

Chap 5, Sadler / Thornton

Ex 5 B, P 91

① Resolving (\rightarrow): $P \cos 30 - 4\sqrt{3} = 0$

(\uparrow): $P \sin 30 + Q - 6 = 0$

So $P = 8\text{ N} \Rightarrow Q = 6 - 8 \sin 30 = 2\text{ N}$

② Resolve (\rightarrow): $P \cos 45 - Q = 0$

(\uparrow): $P \sin 45 - 5\sqrt{2} = 0$

$\therefore P = \dots \quad Q = \dots$

③ Resolve (\rightarrow): $-P \cos \theta + 4 = 0 \Rightarrow P \cos \theta = 4$

(\uparrow): $3 - P \sin \theta = 0 \Rightarrow P \sin \theta = 3$

$$P^2 \cos^2 \theta + P^2 \sin^2 \theta = 16 + 9 = 25$$

So $P = \pm 5 \Rightarrow P = 5\text{ N}$, $\therefore \theta = \cos^{-1} \frac{4}{5} = 36.87^\circ$
(Why +ve?)

④ / Resolve (\rightarrow): $P \cos \theta + 5 - 10 \cos 20 - 10 \sin 20 = 0$

(\uparrow): $P \sin \theta + 10 \sin 20 - 10 \cos 20 = 0$

So $P \cos \theta = 7.817$ & $P \sin \theta = 5.976 \Rightarrow \tan \theta = 0.7645$

So $\theta = 37.4^\circ$, $\therefore P = 9.84\text{ N}$

$$\textcircled{6} \text{ Resolve } (\nearrow): P - 10 \cos 60 = 0$$

$$(\nwarrow): Q - 10 \sin 60 = 0$$

$$\text{So } P = 5 \text{ N}, Q = 8.66 \text{ N} = 5\sqrt{3} \text{ N}$$

$$\textcircled{7} \text{ Resolve } (\searrow): P \cos 60 - Q = 0$$

$$(\nearrow): 12 - P \sin 60 = 0$$

$$\text{So } P = \frac{24}{\sqrt{3}} \text{ N} \text{ \& } Q = 4\sqrt{3} \text{ N}$$

$$\textcircled{8} \text{ Resolve } (\searrow): -Q + 10 \cos 60 + 10 \cos 30 = 0$$

$$(\nearrow): P - 10 \sin 60 + 10 \sin 30 = 0$$

$$\text{So } Q = 10 \cdot \left(\frac{1}{2} + \frac{\sqrt{3}}{2} \right) = 5(1 + \frac{\sqrt{3}}{2}) \text{ N}$$

$$P = \dots$$

$$\textcircled{9} \text{ Resolve } (\nearrow): -3 + P \cos \theta - 5\sqrt{2} \cos 45 = 0 \quad \checkmark$$

$$(\searrow): 5\sqrt{2} \sin 45 - 1 - P \sin \theta = 0 \quad \checkmark$$

$$\text{So } P = \dots$$

$$\theta = \dots$$

~~10~~

~~Ex 5 B, 10, P 92~~

$$a) \quad 6\underline{i} + 4\underline{j} + (-2\underline{i} - 5\underline{j}) + a\underline{i} + b\underline{j} = \underline{0}$$

$$\text{So } (\rightarrow) : 6\underline{i} - 2\underline{i} + a\underline{i} = 0\underline{i} \quad \Rightarrow \quad a = -4 \text{ N}$$

$$(\uparrow) : 4\underline{j} - 5\underline{j} + b\underline{j} = 0\underline{j} \quad \Rightarrow \quad b = 1 \text{ N}$$

b) - c) ✓

$$d) \quad a\underline{i} - 3b\underline{j} + b\underline{i} - 2a\underline{j} - 3\underline{i} + 8\underline{j} = \underline{0}$$

$$(\rightarrow) : a\underline{i} + b\underline{i} - 3\underline{i} = 0\underline{i} \quad \Rightarrow \quad a + b - 3 = 0 \quad \textcircled{1}$$

$$(\uparrow) : -3b\underline{j} - 2a\underline{j} + 8\underline{j} = 0\underline{j} \quad \Rightarrow \quad -3b - 2a + 8 = 0 \quad \textcircled{2}$$

$$2 \times \textcircled{1} + \textcircled{2} : \quad -b + 2 = 0 \quad \Rightarrow \quad b = +2$$

$$\text{Into } \textcircled{1} : \quad \Rightarrow \quad a = 1$$

e) ✓

11 /

12 (a) Resolve (\rightarrow): $P = X \cos \theta$

(\downarrow): $W = X \sin \theta$

So $\frac{W}{P} = \frac{X \sin \theta}{X \cos \theta} \Rightarrow W = P \tan \theta \checkmark$

(b) Resolve (\rightarrow): $W - 2Q \sin 30 = 0$

So $W = 2Q \sin 30$

(\uparrow): $3Q - P - 2Q \cos 30 = 0$

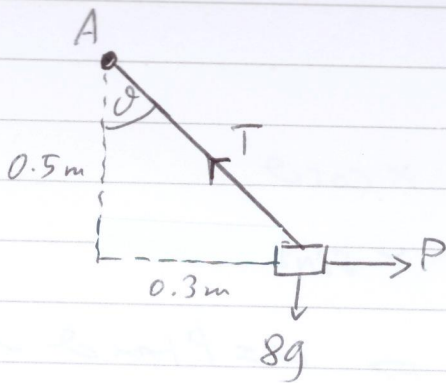
So $P = 3Q - 2Q \cos 30 = 0$

But $Q = \frac{W}{2 \sin 30}$, So $P = \frac{W}{2 \sin 30} (3 - 2 \cos 30)$

$= W(3 - \sqrt{3}) \checkmark$

(c)

(13)



Based on this diag

$$R(\rightarrow): P - T \sin \theta = 0$$

$$(\downarrow): 8g - T \cos \theta = 0$$

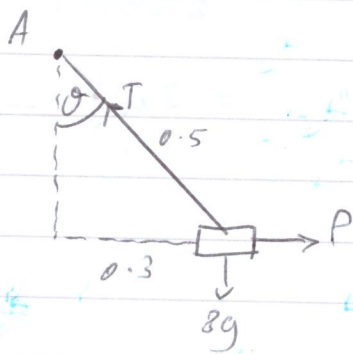
But $\tan \theta = \frac{0.3}{0.5} \Rightarrow \theta = 30.964^\circ$ X

So $T = \frac{8g}{\cos \theta} = 91.43 \text{ N}$ (Book Ans: 98)

$\Rightarrow P = 40.04 \text{ N}$ (Book Ans: 58.8)

So diag is wrong: Δ is wrong why? Because vertical $\neq 0.5$

String = 0.5 long (!) so



So $\sin \theta = \frac{0.3}{0.5}$ ✓

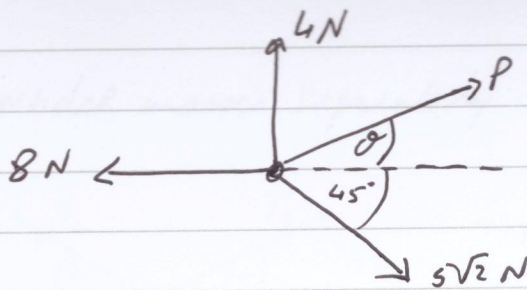
$\cos \theta = \frac{0.4}{0.5}$ ✓

$\Rightarrow T = \frac{8g}{\cos \theta} = 8g \times \frac{0.5}{0.4} = 98 \text{ N}$

$\wedge P = 98 \left(\frac{0.3}{0.5} \right) = 58.8 \text{ N}$

(14) / Same as (13)

15



$$(\uparrow) : 4 + P \sin \theta - 5\sqrt{2} \sin 45 = 0$$

$$(\rightarrow) : -8 + P \cos \theta + 5\sqrt{2} \cos 45 = 0$$

$$\text{So } P \sin \theta = 5\sqrt{2} \sin 45 - 4 = +1 \quad (1)$$

$$P \cos \theta = 8 - 5\sqrt{2} \cos 45 = +3 \quad (2)$$

$$P^2 = 1^2 + 3^2 = 10 \Rightarrow P = \sqrt{10} = 3.16 \text{ N}$$

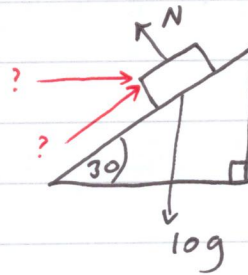
$$\text{Then } \frac{P \sin \theta}{P \cos \theta} = \frac{1}{3} \Rightarrow \tan \theta = \frac{1}{3}$$

$$\theta = 18.435^\circ \checkmark$$

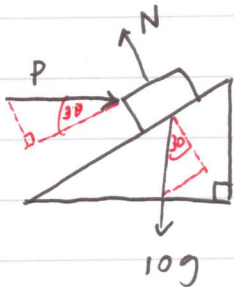
$$= N 71.565 \text{ E} \checkmark$$

16) Do not understand the Q.

see wording of (19)
Force is \parallel to slope



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$$(\uparrow) : -10g \sin 30 + P \cos 30 = 0 \quad (1)$$

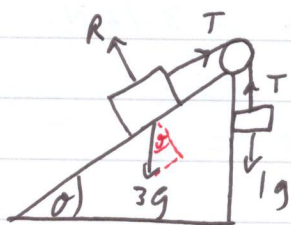
$$(\downarrow) : N - 10g \cos 30 - P \sin 30 = 0 \quad (2)$$

$$\text{By } (1) : P = 10g \tan 30 \Rightarrow P = 58.58 \text{ N}$$

$$\text{By } (2) : N = 10g \cos 30 + 58.58 \sin 30 = 113.16 \text{ N}$$

(18)

(19)



Resolve masses separately. So

$$\begin{aligned} (\uparrow) : T - 1g &= 0 \Rightarrow T = 1g \text{ Newtons} \\ (\rightarrow) \text{ None} & \qquad \qquad \qquad = 9.8 \text{ N } \checkmark \end{aligned}$$

$$\text{Then } (\nearrow) : T - 3g \sin \theta = 0 \quad (1)$$

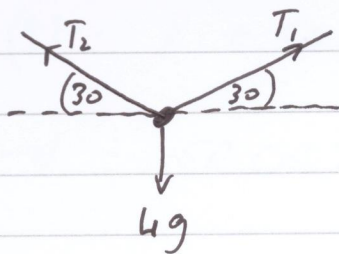
$$(\nwarrow) : R - 3g \cos \theta = 0 \quad (2)$$

$$\text{So by } (1) \quad \sin \theta = \frac{1}{3} \Rightarrow \theta = 19.47^\circ \checkmark$$

$$\nearrow \text{ by } (2) \quad R = 3g \cos 19.47 = 27.72 \text{ N } \checkmark$$

(20)

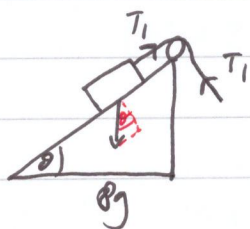
(21) Consider masses separately. So



$$(\rightarrow): -T_2 \cos 30 + T_1 \cos 30 = 0$$

$$(\downarrow): 4g - T_2 \sin 30 - T_1 \sin 30 = 0$$

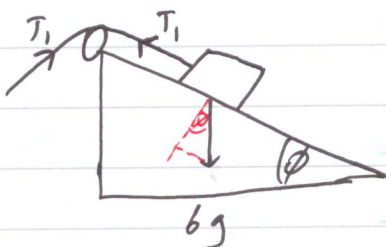
$$\text{So } T_1 = T_2 \text{ } \& \therefore 4g = 2T_1 \sin 30 \Rightarrow T_1 = 39.2 \text{ N} \checkmark$$



$$(\nearrow): T_1 - 8g \sin \theta = 0$$

$$\Rightarrow \sin \theta = \frac{39.2}{8g} = \frac{1}{2}$$

$$\Rightarrow \theta = 30^\circ \checkmark$$



$$(\nearrow): 6g \sin \phi - T_1 = 0$$

$$\Rightarrow \sin \phi = \frac{39.2}{6g} = \frac{2}{3}$$

$$\Rightarrow \phi = 41.81^\circ \checkmark$$

(22) To do :