Exercise 21·4

① (i) $x = 4t$ $\quad y = 5t^2$

$\frac{x}{4} = t \Rightarrow \quad y = 5\left(\frac{x}{4}\right)^2 \Rightarrow \quad y = \frac{5x^2}{16}$

(ii) $x = 5t$ $\quad y = 6 + 2t - 5t^2$

$\frac{x}{5} = t \Rightarrow \quad y = 6 + \frac{2x}{5} - \frac{x^2}{5}$

(iii) $x = 2 - t$ $\quad y = 3t - 5t^2$

$2 - x = t \Rightarrow \quad y = -14 - 5x^2 + 17x$

(iv) $x = 1 + 5t$ $\quad y = 8 + 10t - 5t^2$

$\frac{x-1}{5} = t \Rightarrow y = 8 + 10\left(\frac{x-1}{5}\right) - 5\left(\frac{x-1}{5}\right)^2$

$y = 5 \cdot 8 + 2 \cdot 4x - 0 \cdot 2x^2$

(v) $x = ut$ $\quad y = 2ut - \frac{1}{2}gt^2$

$\frac{x}{u} = t \Rightarrow \quad y = 2u\left(\frac{x}{u}\right) - \frac{1}{2}g\left(\frac{x}{u}\right)^2$

$y = 2x - \frac{1}{2}g \cdot \frac{x^2}{u^2}$

② (i) $y = x\tan\theta + \frac{gx^2}{2u^2\cos^2\theta} \Rightarrow \quad y = V_H t \tan\theta - \frac{g(V_H t)^2}{2V_v^2\cos^2\theta}$

$9 \cdot 8(50\cos 36.9)^2 / 2 \times 50^2 \times (\cos 36.9)^2$

$y = (50\cos 36.9^\circ \times \tan 36.9)t - \frac{9.8(50\cos 36.9)^2}{2 \cdot 50^2 \cos^2(36.9)}$

$- \frac{9.8}{2 \times 50^2} t^2$

Date:

$y = 30.0t - 5t^2$

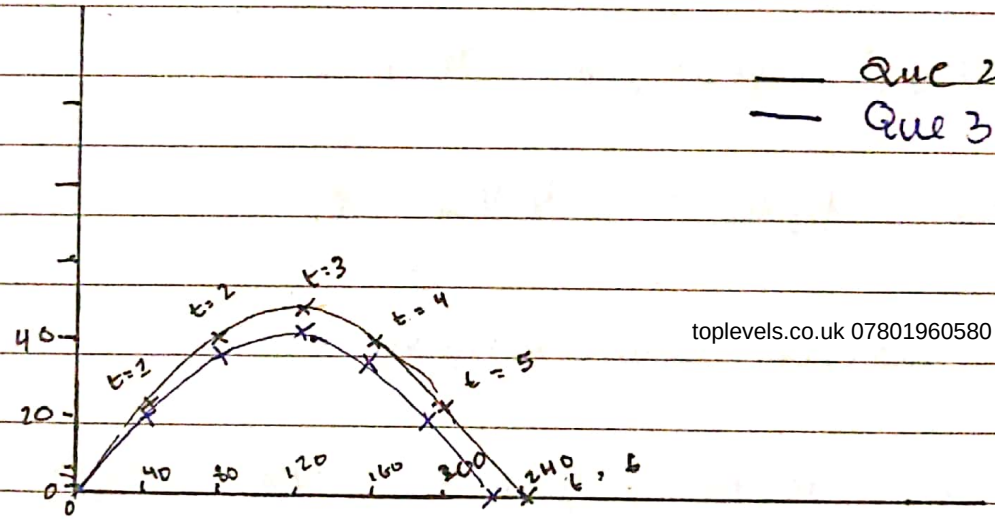
expression for x

$50 \cos(36.9) = 39.98 = 40$ m/s

$x = 40t$

(ii) $\frac{x}{40} = t$, $y = 30\left(\frac{x}{40}\right) - 5\left(\frac{x}{40}\right)^2$

$y = \frac{3x}{4} - \frac{x^2}{320}$



— Que 2 graph
— Que 3 graph

(3) I.V = 50 m/s, $\sin\alpha = 0.6$

(i) $y = x\tan\theta + \frac{g x^2}{2u^2\cos^2\theta}$

$\theta = \sin^{-1}0.6$

$y = x\tan\theta + \frac{(-9.81)x^2}{2(50)^2(\cos\sin^{-1}0.6)}$

$= x(0.75) + \frac{1}{320}x^2$

(ii) Air resistance would have effected the 2nd ball more

Date:

(iii) Yes they are since horizontal acceleration
$= -0.5 m/s$

④ u_x and u_y

(i) $s = ut + \frac{1}{2}gt^2$ $\qquad t = \frac{x}{u_x}$

$$s = u_y \cdot \frac{x}{u_x} - \left(\frac{9.8}{2}\right)\left(\frac{x}{u_x}\right)^2$$

$$s(u_x)^2 = u_y u_x x - 4.9x^2$$

$$su_x^2 - u_y u_x x + 4.9x^2 = 0$$

(ii) By solving simultaneously
(2, 1)

$$u_x^2 - u_x u_y(2) + 4.9(2)^2 = 0 \quad \cdots (1)$$

$$u_x^2 - u_x u_y(10) + 4.9(10)^2 = 0 \quad \cdots (2)$$

hence u_x and u_y found

for resultant velocity,

$$V_R = \sqrt{u_x^2 + u_y^2} = 11.54 m/s$$

$$\cos\theta = \frac{u_x}{V_R} = \theta = 30.96°$$