Finding Equations

For each of the following, choose an equation and solve for the missing variable.

1. $v_i = 0$ m/s , $a = 2.5$ m/s^2 , $t = 3.5$ s , $v_f = ?$

$v_f = v_i + at \rightarrow v_f = 0 + (2.5)(3.5)$

$v_f = 8.75$ m/s

$\therefore v_f \doteq 8.8$ m/s

2. $\Delta d = 5000$m , $v_i = 3.0$ m/s , $v_f = 17$ m/s , $a = ?$ 1/2

$v_f^2 = v_i^2 + 2ad$

$v_f^2 - v_i^2 = 2ad$

$a = \frac{v_f^2 - v_i^2}{2d} \rightarrow a = \frac{17^2 - 3.0^2}{2(5000)}$

$a = 0.028 \frac{m}{s^2}$

$\therefore \vec{a} \doteq 2.8 \times 10^{-2}$

OR

$\therefore \vec{a} = 3 \times 10^{-2}$ 1/2

3. $\Delta d = 30$m, $\Delta t = 1.4$ s , $a = 6.2$ m/s^2 , $v_i = ?$

$d = v_i t + \frac{1}{2} a t^2$

$d - \frac{1}{2} a t^2 = v_i t$

$v_i = \frac{d - \frac{1}{2} a t^2}{t} \rightarrow v_i = \frac{30 - \frac{1}{2}(6.2)(1.4)^2}{1.4}$

$v_i \doteq 17.08857$ m/s

$\therefore v_i \doteq 17$ m/s

OR

$\therefore v_i \doteq 1.7 \times 10^1$ 1/2

4. $\Delta d = 365.5$m , $v_f = 5.0$ m/s , $v_i = 6.59$ m/s , $\Delta t = ?$

1. Find a using $v_f^2 = v_i^2 + 2ad \rightarrow a = \frac{v_f^2 - v_i^2}{2d} = \frac{5.0^2 - 6.59^2}{2(365.5)} = -0.025209439$

2. Find Δt using $v_f = v_i + at \rightarrow v_f - v_i = at$

$t = \frac{v_f - v_i}{a} \rightarrow \frac{5.0 - 6.59}{-0.025209439} \doteq 63$ s 1/2

$\therefore \Delta t = 63$ s

5. $\Delta d = 65.8$ m , $v_f = 3.82$ m/s , $a = -0.53$ m/s^2 , $\Delta t = ?$

1. Find v_i using $v_f^2 = v_i^2 + 2ad \rightarrow v_f^2 - 2ad = v_i^2 \rightarrow v_i = \sqrt{v_f^2 - 2ad}$

2. Find Δt using $v_f = v_i + at \rightarrow t = \frac{v_f - v_i}{a}$

$t = \frac{3.82 - 9.183702957}{-0.53} = 10.12019$ s $\therefore \Delta t \doteq 10$ s

$v_i = \sqrt{3.82^2 - 2(-0.53)(65.8)}$

$v_i = 9.183702957$ m/s

OR $\therefore \Delta t = 1.0 \times 10^1$ s 1/4

6. $v_f = 7.65$ m/s , $v_i = 3.72$ m/s , $\Delta t = 8.3$s , $\Delta d = ?$

1. Find a using $v_f = v_i + at \rightarrow v_f - v_i = at \rightarrow a = \frac{v_f - v_i}{t} = \frac{7.65 - 3.72}{8.3}$

2. Find Δd using $d = v_i t + \frac{1}{2} a t^2 \rightarrow d = (3.72)(8.3) + \frac{1}{2}(0.473493975)(8.3)^2 = 0.473493975$

$d = 47.1855$ m $\therefore \Delta d \doteq 47$m

7. $v_f = 9.75$ m/s , $v_i = 20.3$ m/s , $a = -2.56$ m/s^2 , $\Delta d = ?$ 1/4

$v_f^2 = v_i^2 + 2ad \rightarrow v_f^2 - v_i^2 = 2ad \rightarrow \frac{v_f^2 - v_i^2}{2a} = d \rightarrow d = \frac{9.75^2 - 20.3^2}{2(-2.56)}$

$d = 61.919433594$ m

$\therefore d \doteq 61.9$ m OR $d \doteq 6.19 \times 10^1$ m