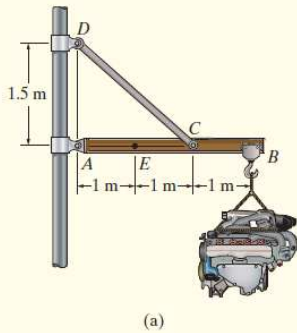
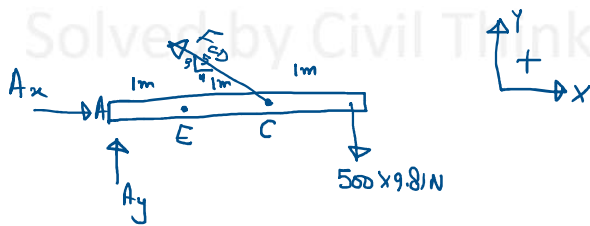


Internal Loading in beams

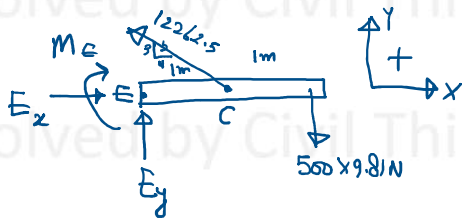
The 500-kg engine is suspended from the crane boom in Fig. 1-5a. Determine the resultant internal loadings acting on the cross section of the boom at point E.



Courtesy: Mechanics of Materials, Tenth Edition in SI Units, R. C. Hibbeler



$$\begin{aligned} \sum M_A = 0: \\ -(500 \times 9.81 \times 3\text{m}) + (F_{CD} \times \frac{3}{5} \times 2\text{m}) &= 0 \\ \Rightarrow F_{CD} &= 12262.5 \text{ N} \end{aligned}$$



$$\begin{aligned} \sum F_y = 0: \quad E_y - (500 \times 9.81 \text{ N}) + (12262.5 \times \frac{3}{5}) &= 0 \\ \Rightarrow E_y &= -2452.5 \text{ N} = 2452.5 \text{ N} (\downarrow) \end{aligned}$$

$$\begin{aligned} \sum F_x = 0: \\ E_x - 12262.5 \times \frac{4}{5} = 0 \Rightarrow E_x &= 9810 \text{ N} (\rightarrow) \end{aligned}$$

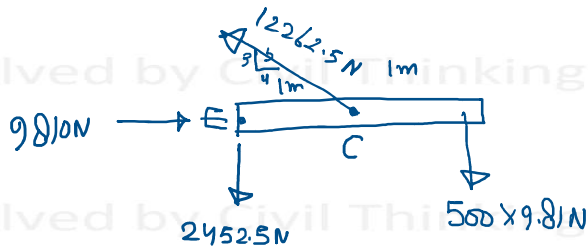
$$\begin{aligned} \sum M_E = 0: \\ -(500 \times 9.81 \times 2\text{m}) + (12262.5 \times \frac{3}{5} \times 1\text{m}) - M_E &= 0 \end{aligned}$$

T / $\frac{1}{5}$ m

$$-(500 \times 9.81 \times 2\text{ m}) + (12262.5 \times \frac{3}{5} \times 1\text{ m}) - M_E = 0$$

$$\Rightarrow M_E = -2452.5 \text{ Nm} = \boxed{2452.5 \text{ Nm}}$$

Summary of internal forces:



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