1) a. ► $V_x(2) = 3 \cdot 2^2 - 4 \cdot 2 + 5 = 12 - 8 + 5 = 9$

   $V_y(2) = 30$

   $\Rightarrow \vec{V}(2) = 9\,\hat{\imath} + 30\,\hat{\jmath}$ m/s

   ► $V_x(4) = 3 \cdot 4^2 - 4 \cdot 4 + 5 = 48 - 16 + 5 = 37$

   $V_y(4) = 45$

   $\Rightarrow \vec{V}(4) = 37\,\hat{\imath} + 45\,\hat{\jmath}$ m/s

b. ► $a_x(t) = 6t - 4$ m/s^2

   $a_x(4) = 6 \cdot 4 - 4 = 20$ m/s^2

   $a_y(4) = 15$ m/s^2

   $\Rightarrow \vec{a}(4) = 20\,\hat{\imath} + 15\,\hat{\jmath}$ m/s^2

c. $r_x(t) = 74 + t^3 - 2t^2 + 5t \Rightarrow r_x(9) = 74 + 9^3 - 2 \cdot 9^2 + 5 \cdot 9$

$$= 74 + 729 - 162 + 45$$
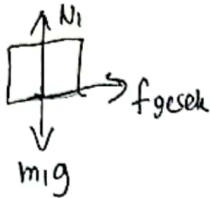
$$= 832$$

$r_y(9) = 40 + \int_{0}^{9} V_y(t)\,dt$

$$= 40 + \int_{0}^{3} 30\,dt + \int_{3}^{5} (15t - 15)\,dt + \int_{5}^{9} (-20t + 160)\,dt$$

$$= 40 + 90 + 90 + 80$$

$$= 300$$

$\Rightarrow \vec{r}(9) = 832\,\hat{\imath} + 300\,\hat{\jmath}$

2). a. Benda m_1

$$\uparrow N_1$$

$\rightarrow f_{gesek}$

$\downarrow$
$m_1 g$

Benda M

$\uparrow N_2$

$f_{gesek} \leftarrow \boxed{} \rightarrow T$

$\downarrow$
Mg

Benda m_2

$\uparrow T$

$\downarrow$
$m_2 g$
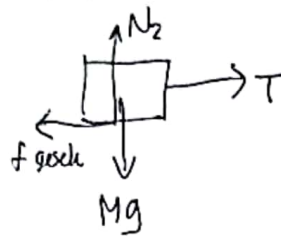
b. Benda m_1 : $f_{gesek} = m_1 . a_{m_1}$

Benda m_2 : $m_2 g - T = m_2 a_{m_2}$

Benda M : $T - f_{gesek} = M a_M$

c. Agar bergerak bersama maka $a_{m_1} = a_{m_2} = a_M = a$

$\Rightarrow m_2 g - f_{gesek} = (m_2 + M) a$

$m_2 g - \mu_s m_1 g = (m_2 + M) a$

$$a = \frac{(m_2 - \mu_s m_1) g}{m_2 + M}$$

$\Rightarrow f_{gesek} = m_1 . a$

$\mu_s . m_1 g = m_1 . a$

$\mu_s . g = a$

$\mu_s . g = \frac{(m_2 - \mu_s m_1) g}{m_2 + M}$

$m_2 \mu_s . g + \mu_s . g . M = m_2 g - \mu_s . m_1 . g$

$\mu_s . m_1 . g + \mu_s . g . M = m_2 g - m_2 \mu_s . g$

$\mu_s . g (m_1 + M) = m_2 . g . (1 - \mu_s)$

$$m_2 = \frac{\mu_s (m_1 + M)}{1 - \mu_s}$$

3) a. $E_p = E_k$

$\frac{1}{2}kx^2 = \frac{1}{2}mV_A^2$

$kx^2 = mV_A^2$

$450\,x^2 = 0{,}5 \cdot 12^2$

$x^2 = \frac{12^2}{900}$

$x = \frac{12}{30}$ m

b. $* f = m.a$

$\mu \cdot mg = ma$

$a = \mu \cdot g$

$a = 0{,}5 \cdot 10$

$a = 2 \; m/s^2$

$* V_B^2 = V_A^2 - 2.a.S_{AB}$

$V_B^2 = 12^2 - 2.2.2$

$V_B^2 = 144 - 8$

$V_B^2 = 136$

$V_B = \sqrt{136} \; m/s$

c. $\frac{1}{2}mV_B^2 = 2mgR + \frac{1}{2}mV^2$

$\frac{1}{2}V_B^2 = 2gR + \frac{1}{2}V^2$

$\frac{1}{2} \cdot 136 = 20 \cdot 2{,}2 + \frac{1}{2}V^2$

$68 = \cancel{424}\,44 + \frac{1}{2}V^2$

$\frac{1}{2}V^2 = 24$

$V^2 = 48$

$V = \sqrt{48} \; m/s$ (~~bisa sampai~~ bisa sampai puncak)

4) a. H.kekekalan momentum : $m_1V_1 + m_2V_2 = m_1V_1' + m_2V_2'$

i) $\cancel{m v_{0}}\,mV_0 = \frac{1}{2}mV_0^{\cos\theta} + mV_2'\cos\alpha \Rightarrow \left(1 - \frac{\cos\theta}{2}\right)V_0 = V_2'\cos\alpha$

ii) $0 = -\frac{m}{2}V_0\sin\theta + mV_2'\sin\alpha \Rightarrow \frac{V_0}{2}\sin\theta = V_2'\sin\alpha$

H.kekekalan energi kinetik :

$\frac{1}{2}m_1V_1^2 + \frac{1}{2}m_2V_2^2 = \frac{1}{2}m_1V_1'^2 + \frac{1}{2}m_2V_2'^2$

$\frac{1}{2}mV_0^2 + 0 = \frac{1}{2}m\left(\frac{1}{2}V_0\right)^2 + \frac{1}{2}mV_2'^2$

$\frac{1}{2}V_0^2 = \frac{1}{8}V_0^2 + \frac{1}{2}\cancel{m}V_2'^2$

$V_0^2 = \frac{1}{4}V_0^2 + \cancel{\frac{1}{2}}V_2'^2$

$\frac{3}{4}V_0^2 = V_2'^2$

c. $* \frac{V_0}{2}\sin\theta = V_2'\sin\alpha$

$\frac{V_0^2}{4} \cdot \sin^2\theta = V_2'^2\sin^2\alpha$

$\frac{V_0^2}{4} \cdot \left(\frac{1}{2}\sqrt{3}\right)^2 = \cancel{}\frac{3}{4}V_0^2 \cdot \sin^2\alpha$

$\sin^2\alpha = \frac{1}{4}$

$\sin\alpha = \frac{1}{2}$

$\alpha = 30^\circ$

$* V_2' = \frac{1}{2}\sqrt{3}\,V_0 \; m/s$

b. $\left(1 - \frac{\cos\theta}{2}\right)^2 V_0^2 + \frac{V_0^2}{4}\sin^2\theta = V_2'^2 = \frac{3}{4}V_0^2$

$1 - \cos\theta + \frac{\cos^2\theta}{4} + \frac{1}{4}\sin^2\theta = \frac{3}{4}$

$1 - \cos\theta \cancel{\frac{1}{4}} + \frac{1}{4} = \frac{3}{4}$

$\cos\theta = \frac{1}{2} \Rightarrow \theta = 60^\circ$

5) a. $X = \dfrac{m_A x_A + m_B x_B + m_c x_c}{m_A + m_B + m_c} = \dfrac{(0,4)(1) + (0,5)(4) + (0,8)(2)}{1,7} = \dfrac{40}{17}$

$y = \dfrac{m_A y_A + m_B y_B + m_c y_c}{m_A + m_B + m_c} = \dfrac{(0,4)(2) + (0,5)(4) + (0,8)(5)}{1,7} = \dfrac{68}{17} = 4$

Pusat massa $\left(\dfrac{40}{17}, 4\right)$

b. $a_{pm,x} = 0$

$a_{pm,y} = \dfrac{m_A \cdot a_{Ay} + m_B \cdot a_{By} + m_c a_{c,y}}{m_A + m_B + m_c} = \dfrac{0 + 3t + 0}{1,7} = \dfrac{30}{17}t \xrightarrow{t=2} \dfrac{60}{17}$

$a_{pm}^{(2)} = \dfrac{60}{17} \hat{\jmath} \; m/s^2$

c. $\vec{V}_{pm}(t) = \dfrac{15}{17}t^2 \hat{\jmath}$

$\vec{r}_{pm}(t) = \dfrac{40}{17}\hat{\imath} + \left(4 + \dfrac{5}{17}t^3\right)\hat{\jmath}$

$\vec{r}_{pm}(2) = \dfrac{40}{17}\hat{\imath} + \dfrac{108}{17}\hat{\jmath}$