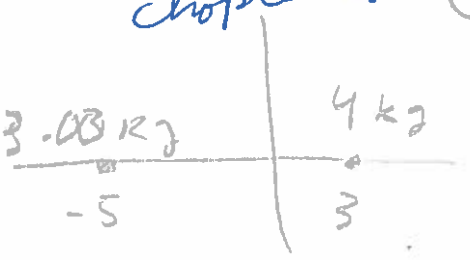
Ayman G nannan
chapter "9" (1)



(1)

$$X_{com} = \frac{\sum_i x_i m_i}{M}$$

$$= \frac{(3)(-5)+(7)(3)}{7}$$

$$= \frac{-15+12}{7}$$

$$= \frac{3}{7}\ m$$

$$= 0.429\ m$$

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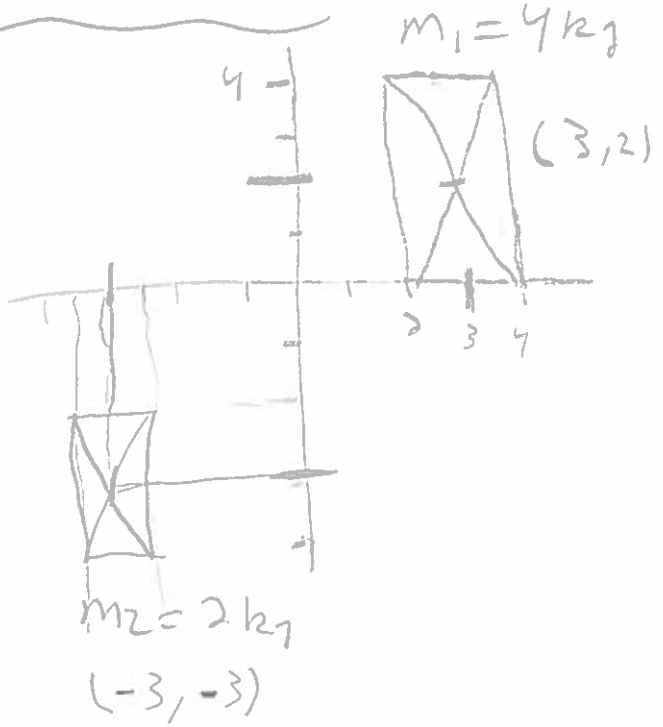
(2) $m_1 = 4\ kg$

$m_2 = 2\ kg$



$$X_{com} = \frac{\sum m_i x_i}{M}$$

$$= \frac{(4)(3)+(2)(-3)}{6}$$

$$= \frac{12-6}{6} = 1\ m$$

$$Y_{com} = \frac{\sum m_i y_i}{M}$$

$$= \frac{(4)(2)+(2)(-3)}{6}$$

$$= \frac{8-6}{6}$$

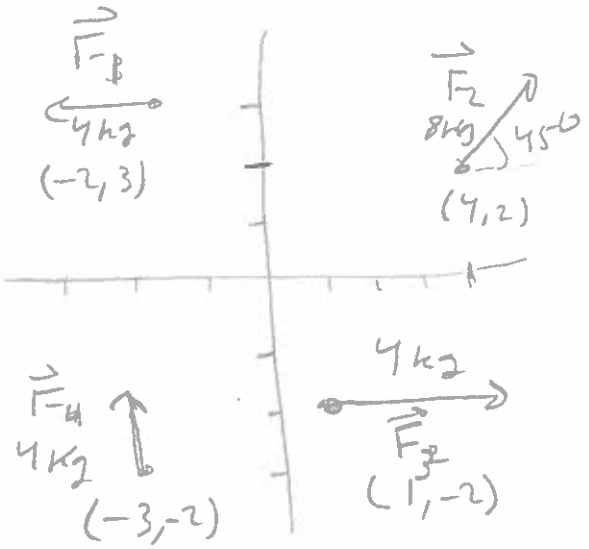
$$= \frac{2}{6} = 0.33\ m$$

(3) $|\vec{F}_1| = 6\,N \quad \vec{F}_1 = -6i + 0j$

$|\vec{F}_2| = 12\,N \quad \vec{F}_2 = 12\cos\theta i + 12\sin\theta j$
$= 8.5i + 8.5j$

$|F_3| = 14\,N \quad \vec{F}_3 = 14i + 0j$

$|F_4| = 6\,N \quad \vec{F}_4 = 0i + 6j$



$\vec{F}_{net} = m\,a$

$F_{net} = M_T\, a_{com}$

$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4$

$= (-6i + 8.5i + 14i + 0i) + (0j + 8.5j + 0j + 6j)$

$= 16.5i + 14.5j$

$a_{com} = \dfrac{\vec{F}_{net}}{M}$

$= \dfrac{16.5i + 14.5j}{20}$

$a_{com} = 0.825i + 0.725j$

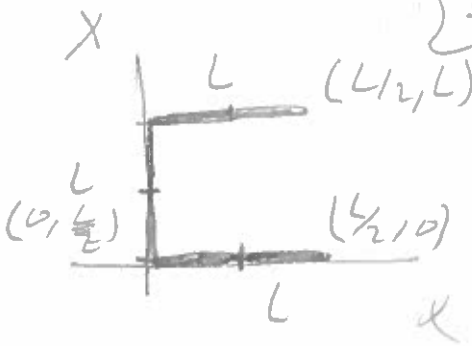
$\theta = \tan^{-1}\left(\dfrac{0.725}{0.825}\right) = 41.3^\circ$

$X_{com} = \dfrac{8\times4 + (4)(-2) + (4)(-3) + 4\times1}{20} = \dfrac{32 - 8 - 12 + 4}{20} = \dfrac{16}{20} = 0.8\,m$

$X_{com} = \dfrac{8\times2 + 4(3) + 4(-2) + 4(-2)}{20} = \dfrac{16 + 12 - 8 - 8}{20} = \dfrac{12}{20} = 0.6\,m$

[4] (X, Y) com??

[3]



$$X_{com} = \frac{m(\frac{L}{2}) + m(\frac{L}{2}) + m(0)}{3m}$$

$$= \boxed{\frac{L}{3}}$$

$$Y_{com} = \frac{m(0) + m(L) + m\frac{L}{2}}{3m}$$

$$= \frac{3/2\, L}{3} = \boxed{\frac{1}{2} L}$$

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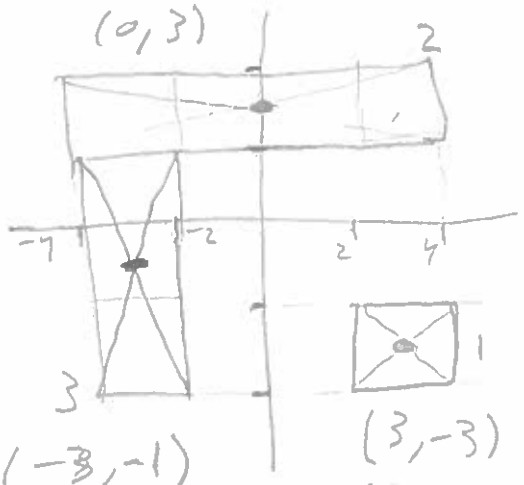
[5]

$m_1 = m$

$m_2 = 4m$

$m_3 = 3m$



$$X_{com} = \frac{\sum m_i x_i}{m}$$

$$= \frac{3m + 0 + 3m(-3)}{8m} = \frac{-6}{8} = -0.75 \text{ m}$$

$$Y_{com} = \frac{-3m + (4m)(3) + (3m)(-1)}{8m} = \frac{-3 + 12 - 3}{8} = 0.75 \text{ m}$$

Q6

$m = 3\,kg$

$\vec{v} = 3i - 4j \ (m/s)$

$\vec{p} = m\vec{v}$

$= 3(3i - 4j)$

$\vec{p} = 9i - 12j$

$|\vec{p}| = \sqrt{9^2 + 12^2} =$

$|\vec{p}| = 15 \ kg\,m/s$

Q7

$m = 1\,kg$

$v_i = -3 \ m/s$

$v_f = +2 \ m/s$

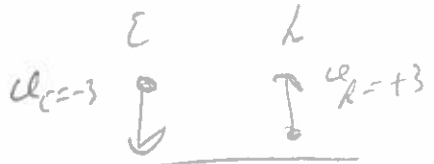
$t = 0.1\,s$

$\Delta p = ?$

$\Delta p = p_f - p_i = m(v_f - v_i)$

$= 1[+2 - (-3)]$

$= 5 \uparrow \ (kg\,m/s)$



2nd method

$\Delta p = Ft$

$F = ma$

$v = v_0 + at$

$2 = -3 + a(0.1)$

$\therefore a = 50 \ m/s$

$\therefore F = ma$

$= (1)(50)$

$= 50\,N$

$\therefore \Delta p = Ft$

$= (50)(0.1)$

$= 5 \ (kg\,m/s)$

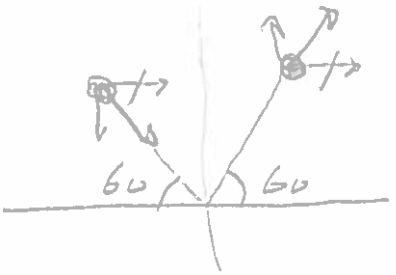
(Q8) $t = 0.2s$

$\theta = 60^\circ$

$S = 10\ m/s$

$m = 3\ kg$

$\vec{F}_{av} = ?!$



$F_{av}\, t = m \Delta v$

- X component will not change $\Rightarrow \Delta P_x = 0 \Rightarrow F_{av_x} = 0$

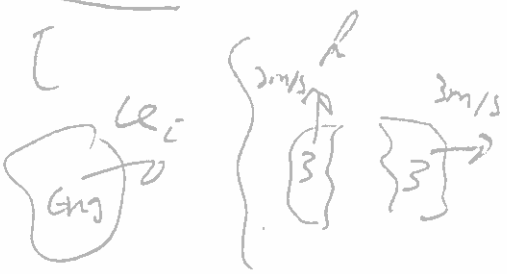
$\Delta P_y = m \Delta v_y = (3)[(10\sin 60) - (-10\sin 60)]$

$\simeq 52\ kg\ m/s$

$F_{avg\,/y} = \dfrac{\Delta P_y}{t} = \dfrac{52}{0.2} \simeq 260\ N$

(Q9) $m = 6\ kg$

$v_i = ?$



$P_i = P_f$

$6\vec{v}_i = (3)(3i) + (3)(3j)$

$6\vec{v}_i = 9i + 9j$

$\vec{v}_i = \dfrac{9i + 9j}{6} = 1.5i + j$

$|\vec{v}_i| = \sqrt{1.5^2 + 1^2} = \underline{1.8\ m/s}$

Q10

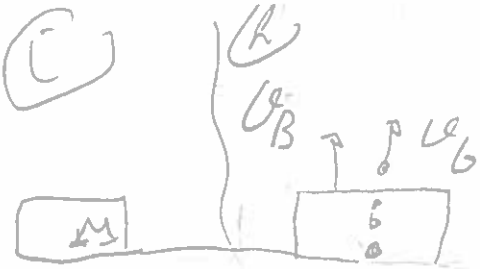
$v_{cb} = 1 \times 10^3 \text{ m/s}$

$M = 10 \text{ kg}$

$m = 20 \text{ g}$

$h = ?$

$v_{R_b} = 400 \text{ m/s}$



$v_{cb} \uparrow_{0m}$

$P_c = P_R$

$0 + (1 \times 10^3)(20 \times 10^{-3}) = (P_{block} + P_{bullet})_R$

$20 = (10)(v_{block}) + (20 \times 10^{-3})(400)$

$20 - 8 = (10) v_{block}$

$v_{block} = 1.2 \text{ m/s}$

$E_C = E_R$

$\frac{1}{2} M v_{B_C}^2 = Mgh$

$\frac{1}{2}(1.2)^2 = 9.8 h$

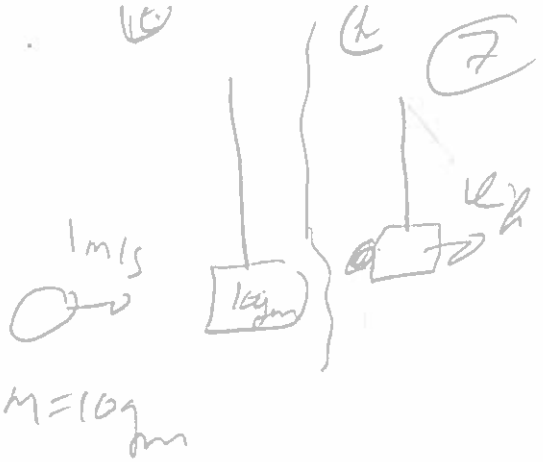
$h = 7.35 \text{ cm}$

$v^2 = u^2 + 2ax$

$0 = 1.2^2 + 2(9.8)x$

$x = 7.35 \text{ cm}$

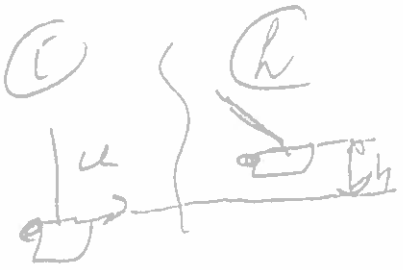
(Q11)



$P_c = P_1$

$(0.01)(1) = (m+M)v_1$

$\frac{0.01}{0.02} = v_1 = \frac{1}{2}$ m/s



$E_c = E_1$

$\frac{1}{2}(m+M)v_1^2 = (m+M)gh$

$h \cong 1.25$ cm

(Q12) $k = 1120$ N/m

$x_{max} = ?$

$E_c = E_1$

$\frac{1}{2}(2)(q^2) + 0 = \frac{1}{2}(2+4)v_1^2 + \frac{1}{2}k\Delta x^2$

$81 = (3)(3)^2 + \frac{1}{2}(1120)\Delta x^2$

$\Delta x = 0.31$ m

$P_c = P_1$

$(2)(9) = (6)v_1$

$v_1 = 3$ m/s

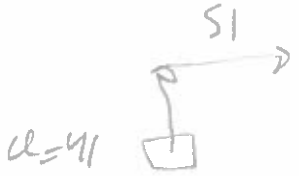
Q 13

$M = 2100\,kg$

$\Delta p = ?$

$\vec{u}_f = \frac{51}{3.6} i$

$\vec{u}_i = \frac{41}{3.6} j$



$\Delta \vec{p} = m \Delta \vec{u}$

$= 2100 (\vec{u}_f - \vec{u}_i)$

$= 2100 \left(\frac{51}{3.6} i - \frac{41}{3.6} j \right)$