Solusi Soal Prediksi 1 UTS 1 (created by: Wawan Wirniawan)

(1) a. Ditanya: $\bar{V}$ dari $t=0 \rightarrow t=6s$

Jawab: $\bar{V} = \frac{\Delta x}{\Delta t} = \frac{\text{luas grafik dibawahnya}}{60s}$

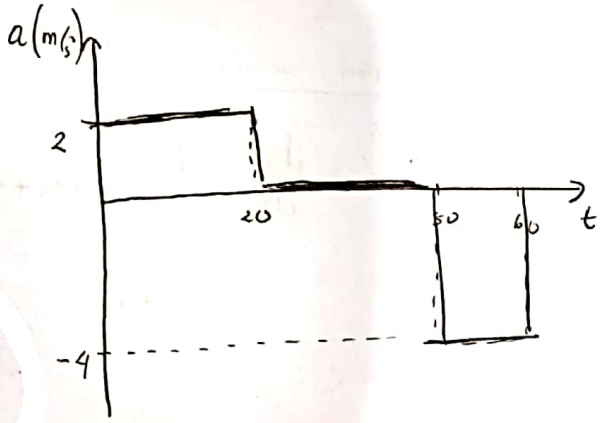
$= 30 m/s$

b. Ditanya: kurva percepatan terhadap waktu.

Jawab: untuk $0 \le t \le 20$, $a = \frac{40}{20} = 2 m/s^2$

$20 \le t \le 50$, $a = 0 m/s^2$

$50 \le t \le 60$, $a = \frac{-40}{10} = -4 m/s^2$

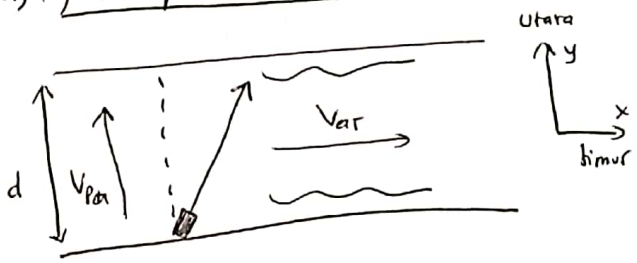


(2) Diketahui: - Besar kecepatan perahu relatif terhadap sungai (V_{pa}) = 2 m/s

- Besar kecepatan air hujan relatif terhadap tanah (V_{ht}) = 1 m/s

$V_{at}(t) = (3t^2+1) m/s$, $d = 10m$, $\vec{r}_0 = 0$

a) Posisi perahu di seberang sungai:



) kecepatan perahu relatif tanah:

$\vec{V}_{pt} = \vec{V}_{pa} + \vec{V}_{at}$

$= \vec{V}_{pa}\hat{j} + \vec{V}_{at}\hat{i}$

$= (3t^2+1)\hat{i} + 2\hat{j}$

) waktu yg diperlukan untuk menyeberang:

$t = \frac{d}{V_{pa}} = \frac{10}{2} = 5 s$

) Posisi perahu setelah sampai di seberang sungai adalah:

$\vec{r}(t) = \vec{r}_0 + \int_0^5 \vec{V}_{pt}(t)\, dt$

$= 0 + \int_0^5 \left((3t^2+1)\hat{i} + 2\hat{j}\right) dt$

$\vec{r} = (130\hat{i} + 10\hat{j}) m$

1 c)

·) $0 \le t \le 20$ s

$$x_1 = 100 + v_0 t + \frac{1}{2} a_1 t^2$$

$$= 100 + \frac{1}{2}(2) t^2$$

$$x_1 = 100 + t^2$$

·) $20 \le t \le 50$ s

$$x_2 = x_i + v_0 t + \frac{1}{2} a_2 t^2$$

$$= \text{luas grafik} + 40(t - 20) + 0$$

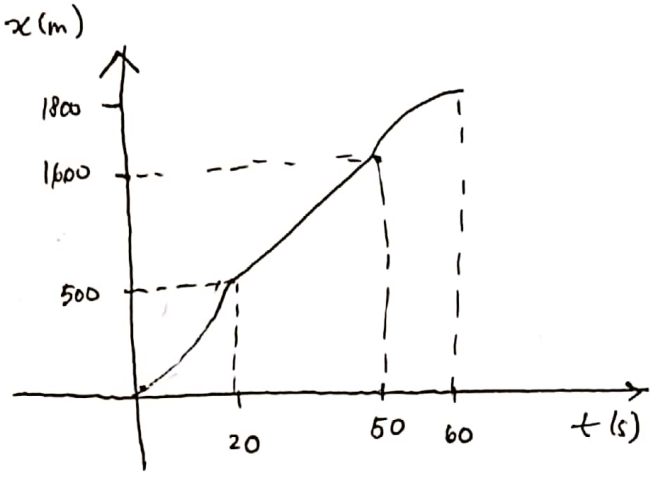
$$(0 - 20)$$

$$= \frac{1}{2}(20)(40) + 40(t - 20)$$

$$= 400 + 40t - 800$$

$$x_2 = 40t - 400$$

Grafik $x - t$



·) $50 \le t \le 60$ s

$$x_3 = x_i + v_0 t + \frac{1}{2} a_3 t^2$$

$$= \text{luas grafik}$$

$$(0 - 50) + 40(t - 50) + \frac{1}{2}(-4)(t - 50)^2$$

$$= [400 + 1200] + 40t - 2000 - 2[t^2 - 100t + 2500]$$

$$= 1600 + 40t - 2000 - 2t^2 + 200t - 5000$$

$$x_3 = -2t^2 + 240t - 5400$$

2

b) Ditanyakan : kecepatan rata-rata dalam tinggi

$$\vec{V} = \frac{\Delta x}{\Delta t}$$

$$\vec{V}_{at}(t) = \frac{dx}{dt}$$

$$dx = \vec{V}_{at}\, dt$$

$$x - x_0 = \int \vec{V}_{at}\, dt$$

$$= \int_{t_0}^{t} (3t^2+1)\, dt$$

$$\Delta x = t^3 + t - t_0^3 - t_0$$

untuk selang waktu $t=0 \rightarrow t=2$ s,

$$\Delta x = 2^3 + 2 = 10\text{ m}.$$

maka :

$$\vec{V} = \frac{\Delta \vec{x}}{\Delta t} = \frac{10\,\hat{i}}{2} = 5\,\hat{i}\ \text{m/s}$$

c) Ditanyakan : kecepatan perahu ketika sampai di seberang.

Setelah 5 s, perahu akan sampai di seberang. Pada saat itu, perahu memiliki kecepatan :

$$\vec{V}_{pt} = \vec{V}_{pa} + \vec{V}_{at}$$

$$= (3t^2+1)\,\hat{i} + 2\hat{j}$$

$$= (3(5)^2+1)\,\hat{i} + 2\hat{j}$$

$$= (76\,\hat{i} + 2\hat{j})\ \text{m/s}$$

d) Ditanya: kecepatan air hujan yg dirasakan oleh orang yg terada di perahu.

Jawab :

kecepatan air hujan yg dirasakan oleh orang di perahu = kecepatan air hujan relatif terhadap perahu (V_{hp}), maka :

$$\vec{V}_{pt} = \vec{V}_{ph} + \vec{V}_{ht} \qquad \vec{V}_{ph} = -\vec{V}_{hp}$$

$$\vec{V}_{pt} = -\vec{V}_{hp} + \vec{V}_{ht}$$

$$\vec{V}_{hp} = \vec{V}_{ht} - \vec{V}_{pt}$$

dimana

$$\vec{V}_{ht} \cdot \vec{V}_{ht}(\hat{k}) = -\hat{k} \qquad \text{(ke atas positif)}$$

maka :

$$\vec{V}_{hp} = \vec{V}_{ht} - \vec{V}_{pt} = \left(-\hat{k} - \left[(3t^2+1)\,\hat{j} - 2\hat{j}\right]\right)\text{m/s}$$

(3) kecepatan partikel 1

$$V_1 = \frac{dx_1}{dt} = \frac{d}{dt}\left(6t^2+3t+2\right)$$

$$= 12t + 3$$

-) kita cari V_2 :

$$V_2 = V_{02} + \int a_2\, dt$$

$$= 20 + \int (-8t)\, dt$$

$$= 20 - 4t^2$$

dikarenakan, $V_1 = V_2$, maka :

$$12t + 3 = 20 - 4t^2$$

$$4t^2 + 12t - 17 = 0$$

Dengan rumus abc, didpt $t = (-3+\sqrt{26})/2)$

$= 1{,}05$ detik

Nilai kecepatan $V_1 = 12(1{,}05) + 3 = 15{,}6$ m/s

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(4) a. Jarak yg ditempuh partikel B dlm arah y:

(4) $y = \frac{1}{2} a_y t^2$

$30 = \frac{1}{2}\left[(0{,}4)\cos\theta\right] t^2$ ..... 1)

b. Dalam arah x:
jarak yg ditempuh A dan B sama saat berpapasan.

$X_A = X_B$

$Vt = \frac{1}{2} a_x t^2$

$30\,t = \frac{1}{2}(0{,}4\sin\theta)\,t^2$

$t = \frac{2V}{a_x} = \frac{2(3)}{0{,}4\sin\theta}$ ..... 2)

kita substitusi pers (2) ke pers (1):

$30 = \frac{1}{2}(0{,}4\cos\theta)\left[\frac{6}{0{,}4\sin\theta}\right]^2$

sifat trigono:

$\sin^2\theta = 1 - \cos^2\theta$.

$30 = \frac{9}{0{,}2}\,\frac{\cos\theta}{1-\cos^2\theta}$

$1 - \cos^2\theta = \frac{9}{(0{,}2)(30)}\cos\theta$

Dengan menggunakan rumus ABC:

didapat: $\cos\theta = \frac{-1{,}5 + \sqrt{1{,}5^2 - 4(1)(-1)}}{2}$

$= \frac{1}{2}$

didpt $\theta = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ$.

(5) Dik: $x = 50\,m$ $V_0 = 25\,m/s$

$y = 3{,}44\,m$

Ditanya: θ_0 ?

maka:

$x = V_0\cos\theta_0\, t$, $y = y_0 + V_0\sin\theta_0 t - \frac{1}{2}gt^2$

kita dpt kan $t = \frac{x}{V_0\cos\theta_0}$

substitusi t ke pers arah sumbu-y:

$y = x\tan\theta_0 - \frac{gx^2}{2V_0^2\cos^2\theta_0}$

karena: $\sec^2\theta_0 = 1 + \tan^2\theta_0$

$\frac{1}{\cos^2\theta_0} = 1 + \tan^2\theta_0$

$\frac{1}{2}\frac{gx^2}{V_0^2}\tan^2\theta_0 - x\tan\theta_0 + y + \frac{1}{2}\frac{gx^2}{V_0^2} = 0$

kita misalkan: $C = \frac{1}{2}\frac{gx^2}{V_0^2}$

$= \frac{1}{2}\frac{(9{,}8)(50)^2}{(25)^2}$

$C = 19{,}6\,m$

maka kita dpt kan pers lebih sederhana:

$C\tan^2\theta_0 - x\tan\theta_0 + y + C = 0$

maka:

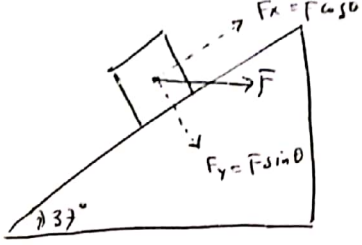
$\tan\theta_0 = \frac{x \pm \sqrt{x^2 - 4(y+c)c}}{2C}$

$= \frac{50\,m \pm \sqrt{(50)^2 - 4(3{,}44 + 19{,}6)(19{,}6)}}{2(19{,}6)}$

$\tan\theta_0 = 1{,}95$ dan $\tan\theta_0 = 0{,}665$

didpt kan: $\theta_0 = 63^\circ$ dan $\theta_0 = 31^\circ$

(6)



a) $\Sigma F_x = ma$

$F\cos\theta - f_k - mg\sin\theta = ma$

$\Sigma F_y = 0$

$N - F\sin\theta - mg\cos\theta = 0, \quad f_k = \mu_k N$

maka kita dpt :

$$a = \frac{F}{m}(\cos\theta - \mu_k \sin\theta) - g(\sin\theta + \mu_k \cos\theta)$$

$a = -2{,}1\ m/s^2$

$|a| = 2{,}1\ m/s^2$, $\mu_k = 0{,}3$

$F = 50N$, $m = 5kg$

arah gerak kebawah.

b)

$V_0 = +4\ m/s$ dan $V = 0$

$V^2 = V_0^2 + 2a\Delta x$

$V_0^2 = -2a\Delta x$

$$\Delta x = -\frac{V_0^2}{2a} = -\frac{(4)^2}{2(-2{,}1)} = 3{,}9\ m$$

c) Kita tahu bahwa $\mu_s \geq \mu_k$,

μ_s minimum $= 0{,}3$

maka : $f_{s\,max} = \mu_s F_N$

$= 0{,}3\,(F\sin\theta + mg\cos\theta)$

$= 21N.$

sedangkan jika kita tinjau sumbu x :

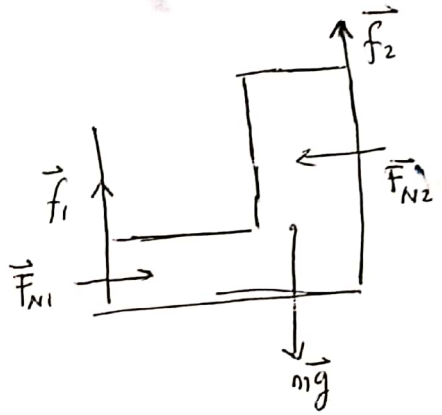
$\Sigma F_x = 0$

$f_s = F\cos\theta - mg\sin\theta = 10N$

karena $f_s < f_{s\,max}$, maka

balok diam.

(7) a. Diagram bebas :



b) Pemanjat tidak memiliki percepatan, maka :

$\Sigma F_x = 0$ | $\Sigma F_y = 0$

$F_{N1} - F_{N2} = 0$ | $f_1 + f_2 - mg = 0$

$F_{N1} = F_{N2}$, maka :

$f_1 = \mu_{s1} F_N$

$f_2 = \mu_{s2} F_N$

maka didpt :

$$f_1 = \left(\frac{\mu_{s1}}{\mu_{s2}}\right) f_2$$

$f_1 + f_2 - mg = 0$

$\left(\frac{\mu_{s1}}{\mu_{s2}}\right) f_2 + f_2 = mg$

$\left(\frac{\mu_{s1}}{\mu_{s2}} + 1\right) f_2 = mg$

$f_2 = 192\ N$

Gaya tekan

$F_N = \frac{f_2}{\mu_{s2}} = 240N$ //

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(7) c. $f_1 = \mu_s F_N$

$= 288\ N$

maka: frasinya: $\frac{f_1}{W}$

$= \frac{288}{49(9,8)}$

$= 0,60$

Sehingga frasinya 60% dari beratnya.

(8) a. Usaha melalui jalur A → B → C

$\vec{F} = (y\hat{i} - x\hat{j})\ N$

$W_{ABC} = W_{AB} + W_{BC}$

$W_{AB} = \int \vec{F} \cdot dy\hat{j}$

$= \int_0^8 (y\hat{i} - x\hat{j})\, dy\, \hat{j}$

$= \int_0^8 (y\hat{i} \cdot dy\hat{j}) - \int_0^8 (x\hat{j}\, dy\, \hat{j})$

$= 0 - \int_0^8 x\, dy$

$= -[xy]_0^8$

$= -8x\ J$

Pada saat AB → $x = -2$,

maka $W_{AB} = -8(-2)$

$= 16\ J$

$W_{BC} = \int \vec{F} \cdot d\vec{r}$

$= \int (y\hat{i} - x\hat{j}) \cdot (dx\hat{i} + dy\hat{j})$

$= \int (y\hat{i} - x\hat{j}) \cdot (dx\hat{i})$

$= \int_{-2}^{6} y\, dx$

$= yx\Big|_{-2}^{6}$

$= (6y + 2y) = 8y$

pada saat BC, $y = 8$

$W_{BC} = 8(8) = 64\ J$

$W_{ABC} = 16 + 64 = 80\ J$

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usaha melalui jalur A → D → C

$W_{ADC} = W_{AD} + W_{DC}$

$W_{AD} = \int \vec{F} \cdot d\vec{r}$

$= \int (y\hat{i} - x\hat{j})\, dx\, \hat{i}$

$= \int_{-2}^{6} y\, dx$

$= yx\Big|_{-2}^{6} = 6y + 2y$

$= 8y$

pada saat AD, $y = 0$

$W_{AD} = 0\ J$

$W_{DC} = \int \vec{F} \cdot d\vec{r}$

$= \int (y\hat{i} - x\hat{j})\, dy\, \hat{j}$

$= -\int_0^8 x\, dy$

$= -xy\,|_0^8$

$= -8x$

pada saat DC, $x = 6$

$W_{DC} = -8(6) = -48\ J$

$W_{ADC} = 0 + (-48) = -48\ J$

b) Sifat gaya $\vec{F}$ tidak konservatif, karena

$W_{ABC} \neq W_{ADC}$

c) Dit: Besar kecepatan di titik (−2, 4).

$W = \int \vec{F} \cdot d\vec{r}$

$= \int (y\hat{i} - x\hat{j})\, dy\, \hat{j}$

$= -\int_0^4 x\, dy$

$= -xy\,|_0^4$

$= -4x$

pada saat $x = (-2)$, maka

$W = -4(-2) = 8\ J$

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Konsep Usaha - Energi

$W = \Delta EM + \Delta E_{th}$ → W_{gesek}

$= E_{M_2} - E_1$

$W = \Delta U + \Delta K$

$W = 0 + \Delta K$

$8 = \frac{1}{2}mv^2 - 0$

$v = 4\ m/s$

(9) a) $\Sigma F_x = ma$

$F - f_k = ma$

$20 - 0{,}2 \cdot 20 = 2a$

$a = 8\ m/s^2$

$v^2 = v_0^2 + 2a\Delta x$

$v = \sqrt{2 \cdot 8 \cdot 4000}$

$v = 252{,}9\ m/s$

b) Seandainya bom tidak pecah, maka bom jatuh di x_{pm}. Lamanya waktu jatuh:

$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$

$0 = h - \frac{1}{2}gt^2$

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2(20)}{10}} = 2\ s$

(9) b.) $X_{pm} = V_{pm} \cdot t$

$= 252,9 \text{ (2)}$

$= 505,8 \text{ m}$

Letak serpihan kedua dpt dicari dari pusat massa

$$X_{pm} = \frac{X_1 m_1 + X_2 m_2}{m_1 + m_2}$$

$$505,8 = \frac{(120)\left(\frac{2}{3}m\right) + X_2\left(\frac{1}{2}m\right)}{m}$$

$$X_2 = 1.277,4 \text{ m}$$

$$X_2 = 1,27 \text{ km}$$

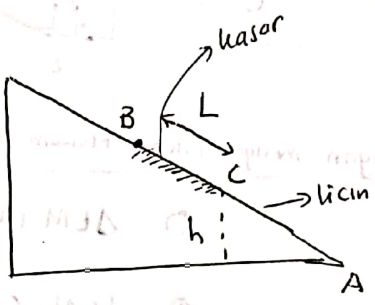
c.) $P_{awal} = P_{akhir}$

$$m_{pm} V_{pm} = m_1 V_1 + m_2 V_2$$

$$M(252,9)\hat{i} = \frac{2}{3}M(6\hat{i} - 3\hat{j}) + \frac{1}{3}MV_2$$

$$\vec{V_2} = (746,7\hat{i} + 6\hat{j}) \text{ m/s}$$

(10)



Kita tinjau lintasan AC

$$\Delta EM + W_{gesek} = 0$$

$$\Delta EM + 0 = 0$$

$$\Delta EM = 0$$

$$EM_C = EM_A$$

$$EM_C = EM_A$$

$$mgh + \frac{1}{2}mV_C^2 = \frac{1}{2}mV_A^2$$

$$\frac{1}{2}V_C^2 = \frac{1}{2}V_A^2 - gh$$

$$V_C = \sqrt{V_A^2 - 2gh}$$

$$= 4,98 \approx 5,0 \text{ m/s}$$

Sehingga : $K_C = \frac{1}{2}mV_C^2$

$$= \frac{1}{2}m(4,98)^2$$

$$K_C = 12,4 \text{ m}$$

① Kita tinjau lintasan kasar C-B

$$W = \Delta EM + W_{gesek}$$

$$0 = \Delta U + \Delta K + fu.d$$

$$-\Delta K = \Delta U + fud$$

$$-(K_B - K_C) = (mgy_B - mgy_C) + fu.d$$

$$-K_B + K_C = (mg((h + l\sin\theta)) - mgh) + fud$$

$$K_B = K_C - mgL\sin\theta - \mu_k mg\cos\theta . L$$

$$\frac{1}{2}mV_B^2 = 12,4m - mgL(\sin\theta + \mu_k\cos\theta)$$

$$\vec{V_B} = \sqrt{2(12,4) - 2(9,8)(0,75)(\sin 30 + 0,4\cos 30)}$$

$$\vec{V_B} = 3,5 \text{ m/s}$$

11) Kita ambil titik referensi di

a) ketinggian balok, $y = 0$

Sehingga balok turun sejauh $y = -d \sin 40^\circ$

$$\Delta EM = 0$$

$$EM_i = EM_f$$

$$K_i + U_i = K + U$$

$$0 + 0 = \frac{1}{2}mv^2 + mgy + \frac{1}{2}kd^2$$

$$-mgy = \frac{1}{2}mv^2 + \frac{1}{2}kd^2$$

$$mgd\sin 40^\circ - \frac{1}{2}kd^2 = \frac{1}{2}mv^2$$

$$v^2 = 2mgd\sin 40^\circ - kd^2$$

$$v = 0{,}81 \text{ m/s}$$

b) Dengan perinsip kekekalan energi :

$$\Delta EM = 0$$

$$EM_i = EM_{sistem}$$

$$K_i + U_i = K + U$$

$$0 + 0 = 0 + mgy + \frac{1}{2}kd^2$$

$$mgd\sin 40^\circ = \frac{1}{2}kd^2$$

$$d = 0{,}21 \text{ m}$$

c) Arah gerak keatas,

karena : $F_{pegas} > F_{gravitasi\ arah\ x}$

$$F_{pegas} = kd$$

$$= 120(0{,}21) = 25{,}2 N$$

$$F_{gravitasi\ arah\ gerak} = mg\sin 40$$

$$= 12{,}6 N$$

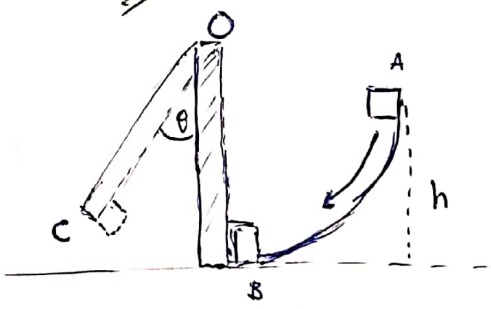
$$\Sigma F_x = ma$$

$$F_{pegas} - F_{gravitasi} = ma$$

$$25{,}2 - 12{,}6 = 2a$$

$$a = \frac{12{,}6}{2} = 6{,}3 \text{ m/s}^2$$

12)



dengan menggunakan Hukum kekekalan energi mekanik

$$0 = \Delta EM + W_{gesek}$$

$$0 = \Delta EM + 0$$

$$EM_i = EM_f$$

$$mgh + 0 = 0 + \frac{1}{2}mv^2$$

$$v = \sqrt{2gh}$$

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(12) Hukum kekekalan momentum sudut balok dan batang.

$$L_i = L_f$$

$$mvd = (I_{batang} + md^2)\omega$$

$$I_{batang} = \frac{1}{12}ML^2 + M\left(\frac{L}{2}\right)^2$$

$$= \frac{1}{12}Md^2 + M\left(\frac{d}{2}\right)^2$$

$$= \frac{1}{3}Md^2$$

maka :

$$mvd = \left(\frac{1}{3}Md^2 + md^2\right)\omega$$

$$\omega = \frac{md\sqrt{2gh}}{\left(Md^2/3 + md^2\right)}$$

Ek rotasi sistem (batang + balok) :

$$Ek = \frac{1}{2}\left(I_{batang} + md^2\right)\omega^2$$

balok ~~batang~~ telah mencapai H, sedangkan batang telah mencapai $H/2$ → pusat massanya → pada saat tepat berhenti.

Sehingga kita tinjau titik B → C

$$\Delta EM = 0$$

$$EM_B = EM_C$$

$$Ek + 0 = 0 + Ep$$

$$\frac{1}{2}\left(I_{batang} + md^2\right)\omega^2 = mgH + Mg\frac{H}{2}$$

dengan $H = d(1 - \cos\theta)$

maka :

$$\frac{1}{2}\frac{m^2d^2(2gh)}{\left(Md^2/3\right) + md^2} = \left(m + \frac{M}{2}\right)gd(1 - \cos\theta)$$

$$\theta = \cos^{-1}\left(1 - \frac{m^2h}{(m + M/2)(m + M/3)}\right]$$

$$= \cos^{-1}\left(\frac{h/d}{(1 + M/2m)(1 + M/3m)}\right]$$

$$= \cos^{-1}\left[1 - \frac{(20\,cm)/(40\,cm)}{(1+1)(1+\frac{2}{3})}\right]$$

$$= \cos^{-1}(0{,}85)$$

$$\theta = 32^\circ$$

(13) a) Dengan memanfaatkan hukum kekekalan energi.

$$\Delta EM = 0$$

$$EM_1 = EM_2$$

$$K_1 + U_1 = K_2 + U_2$$

$$0 + mg(D + x)\sin\theta + \frac{1}{2}kx^2 = \frac{1}{2}mv_2^2 + mgD\sin\theta$$

dengan $m = 2\,kg$, $k = 170\,N/m$

maka : $v_2 = \sqrt{2gx\sin\theta + \frac{kx^2}{m}}$

$$= 2{,}19\,m/s$$

b) Dengan kasus yg sama : $EM_1 = EM_2$

$$K_1 + U_1 = K_2 + U_2$$

$$0 + mg(D + x)\sin\theta + \frac{1}{2}kx^2 = \frac{1}{2}mv_3^2 + 0$$

$$v_3 = 4{,}19\,m/s$$

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(14) Tidak ada gaya horizontal yg bekerja pada sistem anjing - perahu, sehingga pusat massa sistem tidak berubah.

$$M \Delta x_{pm} = m_p \Delta x_p + m_a \Delta x_a$$

$$0 = m_p \Delta x_p + m_a \Delta x_a$$

$$|\Delta x_p| = \frac{m_a}{m_p} |\Delta x_a|$$

⊙ kita lihat geometri (kondisi) relatif terhadap perahu, anjing telah berjalan sejauh $d = 2{,}4$ m, $\rightarrow |\Delta x_p| + |\Delta x_a| = d$

⊙ anjing berjalan kedepan, sedangkan perahu berjalan (bergerak) ke arah sebaliknya.

maka: $\frac{m_a}{m_p} |(\Delta x_a)| + |\Delta x_a| = d$

Sehingga : $|\Delta x_a| = \frac{d}{1 + \frac{m_a}{m_p}} = \frac{2{,}4}{1 + \left(\frac{9{,}5}{18}\right)}$

$$|\Delta x_a| = 1{,}92 \text{ m}$$

Jadi, jarak Anjing dan darat adalah : $D - |\Delta x_a|$

$= 6{,}1 - 1{,}92$

$= 4{,}2$ m

//

(15) Balok 1 dan balok 2 mengalami tumbukan elastik.

maka : $p_i = p_f$

$$m_1 v_{1i} + 0 = m_1 v_{1f} + m_2 v_{2f}$$

Dan Hukum kekekalan energi kinetik:

$$\Delta E_k = 0$$

$$E_{kf} - E_{ki} = 0$$

$$E_{kf} = E_{ki}$$

$$\frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2 = \frac{1}{2} m_1 v_{1i}^2$$

Didapatkan : $v_{2f} = \left(\frac{2 m_1}{m_1 + m_2}\right) v_1$

$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_1$$

⊙ Benda (2) :

$$\Delta x_2 = v_{2f} t$$

⊙ Benda (1) :

$$\Delta x_1 = v_{1f} t$$

waktu yg diperlukan kedua balok, sama yakni t.

maka :

$$\frac{\Delta x_2}{\Delta x_1} = \frac{v_{2f} t}{v_{1f} t}$$

$$\frac{d}{-2d} = \frac{\frac{2 m_1}{(m_1 + m_2)} v_1 t}{\left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_1 t}$$

$$m_2 = 1 \text{ kg}$$

//

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(16) Kita ambil posisi acuan ($x=0$) di ujung perahu (dekat dermaga).

(16) $X_{pm} = \dfrac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$

$= \dfrac{(1500\,kg)(14m - 1,5m) + (4000\,kg)(7m)}{1500\,kg + 4000\,kg}$

$= 8,5\,m$

Karena tidak ada gaya luar terhadap sistem, maka pusat massa tidak berubah.

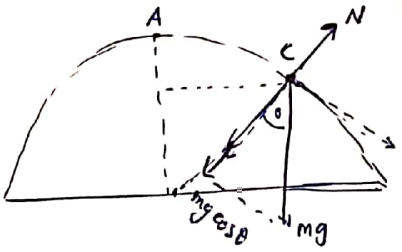
maka :

$X_{pm} = \dfrac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$

$8,5 = \dfrac{(1500\,kg)(x + 1,5m) + (4000\,kg)(7m + x)}{1500\,kg + 4000\,kg}$

$x = 3,0\,m$ //

(17)



kita tinjau titik C, misal anak tepat lepas kontak dari permukaan es,

maka : $\Sigma F_y = \dfrac{mv^2}{R}$

$mg\cos\theta - N = \dfrac{mv^2}{R}$

$N = 0 \quad mg\cos\theta = \dfrac{mv^2}{R}$

$v^2 = gR\cos\theta$

kita tinjau titik A dan C :

$\Delta EM = 0$

$EM_A = EM_C$

$K_A + U_A = K_C + U_C$

$0 + mgR = \frac{1}{2}mv_c^2 + mgR\cos\theta$

$mgR = \frac{1}{2}mgR\cos\theta + mgR\cos\theta$

$1 = \frac{1}{2}\cos\theta + \cos\theta$

$1 = \frac{3}{2}\cos\theta$

$\cos\theta = \frac{2}{3}$.

Ketinggian pada saat anak kehilangan kontaknya, maka : $h = R\cos\theta$

$= R\left(\frac{2}{3}\right)$

$= (13,8)\left(\frac{2}{3}\right)$

$h = 9,20\,m$ //

(18) Massa B turun sejauh $d = 0,25m$, maka massa A naik sejauh $h = d\sin 30°$

maka perubahan energi potensial,

$\Delta U = -m_B g d + m_A g h$

⊙ kita terapkan Hukum kekekalan energi!

$\Delta EM = 0$

$\Delta K + \Delta U = 0$

$\Delta K = -\Delta U$

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$K_f - K_i = -\Delta U$

$= -(-m_B g d + m_A g h)$

$K_f = m_B g d - m_A g h$

$K_f = m_B g d - m_A g d \sin\theta$

$= (m_B - m_A \sin\theta) g d$

$= [2\,kg - (1\,kg \sin 30^\circ)](9{,}8\,m/s^2)(0{,}25)$

$K_f = 3{,}7\,J$ //

Kasus ini hanya untuk $m_B = m_A \sin\theta$, jika

$m_A \sin\theta > m_B \rightarrow$

balok B bergerak keatas.

(19) a) Kita terapkan hukum kekekalan momentum sudut.

$L_i = L_f$

$-dmV + \frac{1}{12} ML^2 \omega = 0$

$d = \frac{ML^2\omega}{12\,mV} = \frac{M(0{,}160)^2(80)}{12\,(M/3)(40)}$

$d = 0{,}180\,m$ //

b) Jika jarak lebih besar d, maka akan bergerak searah jarum jam.

by : Wawan Kurniawan

(Physics '07)

Good luck

Pasti bisa UTS nya !

Semangat !!