Chapter 3 Exercise 3A

Q. 1. (i) $s_y = 28(3) + \frac{1}{2}(-9.8)(3)^2$

$= 39.9$ m

(ii) Let H = maximum height

$u_y = 28, \quad a_y = -9.8,$

$v_y = 0, \quad s = H$

$v^2 = u^2 + 2as$

$\therefore 0 = (28)^2 + 2(-9.8)H$

$\therefore 0 = 784 - 19.6H$

$\therefore H = 40$

(iii) $s_y = 0$

$\Rightarrow 28t - 4.9t^2 = 0$

$\Rightarrow t = 0$ **OR** $t = \frac{40}{7}$

At $t = \frac{40}{7}$, $s_x = 21t$

$= 21\left(\frac{40}{7}\right)$

$= 120$ m

Q. 2. $v_x = 56$

$v_y = 56 - gt$

$s_x = 56t$

$s_y = 56t - \frac{1}{2}gt^2$

(i) Let H = maximum height

$u_y = 56, \quad a_y = -9.8,$

$v_y = 0, \quad s_y = H$

$v^2 = u^2 + 2as$

$\therefore 0 = (56)^2 + 2(-9.8)H$

$\therefore 0 = 3{,}136 - 19.6H$

$\therefore H = 160$ m

(ii) Range: s_x when $s_y = 0$

$s_y = 0$

$\Rightarrow 56t - \frac{1}{2}gt^2 = 0$

$\Rightarrow 112t - gt^2 = 0$

$\Rightarrow t(112 - gt) = 0$

$\Rightarrow \underbrace{t = 0}_{\text{Point of Projection}} \qquad \underbrace{t = \frac{112}{g}}_{\text{Time of Flight}}$

$\Rightarrow$ Range $= 56\left[\frac{112}{g}\right]$

$= 640$ m

(iii) Velocity after 4 seconds: Find v_x and v_y when $t = 4$

$v_x = 56$

$v_y = 56 - g(4)$

$= 16.8$

$\Rightarrow \vec{v} = 56\vec{i} + 16.8\vec{j}$ m/s

Q. 3. $v_x = 70$

$v_y = 105 - gt$

$s_x = 70t$

$s_y = 105t - \frac{1}{2}gt^2$

(i) Need v_x and v_y when $t = 10$

$v_x = 70$

$v_y = 105 - g(10) = 7$

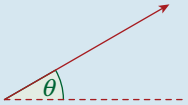
$\Rightarrow \vec{v} = 70\vec{i} + 7\vec{j}$

Magnitude

$|\vec{v}| = \sqrt{70^2 + 7^2}$

$= 70.35$ m/s

Direction



$\tan\theta = \frac{7}{70} = \frac{1}{10}$

$\Rightarrow \theta = \tan^{-1}\left[\frac{1}{10}\right] = 5.71°$

(ii) Range: s_x when $s_y = 0$

$s_y = 0$

$\Rightarrow 105t - \frac{1}{2}gt^2 = 0$

$\Rightarrow 210t - gt^2 = 0$

$\Rightarrow t(210 - gt) = 0$

$\Rightarrow \underbrace{t = 0}_{\text{Point of Projection}} \qquad \underbrace{t = \frac{210}{g}}_{\text{Time of Flight}}$

$\Rightarrow$ Range $= 70\left[\frac{210}{g}\right]$

$= 1{,}500$ m