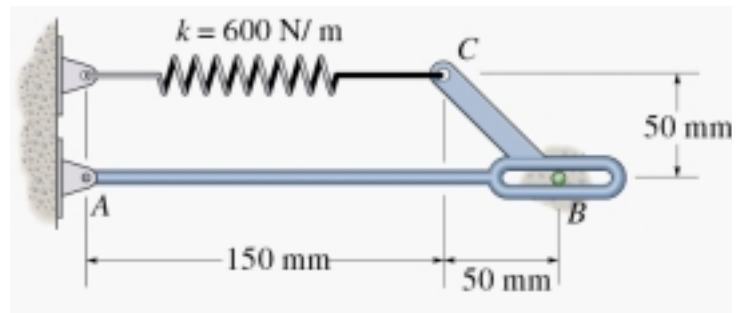


Problem 1:

Determine the reactions at the pins A and B. The spring has an unstretched length of 80mm.



Solution:

Unstretched length of spring = 80 mm = 0.08 m

Stretched length of spring = 150 mm = 0.15 m

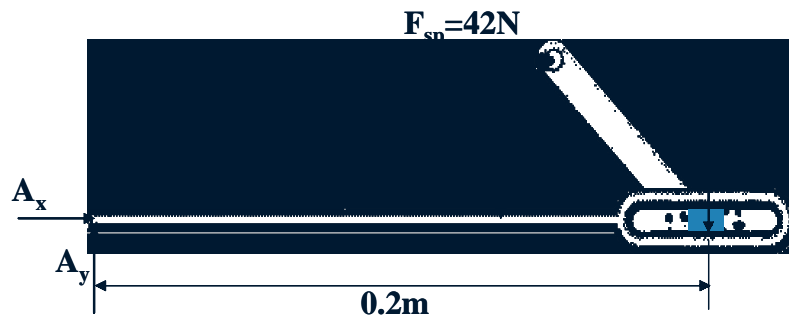
The spring stretches: $x = 0.15 - 0.08 = 0.07$ m

Spring force, $F_{sp} = (k)(x)$

$F_{sp} = (600\text{N/m})(0.07\text{m}) = 42.0$ N

FBD:

- 1) Consider a force at C from the spring,
- 2) Point B is a roller so the only force at B is a normal force perpendicular to the line of sliding,
- 3) Point A is a pin joint, so we have two unknown force at A.
- 4)



It is better to consider the total moment about a point with higher number of unknowns (here A):

Equations of Equilibrium :

$$(+ \sum M_A = 0$$

$$\Rightarrow (42)(0.05) - N_B(0.2) = 0$$

$$\Rightarrow N_B = 10.5 \text{ N}$$

$$\rightarrow \sum F_x = 0$$

$$\Rightarrow A_x - 42 = 0$$

$$\Rightarrow A_x = 42 \text{ N}$$

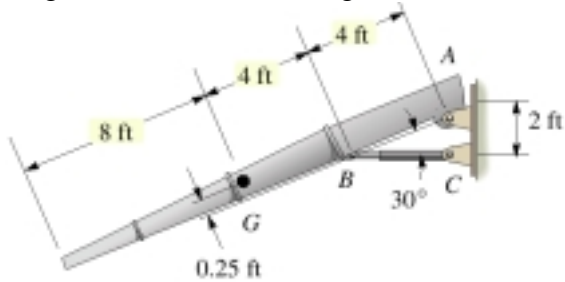
$$+ \uparrow \sum F_y = 0$$

$$\Rightarrow A_y - 10.5 = 0$$

$$\Rightarrow A_y = 10.5 \text{ N}$$

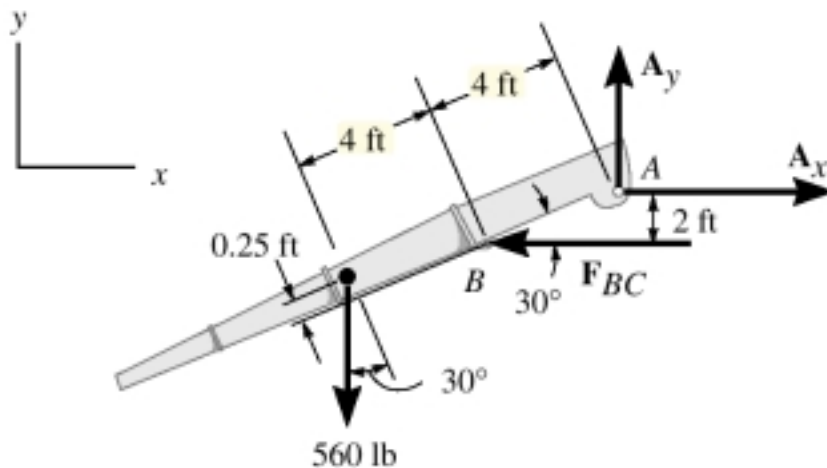
Problem 2:

Placement of concrete from the truck is accomplished using the chute shown in the photo (with the idealized model of the chute shown below). Determine the force that the hydraulic cylinder and the truck frame exert on the chute to hold it in the position shown. The chute and wet concrete contained along its length have a uniform weight of 35 lb/ft.



Solution:

Assume a pin connection at A. Hydraulic cylinder BC acts as a short link. The weight [(35lb/ft)(16ft) = 560 lb] acts at the midpoint of the chute "G". Hence, the FBD is:



Equations of Equilibrium :

$$(+\sum M_A = 0$$

$$-F_{BC}(2ft) + 560 \cos 30^\circ lb(8ft) + 560 \sin 30^\circ lb(0.25ft) = 0$$

$$\Rightarrow F_{BC} = 1975lb$$

$$\rightarrow \sum F_x = 0$$

$$A_x - 1975lb = 0$$

$$\Rightarrow A_x = 1975lb$$

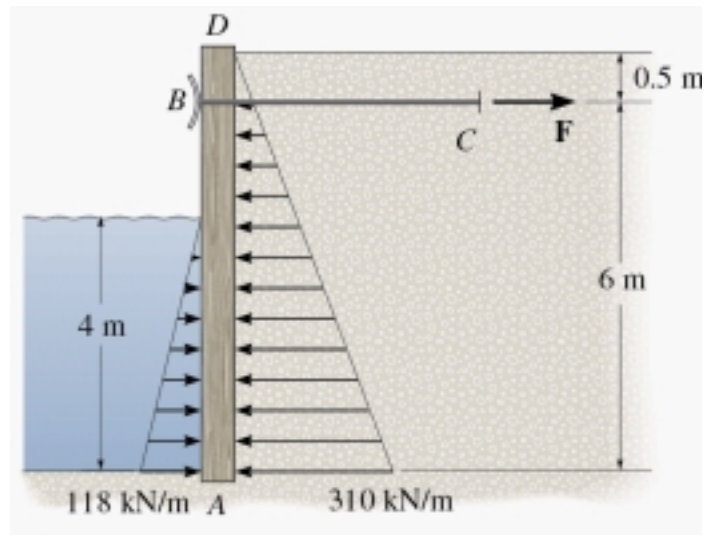
$$+\uparrow \sum F_y = 0$$

$$A_y - 560lb = 0$$

$$\Rightarrow A_y = 560lb$$

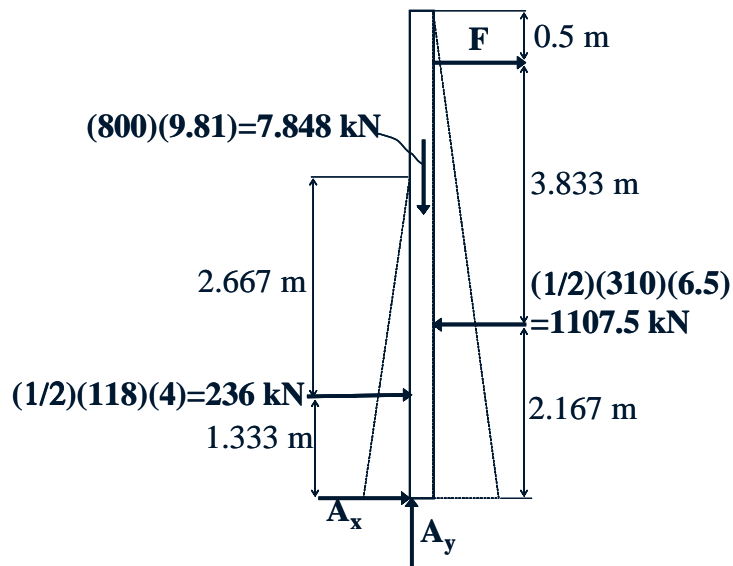
Problem 3:

The bulk head AD is subjected to both water and soil-backfill pressures. Assuming AD is “pinned” to the ground at A, determine the horizontal and vertical reactions there and also the required tension in the ground anchor BC necessary for equilibrium. The bulk head has a mass of 800 kg.



Solution:

The FBD is:



Equations of Equilibrium :

$$(+ \sum M_A = 0$$

$$\Rightarrow (1007.5)(2.167) - (236)(1.333) - (F)(6) = 0$$

$$\Rightarrow F = 311.375 \text{ kN} = 311 \text{ kN}$$

$$\xrightarrow{+} \sum F_x = 0$$

$$\Rightarrow A_x + 311.375 + 236 - 1007.5 = 0$$

$$\Rightarrow A_x = 460 \text{ kN}$$

$$+ \uparrow \sum F_y = 0$$

$$\Rightarrow A_y - 7.848 = 0$$

$$\Rightarrow A_y = 7.85 \text{ kN}$$