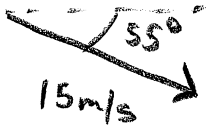
Kinematics Worksheet

(1)



$V_x = 15 \cos 55 = 8.6 \text{ m/s}$

(2)

x	y
$V_x = 28$ m/s	$V_y = 0$
$a_x = 0$	$a_y = -9.8 \text{ m/s}^2$
$d_x = 19.6$ m	$d_y = ?$
$t =$	$t =$

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

$t = \frac{d}{v_i} = \frac{19.6}{28} = .7$

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

$d_y = \frac{1}{2}(-9.8)(.7)^2$

$d_y = -2.4 \text{ m}$

∴ The ball was 2.4 m above the court.

(3)

x

$v_x = 670$ m/s

$a = 0$

$d_x = ?$

$t =$

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

$= 670(.07)$

$d_x = 48$ m

y

$v_y = 0$

$a = -9.8$ m/s^2

$d_y = -0.025$ m

$t =$

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

$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(-.025)}{-9.8}} = 0.07$

(4)

x

$v_x = 30.3 \cos 45$

$a = 0$

$d_x = ?$

$t =$

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

$d = (30.3 \cos 45)\, 4.37$

$d = 93.6$ m

y

$v_y = 30.3 \sin 45$

$a_y = -9.8$

$d_y = 0$

$t =$

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

$t = \frac{-2v_i}{a} = \frac{-2(30.3 \sin 45)}{-9.8}$

$t = 4.37$ s

(5)

x	y
$v_x = 10 \cos 31$	$v_y = 10 \sin 31$
$a = 0$	$a = -9.8$
$d_x = ?$	$d_y = 0$
$t =$	$t =$

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

$$t = \frac{-2v_i}{a} = \frac{-2(10 \sin 31)}{-9.8}$$

$$t = 1.05 \text{ s}$$

(6) (a) at highest point $v_y = 0$

y
$v_i = 6.6 \sin 58$ m/s
$v_f = 0$
$a = -9.8$ m/s^2
$d = ?$

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

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

$$= \frac{-(6.6 \sin 58)^2}{2(-9.8)}$$

$$d = 1.598$$

The skateboarder is $1.2 + 1.598 = 2.8$ m above the ground.

6 (b)

x	y
$v = 6.6 \cos 58$ m/s	$v_i = 6.6 \sin 58$ m/s
$a = 0$	$v_f = 0$ (at highest point)
$d = ?$	$a = -9.8$ m/s^2
$t =$	$t =$

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

$v_f = v_i + at$

$t = \frac{-v_i}{a} = \frac{-6.6 \sin 58}{-9.8}$

$t = 0.571$ s

$d = (6.6 \cos 58)(.571)$

$d = 2.0$ m

(7)

y
$v_i = 0.870 \sin 35$ m/s
$a = -9.8$ m/s^2
$d = ?$
$t = 0.077$ s

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

$= (.870 \sin 35)(.077) + \frac{1}{2}(-9.8)(.077)^2$

$= 9.37 \times 10^{-3}$ m

$d = 9.37$ mm

(8)

x	y
$v_i = 53$ m/s	$v_i = 0$
$a = 0$	$a = -9.8$ m/s^2
$d = ?$	$d = -2$ m
$t =$	$t =$

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

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

$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(-2)}{-9.8}} = 0.639$ s

$= 53(.639)$

$d = 33.86$

The maximum value for D is 34 m.

(9)

x	y
$v_i = 41$ m/s	$v_i = 0$
$a = 0$	$a = -9.8$ m/s
$d = 17$ m	$d = ?$
$t =$	t

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

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

$t = \frac{d}{v_i} = \frac{17}{41}$

$= \frac{1}{2}(-9.8)(.415)^2$

$= -0.818$

$t = 0.415$ s

∴ The ball drops 0.818 m

(10)

x	y
$v_i = v\cos 30$	$v_i = v \sin 30$
$d = 183$	$a = -9.8$
$t = ?$	$d = 0$
	$t = ?$

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

$t = \frac{d}{v_i} = \frac{183}{v\cos 30}$

$0 \quad d = v_i t + \frac{1}{2} a t^2$

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

equal $t = \frac{-2v_i}{a} = \frac{-2v\sin 30}{-9.8}$

$\frac{183}{v\cos 30} = \frac{2v\sin 30}{9.8}$

$183(9.8) = 2v^2 \sin 30 \cos 30$

$v = \sqrt{\frac{183(9.8)}{2\sin 30 \cos 30}}$

$v = 45.5 \text{ m/s.}$

Note: An extremely fast baseball pitch $\approx$ 41 m/s.

(11)

x

$v_i = 75\cos 60$ m/s

$a = 0$

$d = 27$ m

$t = ?$

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

$t = \frac{d}{v_i} = \frac{27}{75\cos 60}$

$t = 0.72$ s

y

$v_i = 75\sin 60$ m/s

$a = -9.8$ m/s^2

$d = ?$

$t =$

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

$= 75\sin 60(.72) + \frac{1}{2}(-9.8)(.72)^2$

$d = 44.23$ m

The projectile clears the wall by

$44.23 - 11 = 33.2$ m

(12)

x

$v_i = 97.5\cos 50$ m/s

$a = 0$

$d = ?$

$t =$

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

$= 97.5\cos 50(22.03)$

$d = 1380$ m

y

$v_i = 97.5\sin 50$ m/s

$a = -9.8$ m/s^2

$d = -732$ m

$t = ?$

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

$-732 = 97.5\sin 50t + \frac{1}{2}(-9.8)t^2$

$4.9t^2 - 74.69t - 732 = 0$

$t = \frac{-(-74.69) \pm \sqrt{(-74.69)^2 - 4(4.9)(-732)}}{2(4.9)}$

$t = 22.03$ s

(13) Tomato

y

$v_i = 11 \text{ m/s}$

$a = -9.8 \text{ m/s}^2$

$d = 0$

$t = ?$

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

$t = \frac{-2v_i}{a} = \frac{-2(11)}{-9.8} = 2.24 \text{ s}$

Car

$v_i = 25 \text{ m/s}$

$a = 0$

$d = ?$

$t = 2.24 \text{ s}$

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

$= (25)(2.24)$

$d = 56 \text{ m}$

(14)

x

$v_i = ?$

$a = 0$

$d = 7.0 \text{ m}$

$t = 1.1 \text{ s}$

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

$v_i = \frac{d}{t} = \frac{7.0}{1.1} = 6.4 \text{ m/s}$

(15)

x

$v_i = 31\cos 33$ m/s

$a = 0$

$d = ?$

$t =$

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

$= 31\cos 33(3.61)$

$d = 94$ m

y

$v_i = 31\sin 33$ m/s

$a = -9.8$ m/s^2

$d = 3$ m

$t =$

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

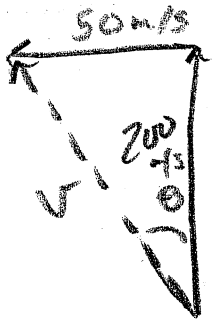
$3 = 31\sin 33\, t + \frac{1}{2}(-9.8)t^2$

$4.9t^2 - 16.88t + 3 = 0$

$t = \frac{-(-16.88) \pm \sqrt{(-16.88)^2 + 4(4.9)(3)}}{2(4.9)}$

$t = 3.61$ s

(16)

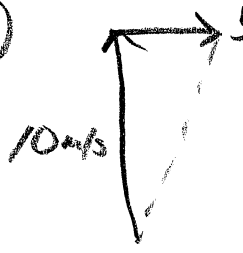


$V = \sqrt{200^2 + 50^2} = 206$ m/s

$\theta = \tan^{-1}\left(\frac{50}{200}\right) = 14°$

206 m/s 14° West of North

(17)



$V = \sqrt{10^2 + 5^2} = 11.18$ m/s

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

$t = \frac{d}{V} = \frac{1600}{11.18} = 143$ s $= 2.4$ minutes

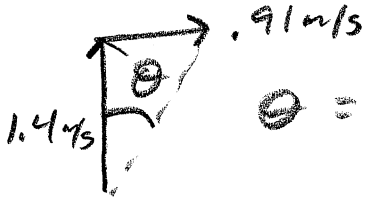
(18)

$v = 36$ km/h

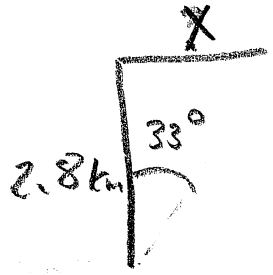
$d = vt$

$t = \frac{d}{v} = \frac{12}{36} = 0.33$ hours $= 20$ minutes

(19)



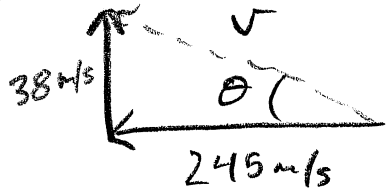
$\theta = \tan^{-1}\left(\frac{.91}{1.4}\right) = 33°$



$\tan 33 = \frac{x}{2.8}$

$x = 2.8 \tan 33 = 1.8$ km

(20)



$\theta = \tan^{-1}\left(\frac{38}{245}\right) = 8.8°$ North of West

∴ The plane should head 8.8° South of West