Practice Problems

Note: Throughout this book, assume that all zeroes not clearly significant are, in fact, significant.

1. A ball is dropped from a height of 80 m. How long does it take to fall?
2. A ball is thrown horizontally at a speed of 40 m/s from a cliff 80 m high.
   (a) How long does it take to strike the ground?
   (b) How far horizontally does the ball travel before striking the ground?
3. A golfball is driven at a speed of 80 m/s at an angle of 40° from the ground. Disregard any effects due to air resistance.
   (a) What is the vertical component of the initial velocity?
   (b) What is the horizontal component of the initial velocity?
   (c) How long will the ball be in the air (if you assume that the ball strikes the ground at the same level as it leaves the ground)?
   (d) What maximum altitude will the golfball reach?
   (e) How far will the golfball go horizontally before striking the ground?
4. A stone is fired from a slingshot at an angle of 65° from the horizontal. The stone strikes the ground 8.0 s later at an altitude 30 m lower than the height at which it was released.
   (a) At what initial velocity was the stone released?
   (b) How far horizontally does the stone go before striking the ground?
5. Two archers are trying to hit a distant target. One shoots at a low angle, thinking that such a shot will be more accurate. The other shoots at a greater angle, expecting to attain greater distance. If you assume that they both shoot at the same initial speed, show that they could both hit the target. Also show that the two angles add up to 90°.

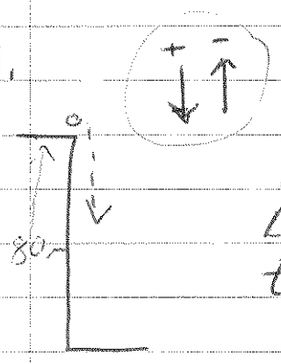
OMIT

Challenge question - trig identities might be needed.

Practice Problems

~~ANSWERS~~ Answer Key

1.



$v_i = 0$

$v_f = ?$

$a = 9.8\ m/s^2$

$\Delta d = 80\ m$

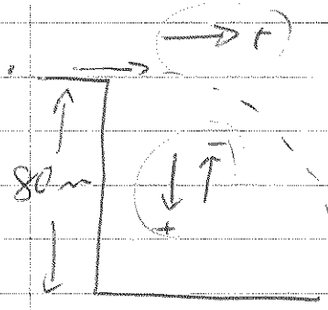
$t = ?$

$\Delta d = \frac{1}{2}at^2 + v_i t$ ($v_i = 0$)

$t = \sqrt{\frac{2\Delta d}{a}} = 4.0406$

$t = \sqrt{\frac{2(80m)}{9.8\ m/s^2}} = \boxed{4.0s}$

2.



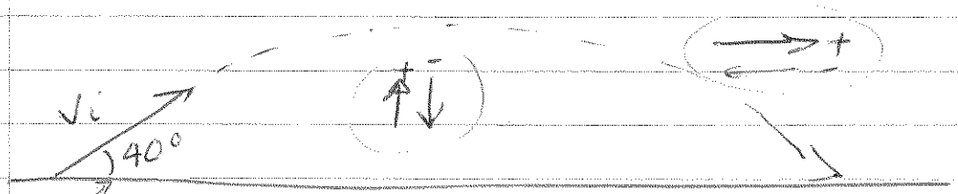
x	y
$v_x = 40\ m/s$	$v_{iy} = 0.0\ m/s$
$d_x = ?$	$\Delta d_y = 80$
$t = ?$	$a = 9.8\ m/s^2$
	$t = ?$
	$v_f = ?$

(a) $\boxed{4.0s}$ (same as q #1)

(b) $d_x = v_x t = (40\ m/s)(4.0406s)$

$\boxed{d_x = 1.6 \times 10^2\ m}$

3.



assume "above horizontal"

x

$v_x = v_i \cos 40° = 80 \cos 40°$

y

$v_{iy} = v_i \sin 40° = 80 \sin 40°$

$a_y = -9.8\ m/s^2$

(a) $v_{iy} = 80 \sin 40° = \boxed{+51\ m/s}$

(b) $v_x = 80 \cos 40° = \boxed{61\ m/s}$

(c) $\Delta d_y = 0$ $\quad \Delta d_y = \frac{1}{2}a_y t^2 + v_{iy} t$

$t = \frac{-2v_{iy}}{a_y} = \frac{-2(80 \sin 40°)}{-9.8} = 10.49\ s$

$\boxed{t = 1.0 \times 10^1\ s}$

(d) $v_{fy} = 0$ $\quad v_{fy}^2 = 2a_y\Delta d_y + v_{iy}^2$

$$\therefore \Delta d_y = \frac{-v_{iy}^2}{2a_y} = \frac{-(80\sin 40^\circ)^2}{2(-9.8)}$$

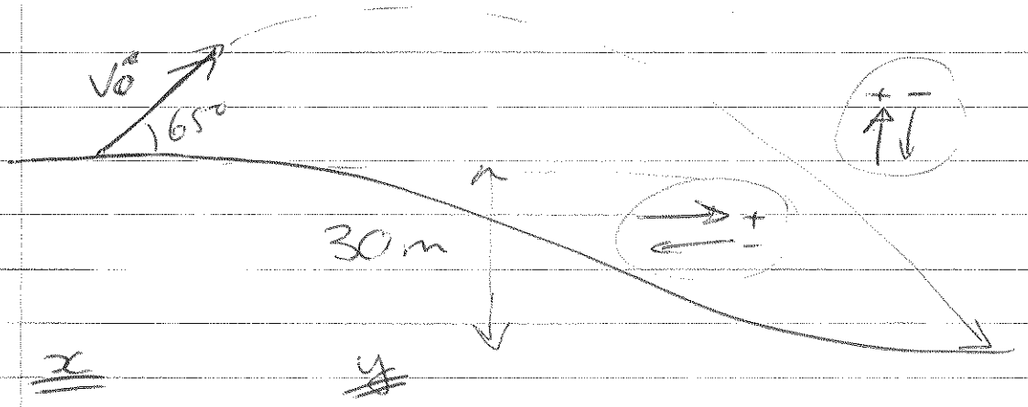
$$\Delta d_y = 134.9 \text{ m}$$

$$\boxed{\Delta d_y = 1.3 \times 10^2 \text{ m}}$$

(e) $d_x = v_x t = (80\cos 40^\circ)(10.49\text{ s})$

$$\boxed{d_x = 6.4 \times 10^2 \text{ m}}$$

4.



$v_x = v_0\cos 65^\circ$ $\quad v_{iy} = v_0\sin 65^\circ$

$d_x = ?$ $\quad a_y = -9.8 \text{ m/s}^2$

$t = 8.0\text{ s}$ $\quad \Delta d_y = -30 \text{ m}$

$t = 8.0\text{ s}$

$v_{fy} = ?$

(a) y $\quad \Delta d_y = \frac{1}{2}a_y t^2 + v_{iy} t$

$$v_{iy} = \frac{\Delta d_y - \frac{1}{2}a_y t^2}{t}$$

$$v_0 \sin 65^\circ = \frac{(-30) - \frac{1}{2}(-9.8)(8)^2}{8}$$

$$\therefore v_0 = 39.1147 \quad \therefore \boxed{v_0 = 39 \text{ m/s}}$$

(b) $d_x = v_x t = (39.1147 \times \cos 65^\circ)(8.0\text{ s})$

$$\boxed{d_x = 1.3 \times 10^2 \text{ m}}$$