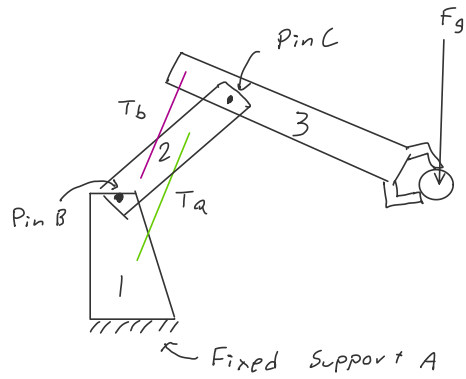


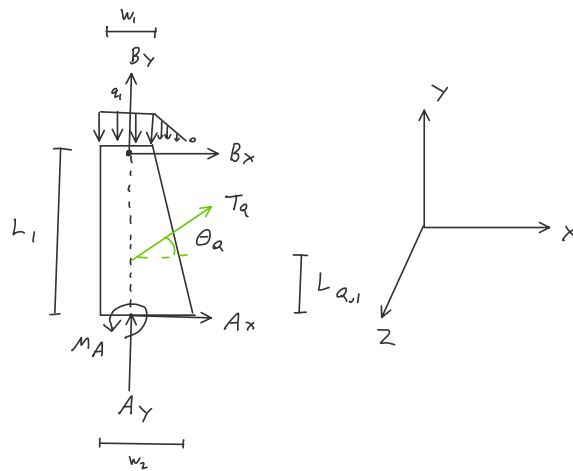
# MEE 342 – Preliminary Statics Calculations

Saturday, January 31, 2026 2:24 PM

Full-Body Figure:



FBD 1



$$\sum F_{x,1} = 0 \rightarrow A_x + B_x + T_a \cos(\theta_a) = 0 \quad (1)$$

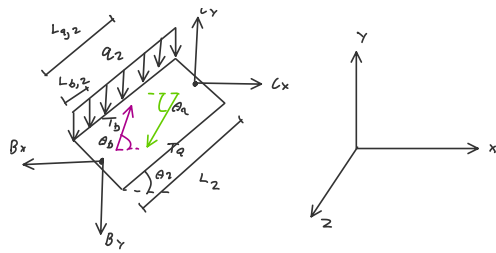
$$\sum F_{y,1} = 0 \rightarrow A_y + B_y + T_a \sin(\theta_a) - q_1 w_1 - \frac{1}{2} q_1 (w_2 - w_1) = 0$$

$$\rightarrow A_y + B_y + T_a \sin(\theta_a) = \frac{1}{2} q_1 (w_1 + w_2) \quad (2)$$

$$\sum M_2 \text{ @ } A = 0 \rightarrow M_A - B_x L_1 - T_a L_{q,1} \cos(\theta_a) - \frac{1}{2} q_1 (w_2 - w_1) \left( \frac{1}{2} w_1 + \frac{(w_2 - w_1)}{3} \right)$$

$$\rightarrow M_A - B_x L_1 - T_a L_{q,1} \cos(\theta_a) = \frac{1}{2} q_1 (w_2 - w_1) (w_1 + 2w_2)$$

FBD 2



$$\sum F_{x,2} = 0 \rightarrow -B_x + C_x - T_a \cos(\theta_a) + T_b \cos(\theta_b) = 0 \quad (4)$$

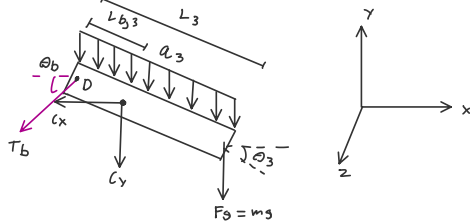
$$\sum F_{y,2} = 0 \rightarrow -B_y + C_y - T_a \sin(\theta_a) + T_b \sin(\theta_b) - q_2 L_2 = 0$$

$$\rightarrow -B_y + C_y - T_a \sin(\theta_a) + T_b \sin(\theta_b) = q_2 L_2 \quad (5)$$

$$\sum M_2 \text{ at } B = 0 \rightarrow -C_x L_2 \sin(\theta_2) + C_y L_2 \sin(90^\circ - \theta_2) - T_a L_{a,2} \sin(\theta_a - \theta_2) + T_b L_{b,2} \sin(\theta_b - \theta_2) - q_2 L_2 \left( \frac{L_2}{2} \sin(90^\circ - \theta_2) \right) = 0$$

$$\rightarrow -C_x L_2 \sin(\theta_2) + C_y L_2 \cos(\theta_2) - T_a L_{a,2} \sin(\theta_a - \theta_2) + T_b L_{b,2} \sin(\theta_b - \theta_2) = \frac{1}{2} q_2 L_2^2 \cos(\theta_2) \quad (6)$$

FBD 3



$$\sum F_{x,3} = 0 \rightarrow -C_x - T_b \cos(\theta_b) = 0$$

$$\rightarrow C_x + T_b \cos(\theta_b) = 0 \quad (7)$$

$$\sum F_{y,3} = 0 \rightarrow -C_y - T_b \sin(\theta_b) - q_3 L_3 - mg = 0$$

$$\rightarrow C_y + T_b \sin(\theta_b) = -q_3 L_3 - mg \quad (8)$$

$$\sum M_2 \text{ at } D = 0 \rightarrow C_x L_{b,3} \sin(\theta_3) - C_y L_{b,3} \sin(90^\circ - \theta_3) - q_3 L_3 \left( \frac{L_3}{2} \right) \sin(90^\circ - \theta_3) - mg L_3 \sin(90^\circ - \theta_3) = 0$$

$$\rightarrow C_x L_{b,3} \sin(\theta_3) - C_y L_{b,3} \cos(\theta_3) = \frac{1}{2} q_3 L_3^2 \cos(\theta_3) + mg L_3 \cos(\theta_3)$$

Linear system:

$A_x$	$A_y$	$M_A$	$B_x$	$B_y$	$C_x$	$C_y$	$T_a$	$T_b$	
1	0	0	1	0	0	0	$\cos(\theta_a)$	0	0
0	1	0	0	1	0	0	$\sin(\theta_a)$	0	$\frac{1}{2} q_1 (w_1 + w_2)$
0	0	1	$-L_1$	0	0	0	$-L_{a,1} \cos(\theta_a)$	0	$\frac{1}{12} q_1 (w_2 - w_1) (w_1 + 2w_2)$
0	0	0	-1	0	1	0	$-\cos(\theta_a)$	$\cos(\theta_b)$	0
0	0	0	0	-1	0	1	$-\sin(\theta_a)$	$\sin(\theta_b)$	$q_2 L_2$
0	0	0	0	0	$-L_2 \sin(\theta_2)$	$L_2 \cos(\theta_2)$	$-L_{a,2} \sin(\theta_a - \theta_2)$	$L_{b,2} \sin(\theta_b - \theta_2)$	$\frac{1}{2} q_2 L_2^2 \cos(\theta_2)$
0	0	0	0	0	1	0	0	$\cos(\theta_b)$	0
0	0	0	0	0	0	1	0	$\sin(\theta_b)$	$-q_3 L_3 - mg$
0	0	0	0	0	$L_{b,3} \sin(\theta_3)$	$-L_{b,3} \cos(\theta_3)$	0	0	$\frac{1}{2} q_3 L_3^2 \cos(\theta_3) + mg L_3 \cos(\theta_3)$