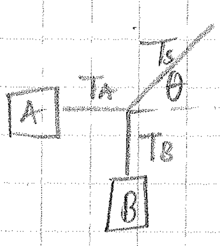
p. 79 #1-3

p.)

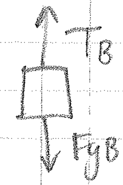
1. $F_{gA} = 6.5N$

$F_{gB} = 2.8N$

$F_{fA} = 1.4N$



a)

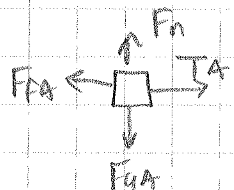


$F_{net} = 0N$

$\therefore F_{net} = 0N = T_B - F_{gB}$

$\therefore F_{gB} = T_B = 2.8N$

b)



$F_{net} = 0N$

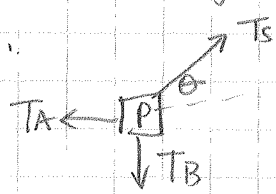
$\sum F_{nety} = 0 = F_n - F_{gA}$

$\therefore F_n = F_{gA} = 6.5N$

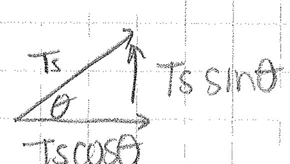
$\sum F_{netx} = 0N = T_A - F_{fA}$

$\therefore T_A = F_{fA} = 1.4N$

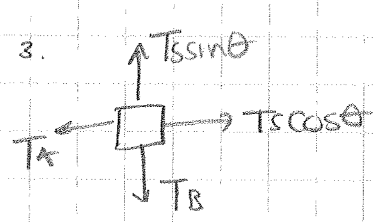
c) 1.



2.



3.



* For 1c) Diagram, see last page. * Much Easier

4. $\sum F_{netx} = 0N = T_A - T_S \cos\theta$

$\therefore T_A = T_S \cos\theta$ (1)

5. $\sum F_{nety} = 0N = T_B - T_S \sin\theta$

$\therefore T_B = T_S \sin\theta$ (2)

We know T_A & T_B, but do not know T_S or θ

So we have 2 equations & 2 unknowns.

To solve, rearrange (1) for T_S and sub into (2)

$T_A = T_S \cos\theta$

$T_S = \dfrac{T_A}{\cos\theta}$

$\therefore T_B = \dfrac{T_A \sin\theta}{\cos\theta}$

1c (cont)) $T_B = \dfrac{T_A \sin\theta}{\cos\theta}$ but $\dfrac{\sin\theta}{\cos\theta} = \tan\theta \rightarrow \dfrac{\sin\theta}{\cos\theta} = \dfrac{\frac{opp}{Hyp}}{\frac{Adj}{Hyp}}$

$= \dfrac{opp}{\cancel{Hyp}} \times \dfrac{\cancel{Hyp}}{Adj}$

$= \dfrac{opp}{Adj} = \tan\theta$

$\therefore T_B = T_A \tan\theta$

$\dfrac{T_B}{T_A} = \tan\theta$

$\theta = \tan^{-1}\left(\dfrac{T_B}{T_A}\right)$

$\theta = \tan^{-1}\left(\dfrac{2.8}{1.4}\right)$

$\theta = 63^\circ$

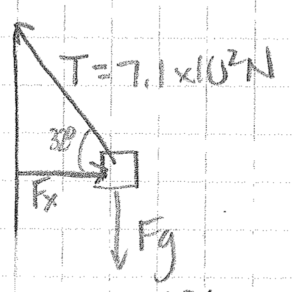
Sub θ into $T_s = \dfrac{T_A}{\cos\theta}$

$T_s = \dfrac{1.4N}{\cos 63^\circ}$

$T_s = 3.1N$

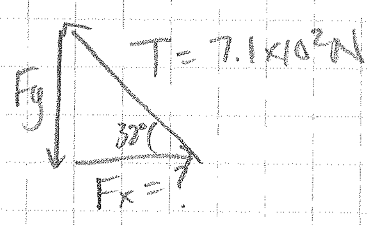
$\therefore T_s = 3.1N$ [63° above the horizontal]

2.



m = 62 kg

Redrawn triangle:

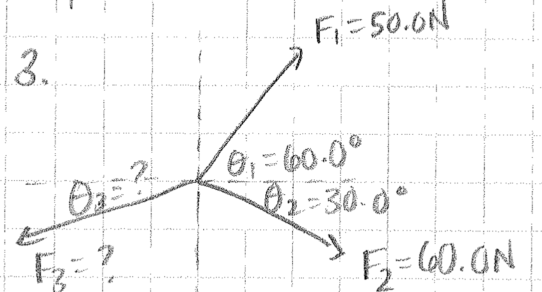


$\Sigma F_{net\,x} = F_x - T\cos\theta = 0N \Rightarrow F_x = T\cos\theta$

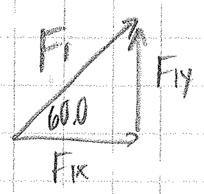
$F_x = (7.1 \times 10^2 N)\cos 32^\circ$

$F_x = 602\,N \rightarrow 6.0 \times 10^2 N$

3.

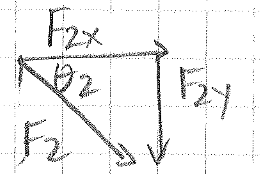


Method 1: Components



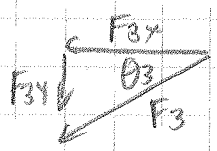
$F_{1x} = F_1 \cos\theta_1$ [E]

$F_{1y} = F_1 \sin\theta_1$ [N]



$F_{2x} = F_2 \cos\theta_2$ [E]

$F_{2y} = F_2 \sin\theta_2$ [S]



$F_{3x} = F_3 \cos\theta_3$ [W]

$F_{3y} = F_3 \sin\theta_3$ [S]

* Choose N, E +ve

At rest, $\therefore$ $\sum_i F_{nety} = 0N$, $\sum_i F_{netx} = 0N$

$$\sum_i F_{nety} = 0 = F_1\sin\theta_1 - F_2\sin\theta_2 - F_3\sin\theta_3$$

$$F_1\sin\theta_1 = F_2\sin\theta_2 + F_3\sin\theta_3 \quad (1)$$

$$\sum_i F_{netx} = 0 = F_1\cos\theta_1 + F_2\cos\theta_2 - F_3\cos\theta_3$$

$$F_3\cos\theta_3 = F_1\cos\theta_1 + F_2\cos\theta_2 \quad (2)$$

Rearrange (2) for F_3

$$F_3 = \frac{F_1\cos\theta_1 + F_2\cos\theta_2}{\cos\theta_3} \quad (3) \rightarrow \text{Sub into } (1)$$

$$F_1\sin\theta_1 = F_2\sin\theta_2 + \frac{(F_1\cos\theta_1 + F_2\cos\theta_2)}{\cos\theta_3}\sin\theta_3$$

$$\frac{\sin\theta_3}{\cos\theta_3} = \tan\theta_3 \quad \therefore \quad F_1\sin\theta_1 = F_2\sin\theta_2 + (F_1\cos\theta_1 + F_2\cos\theta_2)\tan\theta_3$$

3 con't $F_1\sin\theta_1 - F_2\sin\theta_2 = \tan\theta_3\,(F_1\cos\theta_1 + F_2\cos\theta_2)$

$$\frac{F_1\sin\theta_1 - F_2\sin\theta_2}{F_1\cos\theta_1 + F_2\cos\theta_2} = \tan\theta_3$$

$$\theta_3 = \tan^{-1}\left(\frac{F_1\sin\theta - F_2\sin\theta_2}{F_1\cos\theta_1 + F_2\cos\theta_2}\right)$$

$$\theta_3 = \tan^{-1}\left(\frac{(50.0)\sin(60.0) - (60.0)\sin(30.0)}{(50.0)\cos(60.0) + (60.0)\cos(30.0)}\right)$$

$\theta_3 = 9.8°$

Sub θ_3 into (3)

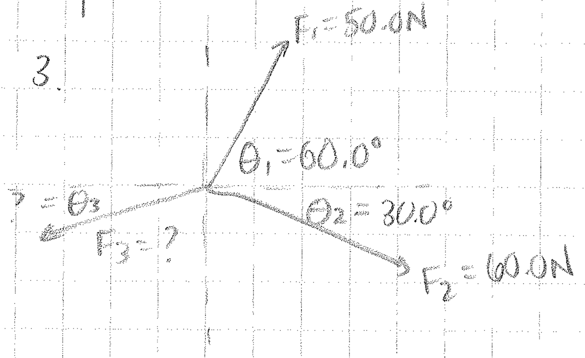
$$F_3 = \frac{(50.0)\cos 60.0 + (60.0)\cos 30.0}{\cos(9.8°)}$$

$F_3 = 79\text{ N}$

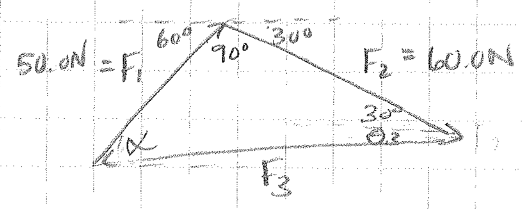
$\therefore \vec{F}_3 = 79\text{ N [W 9.8° S]}$

p. 79 #1-3

3.



Method 2: Cosine Law



Right-Angled Triangle!

$\therefore$ F_3 = Hypotenuse.

$$F_3 = \sqrt{F_1^2 + F_2^2}$$

$$F_3 = 78\ N$$

$$\tan\alpha = \frac{F_2}{F_1}$$

$$\alpha = \tan^{-1}\left(\frac{60.0}{50.0}\right)$$

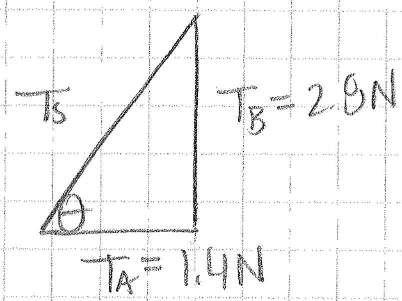
$$\alpha = 50.2°$$

$$\theta_3 = 180° - 90° - 30° - 50.2°$$

$$\theta_3 = 9.8°$$

$\therefore$ $\vec{F}_3 = 78N$ [W 9.8°S] p.79 #1-3

1c) Diagram Method



$$T_S = \sqrt{T_A^2 + T_B^2}$$

$$T_S = \sqrt{(1.4)^2 + (2.8)^2}$$

$$T_S = 3.1\,N$$

$$\tan\theta = \frac{T_B}{T_A}$$

$$\theta = \tan^{-1}\left(\frac{2.8N}{1.4N}\right)$$

$$\theta = 63^\circ$$

$\therefore$ $\vec{T_S} = 3.1N$ [63° above the horizontal]