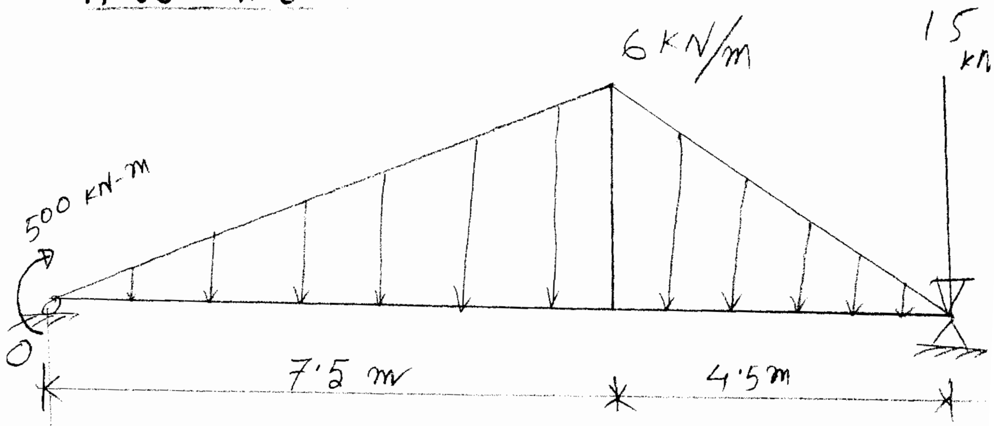
CE 201-2 (041)

H.W. #6

Prob 4-142 (P-185)

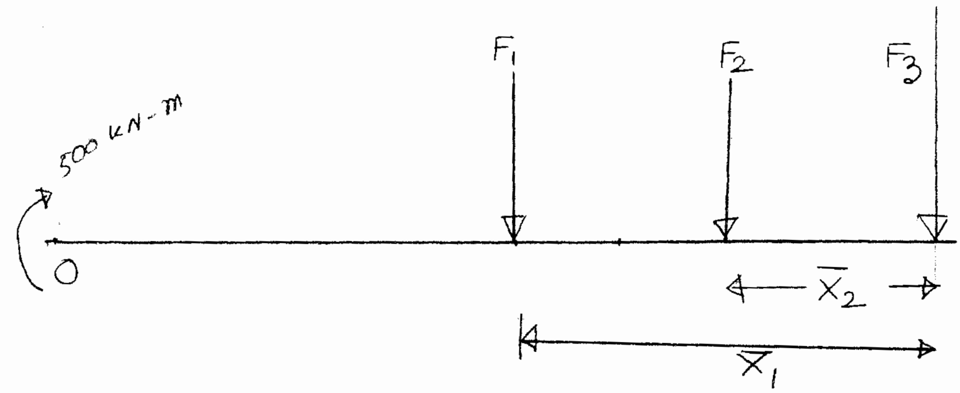


Given:

The forces are shown in Fig.

Req.d:

Replace the loading by a single force, and Specify the location of the force on the beam measured from point O.



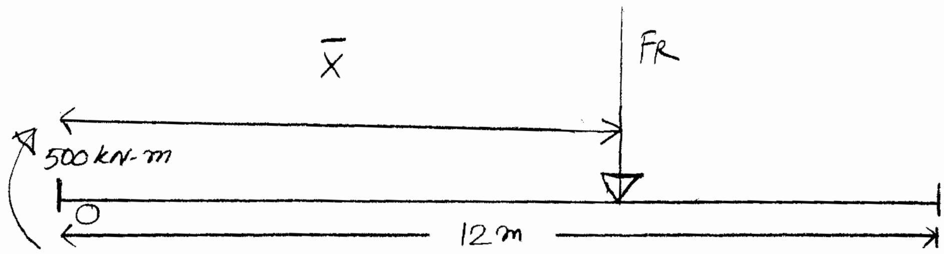
Sol.n:

Here

$F_1 = \frac{1}{2} * 7.5 * 6 = 22.5\ kN$

$F_2 = \frac{1}{2} * 4.5 * 6 = 13.5\ kN$

$F_3 = 15\ kN$



$F_R = F_1 + F_2 + F_3$

$= 22.5 + 13.5 + 15$

$\boxed{F_R = 51\ kN}$

$\bar{x}_1 = 4.5 + \frac{1}{3}(7.5) = 7.0\ m$

$\bar{x}_2 = \frac{2}{3} * 4.5 = 3.0\ m$

Now talking Moment about "O"

$+\circlearrowright M_R = \Sigma M_o$

$\Rightarrow F_R(\bar{x}) = F_1(12-7) + F_2(12-3) + F_3(12) + 500$

$\Rightarrow \bar{x} = \dfrac{22.5 * 5 + 13.5 * 9 + 15 * 12 + 500}{51}$

$\boxed{\bar{x} = 17.922\ m}$

Note that $17.922 > 12 \Rightarrow$??!!

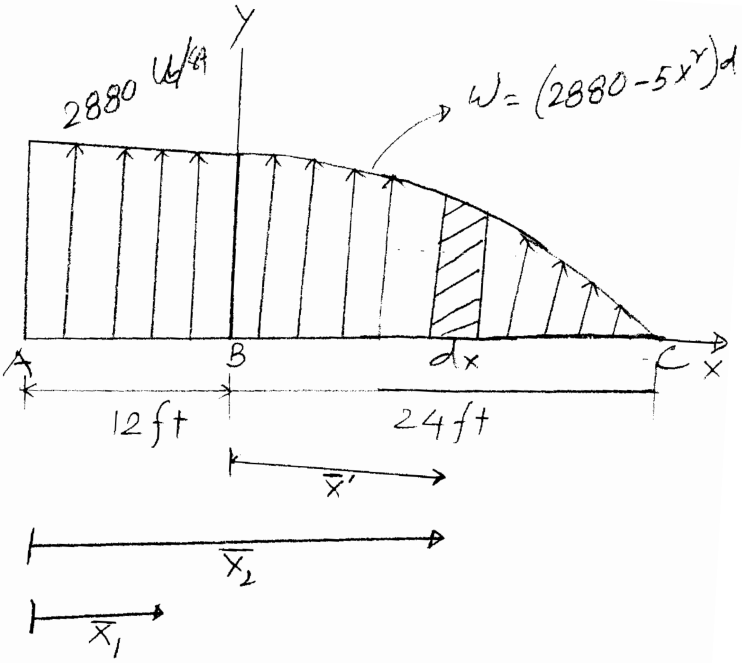
4-158

Given:

The forces shown in Fig.

Req.d:

Replace the loading by a single resultant force and specify its location measured from point A.



Soln.:

$W_1 = 12 * 2880 = 34560$ lb

$W_2 = \int_A dA = \int_0^{24} (2880 - 5x^2)dx$

$= 2880 * 24 - \frac{5}{3} * 24^3$

$= 46080$ lb

$\therefore W = W_1 + W_2$

$= 34560 + 46080$

$\boxed{W = 80640 \text{ lb}}$

$\bar{x}' = \dfrac{\int_A x \, dA}{\int_A dA} = \dfrac{\int_0^{24} x(2880 - 5x^2)dx}{46080}$

$= \dfrac{1}{46080} \left\{ \int_0^{24} (2880x - 5x^3) dx \right\}$

$= \dfrac{1}{46080} \left\{ 2880 * \frac{24^2}{2} - \frac{5}{4}(24)^4 \right\}$

$= \dfrac{414720}{46080} = 9$ ft

$\bar{x}_1 = \frac{12}{2} = 6$ ft

$\bar{x}_2 = 12 + 9 = 21$ ft

Now taking moment about 'A'

$+\curvearrowright M_R = \Sigma M_A$

$\Rightarrow \quad W * \bar{x} = \bar{x}_1 * W_1 + \bar{x}_2 * W_2$

$\Rightarrow \quad \bar{x} = \dfrac{6 * 34560 + 21 * 46080}{80640}$

$\boxed{\bar{x} = 14.571 \text{ ft}}$

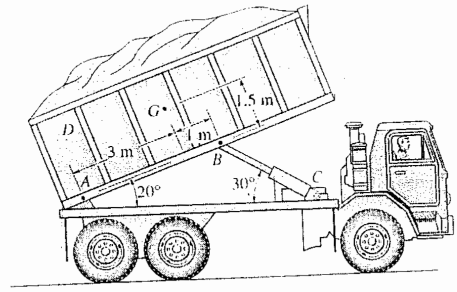
Prob. 5-3 (P.-207)

Given:

The forces shown in figure.

Req.d:

Draw the Free Body Diagram (FBD) of the truck and explain the significance of each force.

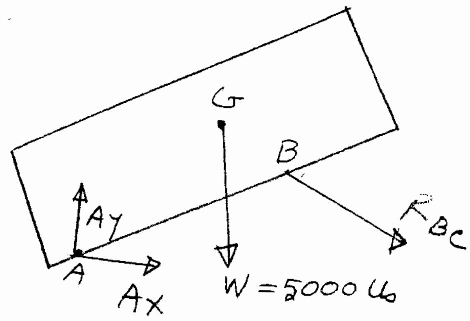


Sol.n:

FBD shown in figure.

Explanation:

- Reaction R_{BC} acting on "B" to move the truck upward.



FBD

- Reaction A_Y & A_X acting on point A to prevent the truck to move vertically and horizontally respectively.

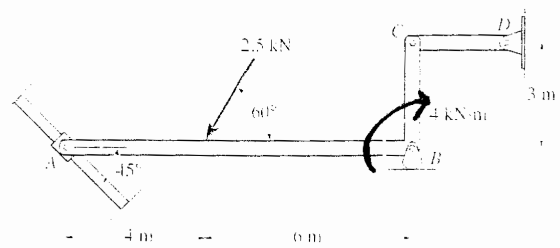
- The weight of the truck, w (5000 lb) acting along centre of gravity "G" of the truck at vertically downward.

⊛ Note that the directions of the reactions (unknown forces) can be assumed. For exampl, the direction of R_{BC} can be reversed.

⇒ See the details in the handouts / class notes / textbook.

Prob. 5-8 (P.-208)

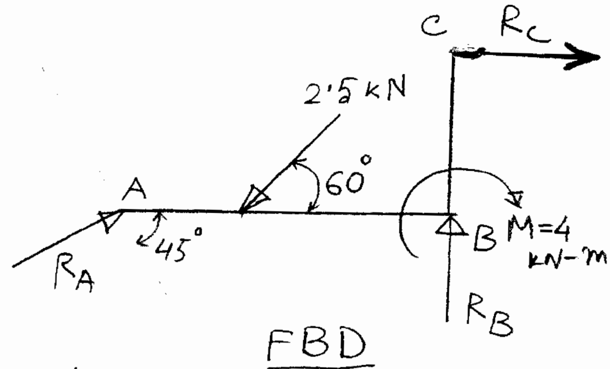
Given:
The forces are shown in figure.



Req.d:
FBD of member ABC and its explanation.

Sol.n:

FBD is shown in fig.



Explanation:

- The reaction R_A acting at Point A which is normal to the collar. The beam is allowed to move along the collar.
- The reaction R_B acting at roller "B" vertically upward.
- The reaction R_C acting on Pin support C due to short link
- 2'5 kN is applied force acting on the beam at 60° angle.
- 4 kN-m is an applied couple moment.

⊛ See the note on the directions in the previous problem.

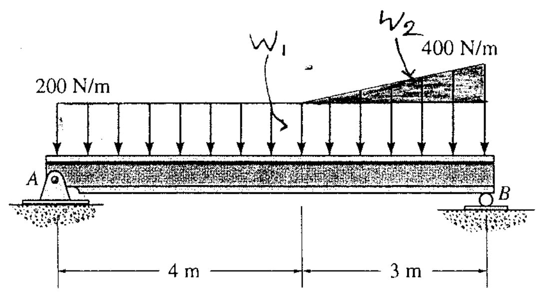
Prob 5-100 (P-255)

Given:

The forces shown in figure.

Req.d:

The reaction at A and B.



Prob. 5–100

Sol.n:

$W_1 = 200 * (4+3)\ N$

$W_1 = 1400\ N$

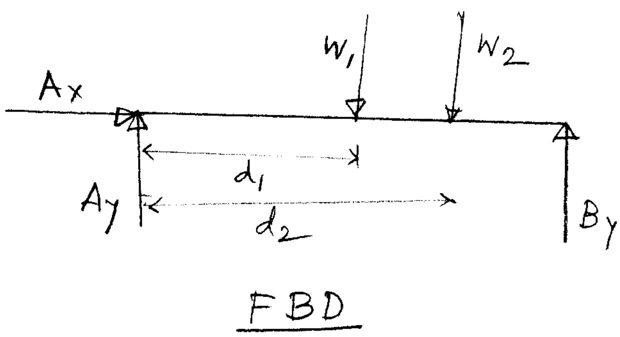
$d_1 = (4+3)/2 = 3.5\ m.$

$W_2 = \frac{1}{2} * 3 * (400-200)\ N$

$= 300\ N$

$d_2 = (4 + \frac{2}{3} * 3)\ m$

$= 6\ m$



From FBD. $+\Sigma M_A = 0$

$\Rightarrow W_1 * d_1 + W_2 * d_2 - B_y * 7 = 0$

$\Rightarrow 1400 * 3.5 + 300 * 6 - B_y * 7 = 0$

$\Rightarrow \underline{\underline{B_y = 957.143\ N}}$

$\Sigma F_y = 0 \Rightarrow A_y + B_y = W_1 + W_2$

$\Rightarrow A_y = (1400 + 300 - 957.143)\ N$

$\underline{\underline{A_y = 742.857\ N.}}$

$\Sigma F_x = 0$

$\Rightarrow \underline{\underline{A_x = 0}}$