Q. 4. (i) $s_y = 21t - 4.9t^2$

$= 22.4$

$\Rightarrow 7t^2 - 30t + 32 = 0$

$\Rightarrow (7t - 16)(t - 2) = 0$

$t = \frac{16}{7}$ **OR** $t = 2$

(ii) When it is at its greatest height, $v_y = 0$ and $v_x = 14$, as always.

$\therefore \vec{v} = 14\vec{i} + 0\vec{j}$

Q. 5. (i) $u_y = 49, \quad a_y = -9.8,$

$v_y = 0, \quad s_y = H$

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

$\therefore 0 = (49)^2 + 2(-9.8)H$

$\therefore H = 122.5$ m

(ii) $s_y = 0$

$\Rightarrow 105t - 4.9t^2 = 0$

$t = 0$ **OR** $t = \frac{105}{4.9} = \frac{150}{7}$

At $t = \frac{150}{7}$, $s_x = 70t$

$= 70\left(\frac{150}{7}\right)$

$= 1{,}500$ m

(iii) $v_x = 10$

$v_y = 49 - (9.8)(6)$

$= -9.8$

$\therefore \vec{v} = 10\vec{i} - 9.8\vec{j}$ m/s

Q. 6. $v_x = 70$

$v_y = 140 - gt$

$s_x = 70t$

$s_y = 140t - \frac{1}{2}gt^2$

(i) Need to find v_x and v_y when $t = 5$

$v_x = 70$

$v_y = 140 - g(5) = 91$

$\Rightarrow \vec{v} = 70\vec{i} + 91\vec{j}$

Magnitude

$|\vec{v}| = \sqrt{70^2 + 91^2}$

$= 114.8$ m/s

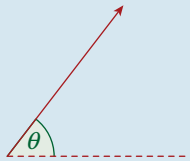
Direction

$\tan\theta = \frac{91}{70}$

$= \frac{13}{10}$

$\Rightarrow \theta = \tan^{-1}\left[\frac{13}{10}\right]$

$= 52.43°$



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

$s_y = 0$

$\Rightarrow 140t - \frac{1}{2}gt^2 = 0$

$\Rightarrow 280t - gt^2 = 0$

$\Rightarrow t(280 - gt) = 0$

$\Rightarrow \underbrace{t = 0}_{\text{Point of Projection}} \qquad \underbrace{t = \frac{280}{g}}_{\text{Time of Flight}}$

Range $= 70\left[\frac{280}{g}\right]$

$= 2{,}000$ m

Q. 7. $v_x = 20$

$v_y = 28 - gt$

$s_x = 20t$

$s_y = 28t - \frac{1}{2}gt^2$

(i) Need s_y when $t = 3$

$= 28(3) - \frac{1}{2}g(9)$

$= 39.9$ m

(ii) Need v_x and v_y when $t = 4$

$v_x = 20$

$v_y = 28 - g(4)$

$= -11.2$

$\Rightarrow \vec{v} = 20\vec{i} - 11.2\vec{j}$

$\Rightarrow$ Speed $= \sqrt{20^2 + (-11.2)^2}$

$= 22.92$ m/s

Q. 8. (i) $v_y = 0$

$\Rightarrow 35 - 9.8t = 0$

$\Rightarrow t = \frac{35}{9.8}$

$= \frac{25}{7}$