เฉลยการบ้านครั้งที่ 2

2.1

$$\vec{r}(t) = (2\ m/s)t\,\hat{i} + (5\ m - 1\ m/s^2 t^2)\,\hat{j}$$

(ก)
$$\vec{v}(t) = \frac{d\vec{r}(t)}{dt} = (2\ m/s)\,\hat{i} - (2t\ m/s^2)\,\hat{j}$$

(ข)
$$\vec{v}(t=2\ s) = (2\,\hat{i} - 4\,\hat{j})\ m/s$$

$$\vec{a}(t) = \frac{d\vec{v}(t)}{dt} = -2\,\hat{j}\ m/s^2$$

$$\vec{a}(t=2\ s) = -2\,\hat{j}\ m/s^2$$

2.2

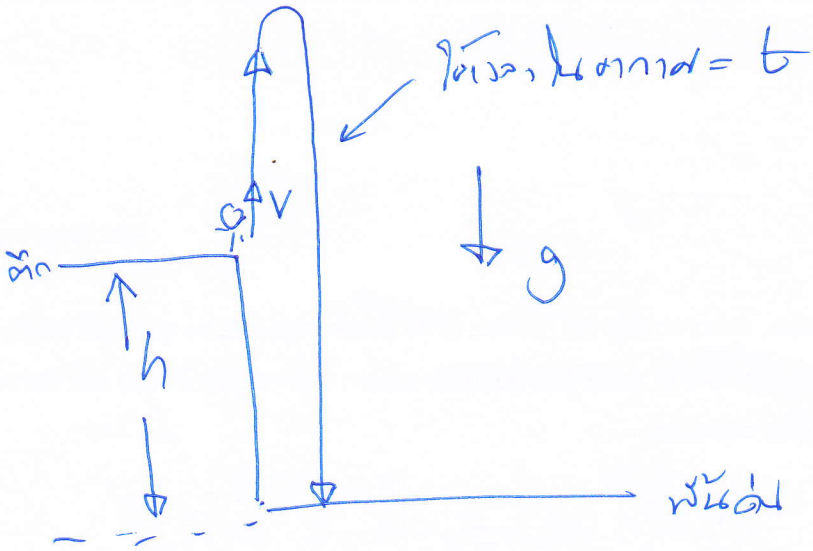
$$\vec{r}(t) = 20t\,\hat{i} - 20t^2\,\hat{j} + 50\,\hat{k}\ m$$

$$\vec{v}(t) = \frac{d\vec{r}(t)}{dt} = 20\,\hat{i} - 40t\,\hat{j}\ m/s$$

$$\vec{a}(t) = \frac{d\vec{v}(t)}{dt} = -40\,\hat{j}\ m/s^2$$

$$\vec{a}(t=2\ s) = -40\,\hat{j}\ m/s^2$$

2.3



$$y = u_y t - \frac{1}{2} g t^2$$

$$-h = vt - \frac{g}{2} t^2$$

$$\frac{g}{2} t^2 - vt - h = 0 \qquad t > 0$$

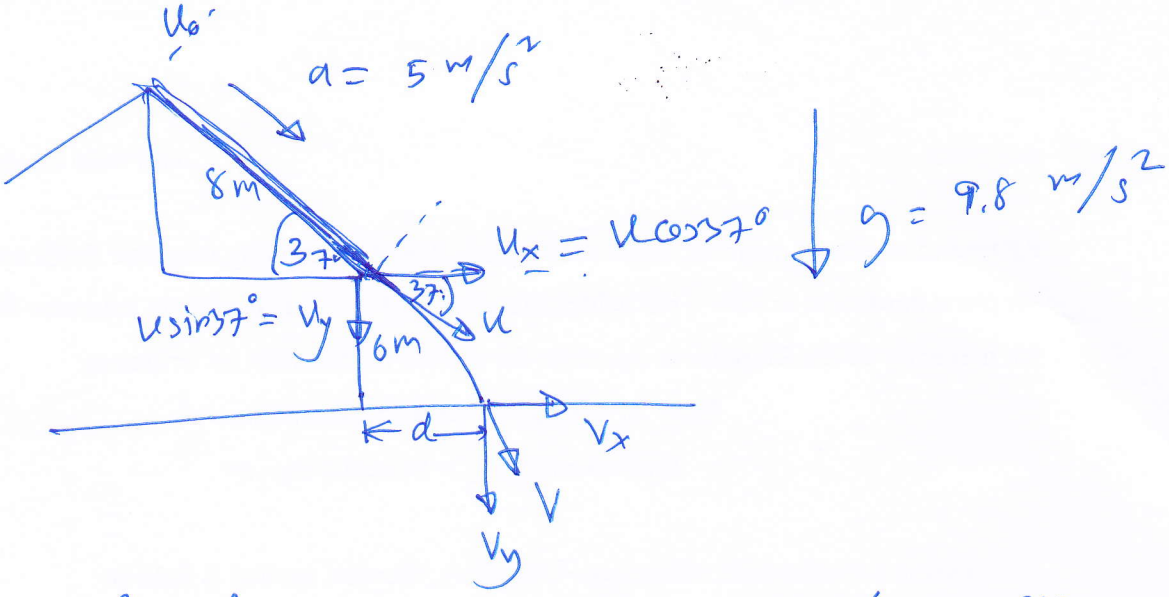
$$t = \frac{+v \pm \sqrt{v^2 - 4 \times \frac{g}{2}(-h)}}{g}$$

$$= \frac{v \pm \sqrt{v^2 + 2gh}}{g} \quad , t > 0$$

$$\Rightarrow \quad t = \frac{v + \sqrt{v^2 + 2gh}}{g}$$

$$= \frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right] \quad \#$$

(2.4)



(1)

(a) $u^2 = u_0^2 + 2as = 0 + 2\times 5\ m/s^2 \times 8\ m$

$= 80\ m^2/s^2$

$u = \sqrt{80}\ m/s$

$u_x = u\cos 37° = \sqrt{80} \times \frac{4}{5}\ m/s$

$u_y = u\sin 37° = \sqrt{80} \times \frac{3}{5}\ m/s$

$V_x = u_x = \sqrt{80} \times \frac{4}{5}\ m/s$

$= 7.2\ m/s$

$V_y^2 = u_y^2 + 2gh = 80 \times \frac{9}{25} + 2\times 9.8 \times 6\ m^2/s^2$

$= 28.8 + 117.6\ m^2/s^2$

$= 146.4\ m^2/s^2$

$V_y = \sqrt{146.4}$

$= 12.1\ m/s$

$\vec{V} = V_x \hat{i} + V_y \hat{j}\ m/s$

(7) เวลาที่ใช้ขณะเคลื่อนที่ t_1

เวลาขณะที่ลูกกลมกลิ้งเป็นเวลา t_2

$t = t_1 + t_2$

ใน t_1 จาก

$$s = ut + \frac{1}{2}at^2$$

$$8 = 0 + \frac{5}{2}t^2$$

$$\Rightarrow t^2 = \frac{16}{5} \Rightarrow t_1 = \sqrt{\frac{16}{5}} = 1.79 \text{ s}$$

ใน t_2 จาก $s = u_y t + \frac{1}{2}gt^2$

$$+6 = \sqrt{80} \times \frac{3}{5} t + \frac{9.8}{2} t^2$$

↑ 16×3

$$4.9t^2 + \sqrt{80} \times \frac{3}{5} t - 6 = 0$$

$$4.9t^2 + 5.37t - 6 = 0$$

$$t = \frac{-5.37 + \sqrt{(5.37)^2 - 4(4.9)(-6)}}{2 \times 4.9}$$

$$= \frac{-5.37 + \sqrt{(5.37)^2 + 24 \times 4.9}}{9.8}$$

$$= 0.69 \text{ s}$$

(ก)

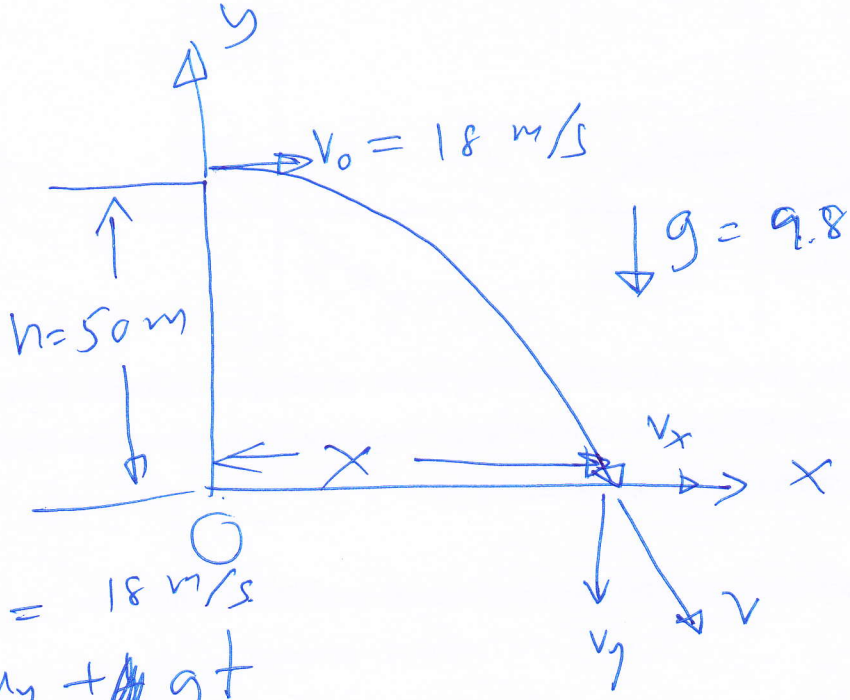
$$d = v_x t = u_x \cos 37^\circ t$$

$$= \sqrt{80} \times \frac{4}{5} \times 0.69$$

$$= 4.94 \text{ m}$$

$$\simeq 5.0 \text{ m}. \quad \#$$

2.5



(ก)

$v_x = v_0 = 18$ m/s

$v_y = u_y + gt$

$v_y^2 = u_y^2 + 2gh$

$= 0 + 2 \times 9.8 \times 50 = 980$

$v_y = \sqrt{980}$ m/s

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{18^2 + 980} = 36.1 \text{ m/s}$$

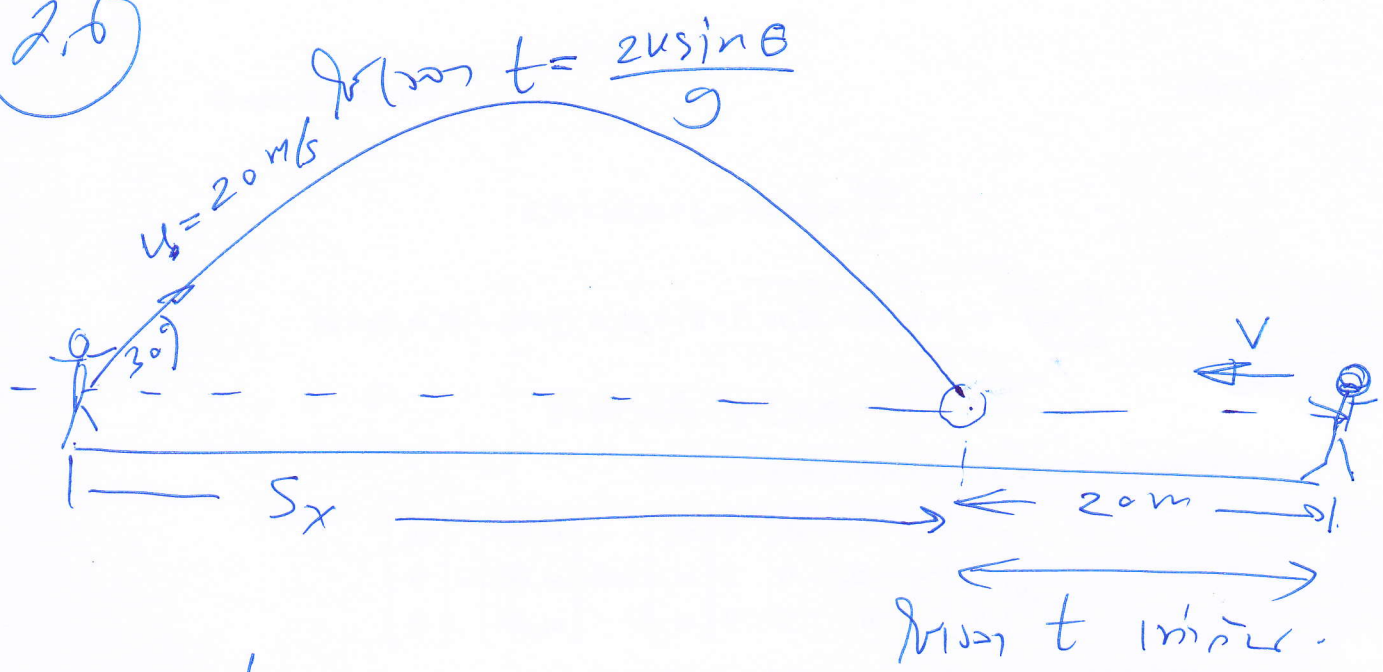
$$\vec{v} = v_x \hat{i} + v_y \hat{j} = 18\hat{i} - 31.3\hat{j} \text{ m/s}$$

(ข) ดังนั้น $v_y = u_y + gt \Rightarrow \sqrt{980} = 0 + 9.8t$

$t = \frac{\sqrt{980}}{9.8}$ s $\#$

2.6

$\theta = 30°$



dalam t = $\frac{2u\sin\theta}{g}$

dalam t ini.

$$t = \frac{2u\sin 30°}{g} = \frac{2 \times 20 \times \frac{1}{2}}{9.8} = \frac{20}{9.8} \text{ s}$$

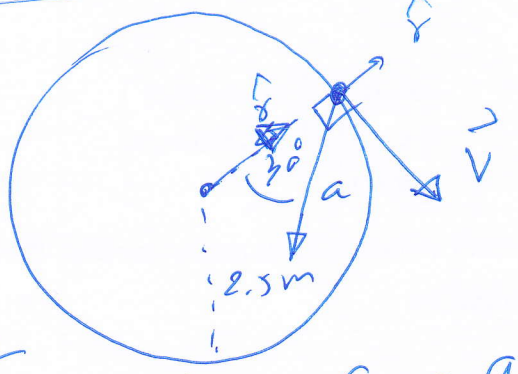
$\Rightarrow$ dalam $x = vt$

$$20 = v\left(\frac{20}{9.8}\right)$$

$$v = 9.8 \text{ m/s} \quad \#$$

2.7

$a = 15 \text{ m/s}^2$



a) $a_c = \frac{v^2}{r}$ # utk $30°$ $\quad a_c = a\cos 30°$

$= 15 \times \frac{\sqrt{3}}{2}$ m/s

$= 13.0$ m/s

$\rightarrow \hat{x}$

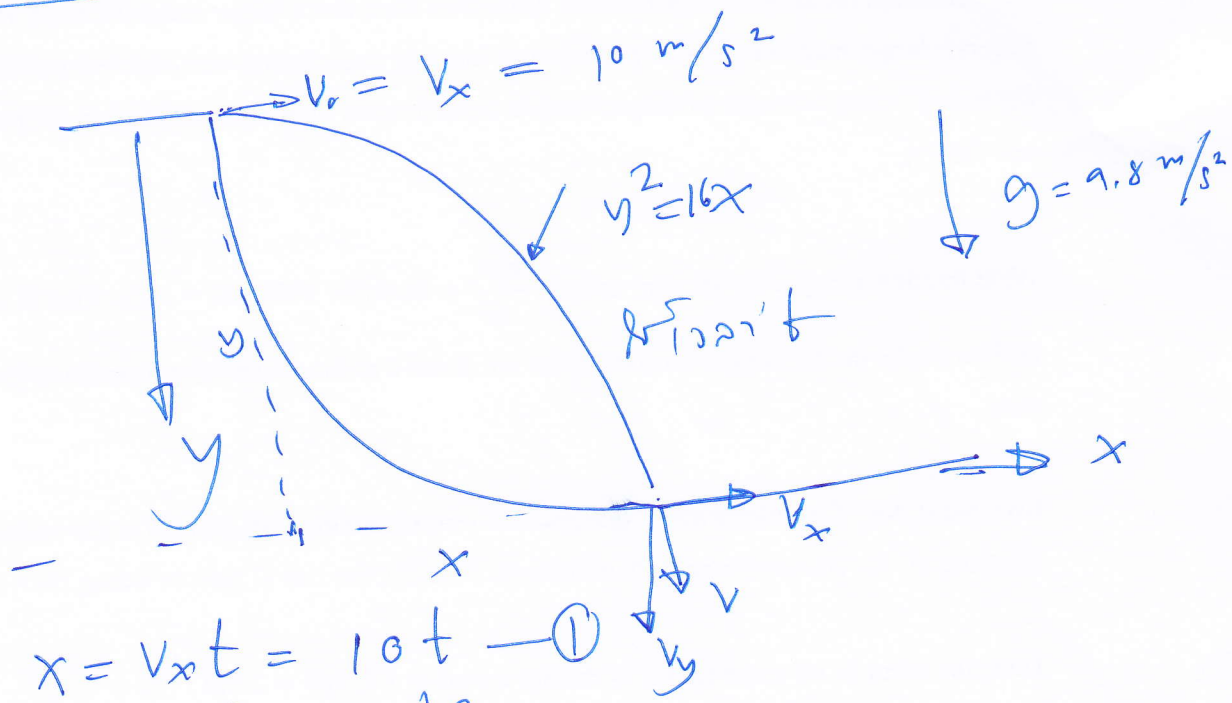
(ו) מן $a_c = \frac{v^2}{r}$

$$13.0 = \frac{v^2}{2.5} \Rightarrow v^2 = 13.0 \times 2.5 = 32.5$$

$$v = \sqrt{32.5} = 5.7 \text{ m/s}$$

(ח) $a_t = a\sin 30^\circ = \frac{15}{2} = 7.5 \text{ m/s}$ #

2.8



$x = v_x t = 10t$ — ①

(א) $y = v_y t + \frac{1}{2} g t^2$

$= 0 + \frac{9.8}{2} t^2$ — ②

מן $y^2 = 16x$ # $v = 70$

$$\left(\frac{9.8}{2}\right)^2 t^4 = 16(10t)$$

$$(4.9)^2 t^4 = 160t$$

$$24.01 \quad 160$$

3

$t = 6.66 \Rightarrow t = 1.88$ s

$\therefore v_y = u_y + gt = 0 + 9.8 \times 1.88$

$= 18.4$ m/s

$\vec{V} = v_x \hat{i} - v_y \hat{j}$

$= 10\hat{i} - 18.4\hat{j}$ m/s

(b) $x = v_x t = 10t = 10 \times 1.88$

$= 18.8$ m

$\simeq 19$ m

$y^2 = 16x = 160t$

$= 160 \times 1.88 = 300.8$

$y = \sqrt{300.8} = 17.34$ m

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