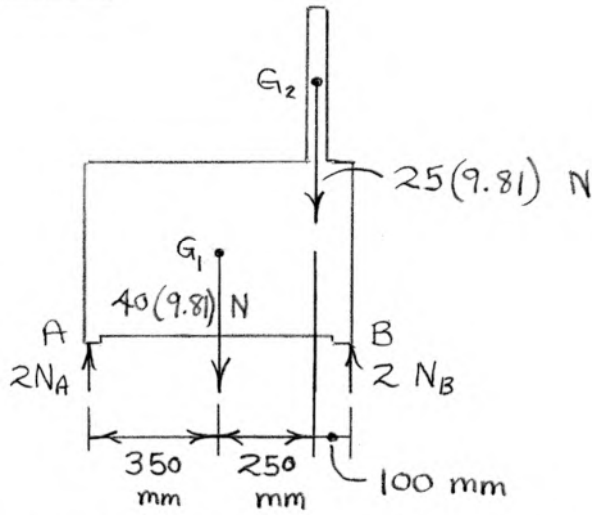


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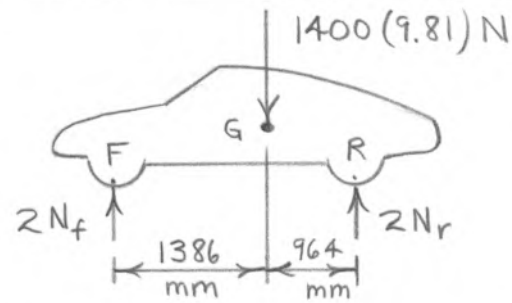


$$+\uparrow \Sigma F = 0 : 2N_A + 2N_B - (25 + 40)9.81 = 0$$

$$\begin{aligned} \curvearrowright \Sigma M_A = 0 : & -40(9.81)(350) - 25(9.81)(600) \\ & + 2N_B(700) = 0 \end{aligned}$$

$$\Rightarrow \begin{cases} N_A = 115.6 \text{ N} \\ N_B = 203 \text{ N} \end{cases}$$

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$$\uparrow \Sigma F = 0 : 2N_f + 2N_r - 1400(9.81) = 0$$

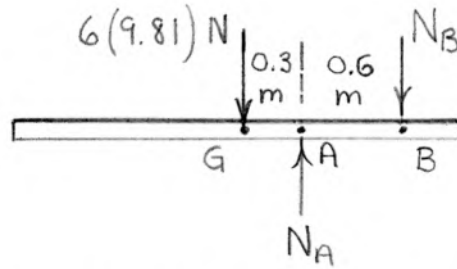
$$\curvearrowright \Sigma M_F = 0 : -1400(9.81)(1386) + 2N_r(1386 + 964) = 0$$

$$\text{Solution : } \begin{cases} N_f = 2820 \text{ N} \\ N_r = 4050 \text{ N} \end{cases}$$

Assumes  $G$  midway between left and right wheels.

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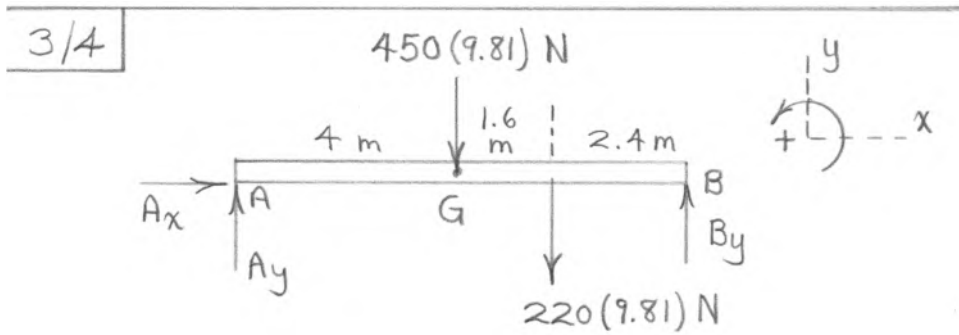
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$$\curvearrowright \sum M_B = 0: 6(9.81)(0.9) - N_A(0.6) = 0$$

$$\underline{N_A = 88.3 \text{ N}}$$

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$$\text{From } \Sigma F_x = 0, \quad A_x = 0$$

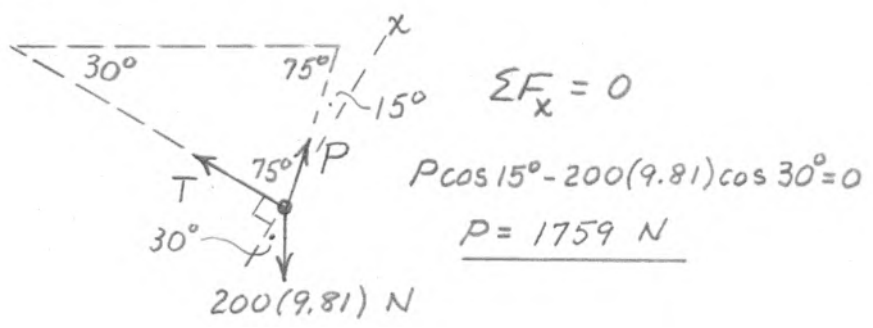
$$\Sigma M_A = 0: -450(9.81)4 - 220(9.81)(5.6) + B_y(8) = 0, \quad \underline{B_y = 3720 \text{ N}}$$

$$\Sigma F_y = 0: A_y - 450(9.81) - 220(9.81) + 3720 = 0$$

$$\underline{A_y = 2850 \text{ N}}$$

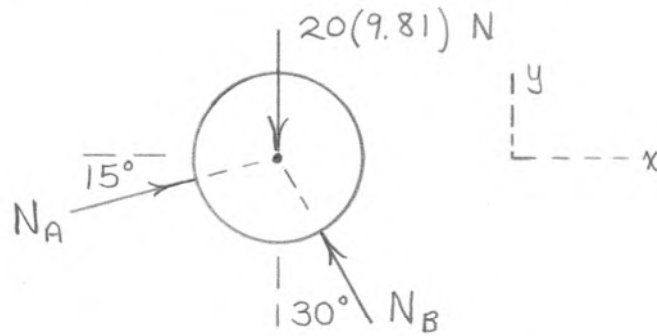
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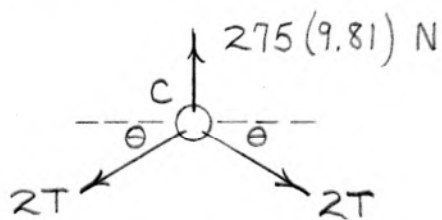


$$\left\{ \begin{array}{l} \sum F_x = 0: N_A \cos 15^\circ - N_B \sin 30^\circ = 0 \quad (1) \\ \sum F_y = 0: N_A \sin 15^\circ + N_B \cos 30^\circ - 20(9.81) = 0 \quad (2) \end{array} \right.$$

$$\text{Solution: } \begin{cases} N_A = 101.6 \text{ N} \\ N_B = 196.2 \text{ N} \end{cases}$$

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3/7 | FBD of junction ring C:



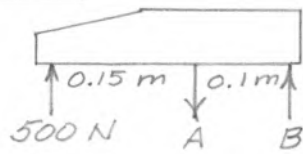
$$\theta = \tan^{-1} \frac{250}{900/2}$$
$$= 29.1^\circ$$

$$\uparrow + \Sigma F = 0: 275(9.81) - 4T \sin 29.1^\circ = 0$$

$$\underline{T = 1389 \text{ N}}$$

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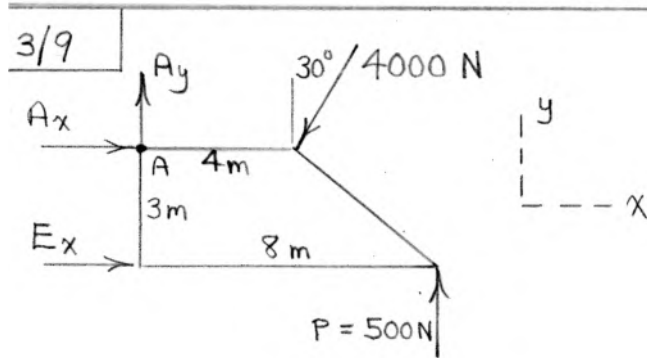
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$$\sum M_B = 0; 500(0.25) - 0.1A = 0$$
$$\underline{A = 1250 \text{ N}}$$

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$$\sum F_x = 0: A_x + E_x - 4000 \sin 30^\circ = 0$$

$$\sum F_y = 0: A_y - 4000 \cos 30^\circ + 500 = 0$$

$$\sum M_A = 0: E_x(3) + 500(8) - 4000 \cos 30^\circ(4) = 0$$

$$\Rightarrow \underline{A_x = -1285 \text{ N}}, \quad \underline{A_y = 2960 \text{ N}}, \quad \underline{E_x = 3290 \text{ N}}$$

$$\text{For maximum } P: E_x = 0 \text{ and } \sum M_A = 0:$$

$$P(8) - 4000 \cos 30^\circ(4) = 0, \quad \underline{P = 1732 \text{ N}}$$

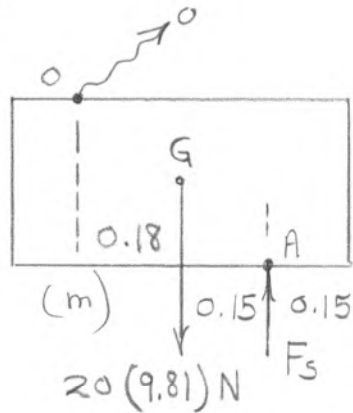
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$P = 50(9.81) \tan \theta$   
 $\sin \theta = 1/4$   
 $\tan \theta = 1/\sqrt{4^2 - 1^2} = 0.258$   
 $P = 50(9.81)(0.258) = \underline{126.6 \text{ N}}$

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$$\uparrow \sum M_o = 0 : -20(9.81)(0.18) + F_s(0.18 + 0.15) = 0$$

$$F_s = 107.0 \text{ N}$$

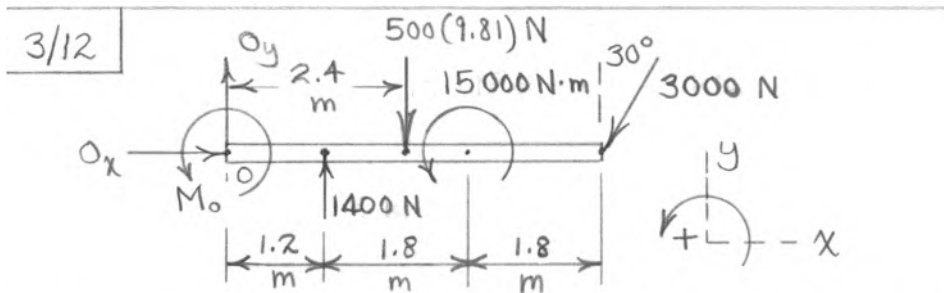
$$F_s = k\delta : 107.0 = 2000\delta, \delta = 0.0535 \text{ m}$$

or  $\delta = 53.5 \text{ mm}$

$$L = 0.1 + \delta = 0.1 + 0.0535 = 0.1535 \text{ m}$$

or 153.5 mm

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$$\Sigma F_x = 0 : O_x - 3000 \sin 30^\circ = 0 , \quad \underline{O_x = 1500 \text{ N}}$$

$$\Sigma F_y = 0 : O_y + 1400 - 500(9.81) - 3000 \cos 30^\circ = 0$$

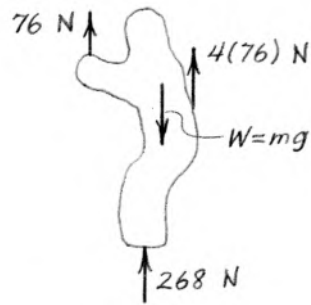
$$\underline{O_y = 6100 \text{ N}}$$

$$\Sigma M_o = 0 : M_o + 1400(1.2) - 500(9.81)(2.4) + 15000 - (3000 \cos 30^\circ)(4.8) = 0$$

$$\underline{M_o = 7560 \text{ N}\cdot\text{m}}$$

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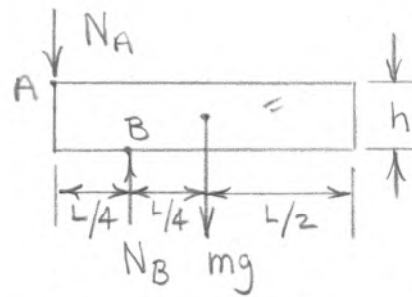
$$\Sigma F = 0: 76 + 4(76) + 268 - W = 0$$

$$\underline{W = 648 \text{ N}}$$

$$m = \frac{W}{g} = \frac{648}{9.81} = \underline{66.1 \text{ kg}}$$

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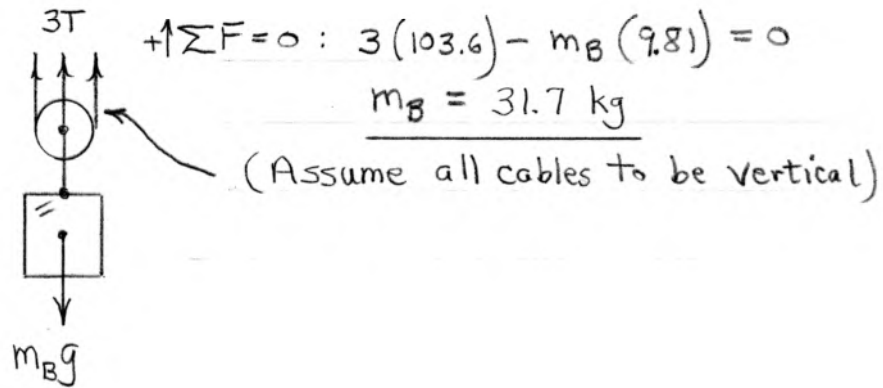
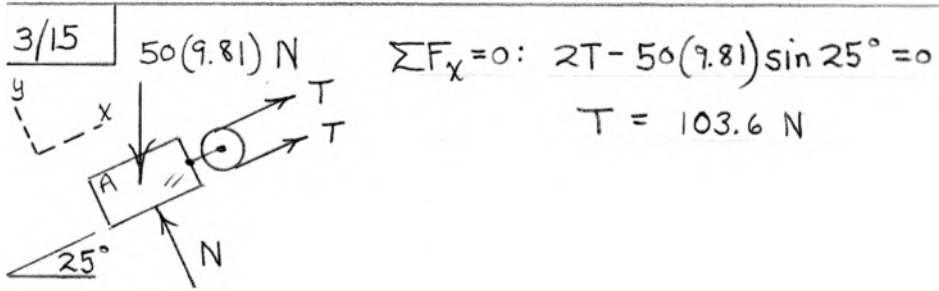
$$\uparrow \Sigma F = 0: N_B - N_A - mg = 0$$

$$\curvearrowleft \Sigma M_A = 0: N_B \left(\frac{L}{4}\right) - mg \left(\frac{L}{2}\right) = 0$$

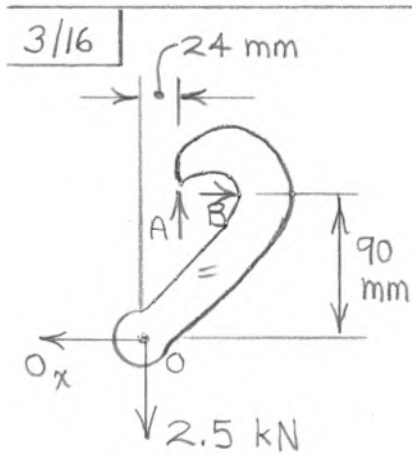
$$\text{Solution: } \begin{cases} N_A = mg & (\text{down}) \\ N_B = 2mg & (\text{up}) \end{cases}$$

The height  $h$  has no bearing on the above results, assuming no friction at  $A$  and  $B$ .

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From vertical equilibrium,

$$A = 2.5 \text{ kN}$$

$$\curvearrow + \sum M_O = 0:$$

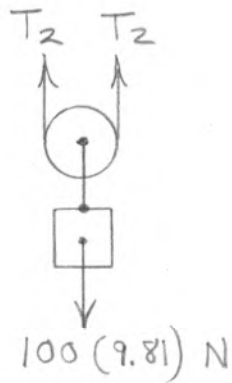
$$2.5(24) - B(90) = 0$$

$$B = 0.667 \text{ kN}$$

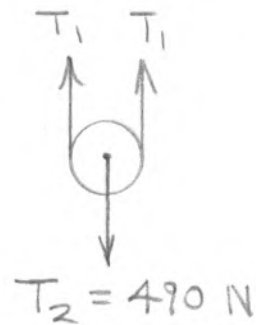
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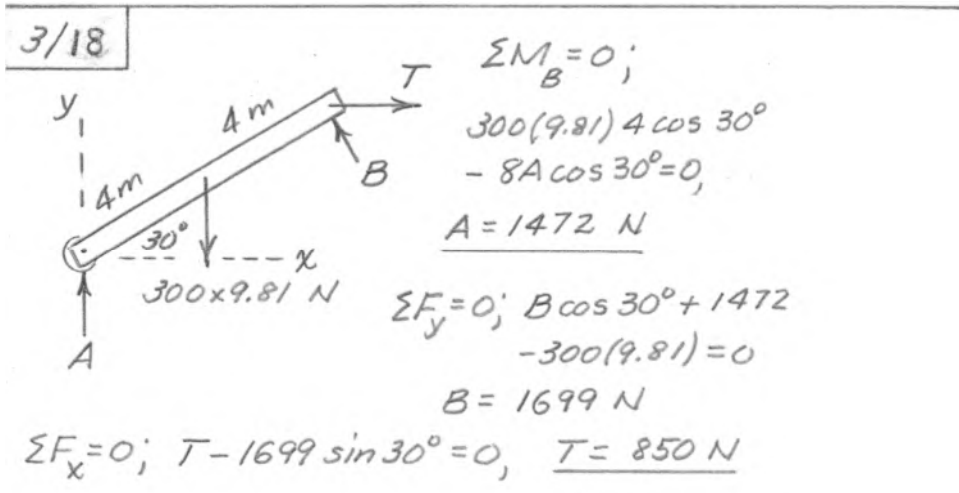


$$\text{From } \uparrow \Sigma F = 0, \quad T_2 = \frac{100(9.81)}{2}$$
$$T_2 = 490 \text{ N}$$



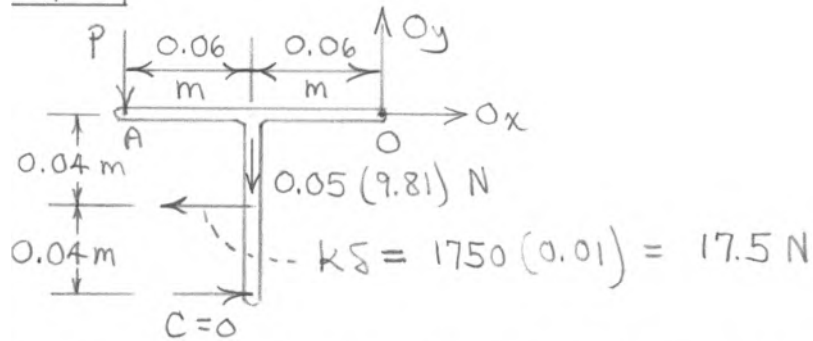
$$\text{Similarly, } T_1 = \frac{1}{2} T_2$$
$$= \frac{1}{2} (490) = \underline{245 \text{ N}}$$

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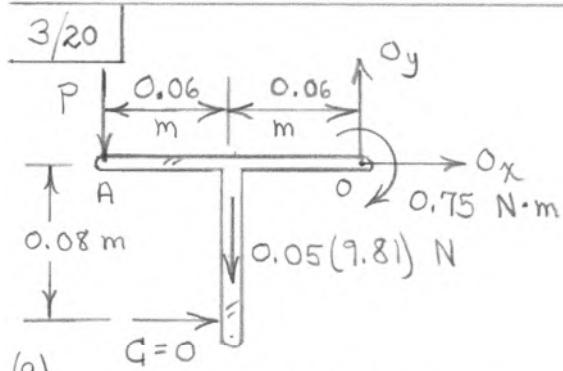
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$$(a) \quad \sum M_O = 0: P(0.12) + 0.05(9.81)(0.06) - 17.5(0.04) = 0$$
$$P = 5.59 \text{ N}$$

$$(b) \quad \sum M_O = 0: P(0.12) - 17.5(0.04) = 0$$
$$P = 5.83 \text{ N}$$

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(a)

$$\uparrow \sum M_o = 0 : P(0.12) + 0.05(9.81)(0.06) - 0.75 = 0$$

$$\underline{P = 6.00 \text{ N}}$$

(b)

$$\uparrow \sum M_o = 0 : P(0.12) - 0.75 = 0$$

$$\underline{P = 6.25 \text{ N}}$$

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