Answers to "Practice Problems: Acceleration due to gravity"

1) $v_i = 0$
$\Delta t = 2.50$ s
$a = -9.8$ m/s^2
$\Delta d = ?$

Ans: 30.6 m

$$\Delta d = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$$
$$\Delta d = 0 + \frac{1}{2}\left(-9.8 \tfrac{m}{s^2}\right)(2.50s)^2$$
$$\Delta d = -30.6m$$

2) $v_i = 5.00$ m/s
$v_f = ?$
$a = -9.8$ m/s^2
$\Delta d = -12.0$ m

Ans: 16.1 m/s

$$v_f^2 = v_i^2 + 2a\Delta d$$
$$v_f^2 = (5.00m/s)^2 + 2(-9.8m/s^2)(-12.0m)$$
$$v_f = 16.1m/s$$

3) **a)**
$v_i = 40.0$ m/s
$v_f = -20.0$ m/s
$\Delta t = ?$
$a = -9.8$ m/s^2

Ans: 6.12 s

$$v_f = v_i + a\Delta t$$
$$\Delta t = \frac{v_f - v_i}{a} = \frac{-20.0m/s - 40.0m/s}{-9.8m/s^2} = 6.12s$$

b)
$v_i = 40.0$ m/s
$v_f = 0$
$a = -9.8$ m/s^2
$\Delta d = ?$

Ans: 81.6 m

$$v_f^2 = v_i^2 + 2a\Delta d$$
$$\Delta d = \frac{-v_i^2}{2a}$$
$$\Delta d = \frac{-(40.0m/s)^2}{2(-9.8m/s^2)} = 81.6m$$

4) $v_i = 0$
$\Delta t =$
$a = -9.8$ m/s^2
$\Delta d = -45$ m

Ans : 3.0s

$$\Delta d = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$$
$$\Delta d = \frac{1}{2} a (\Delta t)^2$$
$$(\Delta t)^2 = \frac{2\Delta d}{a} = \frac{2(-45m)}{-9.8m/s^2} = 9.0s^2$$
$$\Delta t = 3.0s$$

5) **Skip it, you don't have enough info!**

6) $v_i = 0$
$\Delta t = 3.0$ s
$a = -9.8$ m/s^2
$\Delta d = ?$

$$\Delta d = v_i \Delta t + \frac{1}{2} a(\Delta t)^2$$
$$\Delta d = \frac{1}{2} a(\Delta t)^2$$
$$\Delta d = \frac{1}{2}(-9.8 m/s^2)(3.0 s)^2$$
$$\Delta d = -44.1 m$$

Ans : 44.1 m

7) $v_i = 2$ m/s
$v_f = ?$
$a = -9.8$ m/s^2
$\Delta d = -14$ m

$$v_f^2 = v_i^2 + 2a\Delta d$$
$$v_f^2 = (2 m/s)^2 + 2(-9.8 m/s^2)(-14 m)$$
$$v_f = -16.7 m/s$$

Ans: -16.7 m/s

8) $v_i = ?$
$\Delta t = 0.550$ s
$a = -9.8$ m/s^2
$\Delta d = -11.2$ m

$$\Delta d = v_i \Delta t + \frac{1}{2} a(\Delta t)^2$$
$$v_i = \frac{\Delta d - \frac{1}{2} a(\Delta t)^2}{\Delta t}$$
$$v_i = \frac{-11.2 m - \frac{1}{2}(-9.8 ms^2)(0.550 s)^2}{0.550 s}$$
$$v_i = -17.7 m/s$$

Ans : 17.7m/s down

9) $v_i = -10.0$ m/s
$v_f = -25.0$ m/s
$\Delta t = ?$
$a = -9.8$ m/s-2

$$v_f = v_i + a\Delta t$$
$$\Delta t = \frac{v_f - v_i}{a} = \frac{-25.0 m/s - (-10.0 m/s)}{-9.8 m/s^2} = 1.53 s$$

Ans : 1.53 s

10) v_i = 10.0 m/s
v_f = -10.0 m/s
Δt = ?
a = -9.8 m/s^2
Δd = 0

Ans: 2.04 s

$$v_f = v_i + a\Delta t$$

$$\Delta t = \frac{v_f - v_i}{a} = \frac{-10.0m/s - 10.0m/s}{-9.8m/s^2} = 2.04s$$

OR

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

$$-v_i \Delta t = \frac{1}{2} a(\Delta t)^2$$

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

$$\Delta t = \frac{-2v_i}{a}$$

$$\Delta t = \frac{-2v_i}{a}$$

$$\Delta t = \frac{-2(10.0m/s)}{-9.8m/s^2}$$

$$\Delta t = 2.04s$$