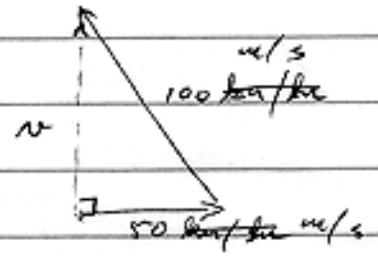
(1) 1. $v = v_0 + at$ $\quad v = 0,\ a = -65\ m/s^2,\ t = 0.45\ s$

$v_0 = -at = -65 \times 0.45 = 29.25\ m/s.$

2.

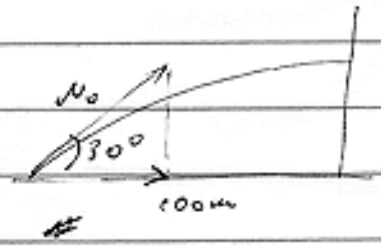


$v^2 = \sqrt{(100)^2 - (50)^2} = 86.6$ ~~km/hr~~ m/s.

(3) $v = \frac{\Delta x}{\Delta t}$ $\quad \Delta x = 100\ km$

$\Delta t = \frac{\Delta x}{v} = \frac{100\ km}{86.6\ km/s} = 1155\ s.$

3.



$v_{0x} = v_0 \cos 30°$

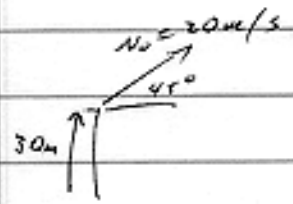
$v_{0y} = v_0 \sin 30°$

$v_{0x} = \frac{\Delta x}{\Delta t}$ $\quad \Delta t = \frac{100}{.866 v_0}$

(1) $v_y = v_{0y} + at$ $\quad v_y = 0$ $\quad v_{0y} = -a\Delta t = \frac{9.8 \times 100}{.866\ v_0} = v_0 \sin 30°$

$\therefore v_0^2 = \frac{9.8 \times 100}{0.5 \times .866}$ $\quad v_0 = 47.6\ m/s$

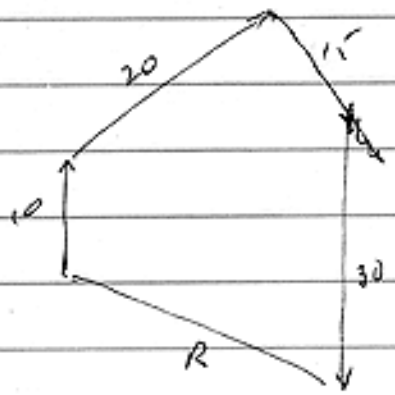
4.



$v_{0x} = v_0 \cos 45° = 20 \times 0.7071 = 14.14\ m/s.$

(5)

5.



$\Delta x = 20 \cos 45 + 15 \cos 45 = 35 \cos 45$

$= 35 \times 0.7071 = 24.75\ mi$

(4)

$\Delta y = 10 + 20 \sin 45 - 15 \sin 45 - 30$

$= -20 + 5 \sin 45 = -20 + 5 \cdot 0.7071 = -16.46\ mi$

$R = \sqrt{\Delta x^2 + \Delta y^2} = 29.73\ mi$

(1) 6. $x = \frac{v + v_0}{2} \cdot t = \frac{30+0}{2} \cdot 7 = 105\ m$

7. (3)

$\downarrow\ {}^{0}y_A = v_{0yA} t + \frac{1}{2} a_y t^2 = -\frac{1}{2} g t^2$ $\qquad 10 = y_B - y_A$

$\uparrow\ {}_{0}\ y_B = v_{0yB} + \frac{1}{2} a t^2 = 15t - \frac{1}{2} g t^2$ $\qquad = 15t - \cancel{\frac{1}{2} g t^2} + \cancel{\frac{1}{2} g t^2}$

$t = \frac{10}{15} = 0.67\ s.$

8 (2)

$a = const = -g$

$\therefore |a| = 9.8\ m/s^2$

9 (2)

$x = v_a t$ auto $\qquad$ Put these equal

$x = v_{0c} t + \frac{1}{2} a_c t^2$ cruiser $\qquad 50 \cdot \cancel{t} = 10 \cdot \cancel{t} + \frac{1}{2} \cdot 3 \cdot t^{\cancel{2}}$

$t = \frac{2 \cdot 40}{3} = 26.7\ s.$

10 (3)

$0 \longrightarrow x_A \qquad x_B \longleftarrow 0$

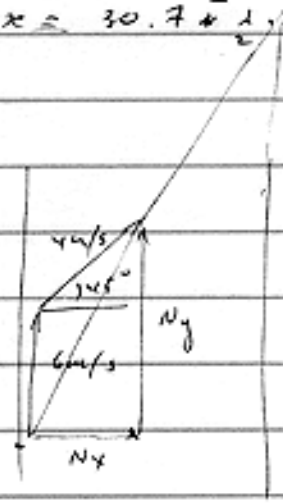
$x_A = v_{0A} t + \frac{1}{2} a_a t^2$

$x_B = v_{0B} t$

$x = x_A + x_B = v_{0A} t + \frac{1}{2} a t^2 + v_{0B} t$ at $t = 7\ s.$

$x = 30 \cdot 7 - \frac{1}{2} \cdot 3 \cdot 7^2 + 20 \cdot 7 = 50 \times 7 - 10.5 \times 7 =$ 276.5 ~~423.5~~ m.

11. (1)



$v_y = 6 + 4 \sin 45° = 8.828\ m/s.$

$y = v_y \cdot t = 8.828 \times 100 = 882.8\ m.$

12. $x_A = \cancel{v_{0A} t_A} + \frac{1}{2} a_A t_A^2$ Put $x_A = x_B$ and use $a_B = \frac{1}{2} a_A$

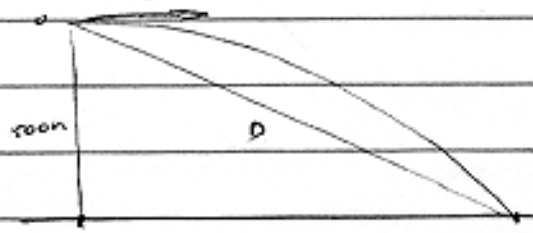
(3) $x_B = \cancel{v_{0B} t_B} + \frac{1}{2} a_B t_B^2$

$\therefore \frac{1}{2} a_A t_A^2 = \frac{1}{2} a_B t_B^2 = \frac{1}{2}\left(\frac{1}{2} a_A\right) t_B^2$

$\therefore t_B^2 = 2 t_A^2 \quad t_B = \sqrt{2}\, t_A = \sqrt{2} \cdot 20 = 28.3$

13. $v_0 = 100\,m/s$

(5)



$y = v_{0y} t + \frac{1}{2} a t^2$

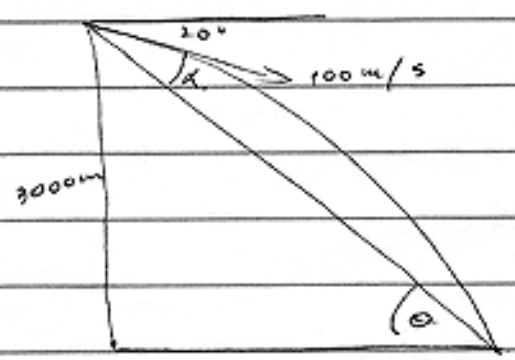
$t = \sqrt{\frac{2y}{a}} = \sqrt{\frac{2 \cdot -500}{-9.8}} = 10.1\,s$

$x = v_{0x} t = 1.01\,km$

$D = \sqrt{(y)^2 + x^2} = 1.127\,km$

14

(3)



$v_{0x} = 100 \cos 20° = 94\,m/s$

$v_{0y} = -100 \sin 20° = -34.2\,m/s$

$y = v_{0y} t + \frac{1}{2} a t^2$

$-3000 = -34.2 t - \frac{1}{2} \cdot 9.8 t^2$

$4.9 t^2 + 34.2 t - 3000 = 0$

$t = \frac{-34.2 \pm \sqrt{1170 + 58800}}{9.8}$

$= \frac{-34.2 + 244.9}{9.8} = 21.7\,s$

$x = v_{0x} \cdot t$

$= 2021$

$\tan\theta = \frac{|y|}{x} = \frac{3000}{2021} = 56°$ $\alpha = \theta - 20 = 36°$

15

(5)

$v_y = 400\,m/s$

$\cancel{v_x = v_{0x} t + \frac{1}{2} a_x t^2}$

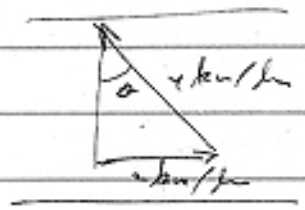
$= \cancel{0 + \frac{1}{2} 50 \cdot (6)^2}$

$= \cancel{900\,m/s}$

$v_x = v_{0x} + a_x t$

$= 50 \cdot 6 = 300\,m/s$

$\therefore v = \sqrt{v_x^2 + v_y^2} = 500\,m/s$

16. 

$\sin\theta = \frac{2}{4} = \frac{1}{2} \qquad \theta = 30°.$

(1)

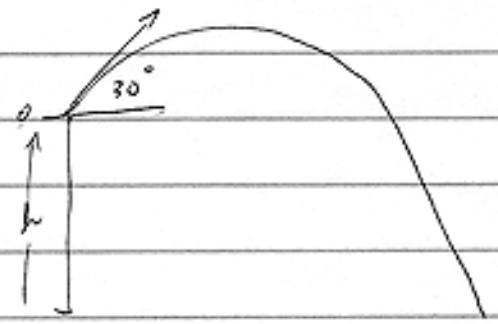
(4) 17. $-\frac{y}{2} = -\frac{1}{2} \cdot 9.8 \cdot (3)^2 \qquad y = 9.8 \times 9 = 88.2\ m.$

18 $v^2 = v_0^2 + 2ax \qquad v_0^2 = v^2 - 2ax$

(4)

$= (35)^2 - 2 \cdot \frac{3}{2} \cdot 392.$

$v_0^2 = 49 \qquad v_0 = 7\ m/s.$

19 

(4)

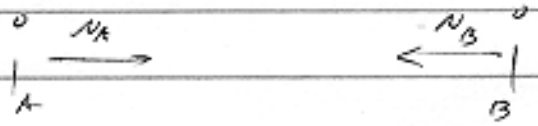
$v_{0y} = v_0 \sin 30° = 5\ m/s$

$y = v_{0y} t + \frac{1}{2} a t^2$

$= 5 \cdot 10 - \frac{1}{2} \cdot 9.8 \times 100$

$= -440\ m.$

$\therefore h = 440\ m.$

20 

$x_A = v_A \cdot t$

$x_B = v_B \cdot t$

(4)

$250 = x_A + x_B = v_A t + v_B t = 65 \cdot t + 105 \cdot t = 170 \cdot t$

$\therefore t = \frac{250}{170} = 1.47\ hrs$