of the velocity-time graph at the right is a trapezoid. To calculate the displacement of the trapezoid, use A = ½ (b_1 + b_2) h where A is displacement, b_1 is the initial velocity and b_2 is the final velocity and t is time.

displacement = ½ (initial velocity + final velocity) time

$\vec{d}$ = 1/2(v_0 + v)t



NOTES:

- *The displacement of the moving object that forms a trapezoid on a graph of velocity as a function of time can be calculated by using the other two area formulas then combining the result.*
- *The y-intercept of the last graph shows a value of velocity when the time is 0 s*