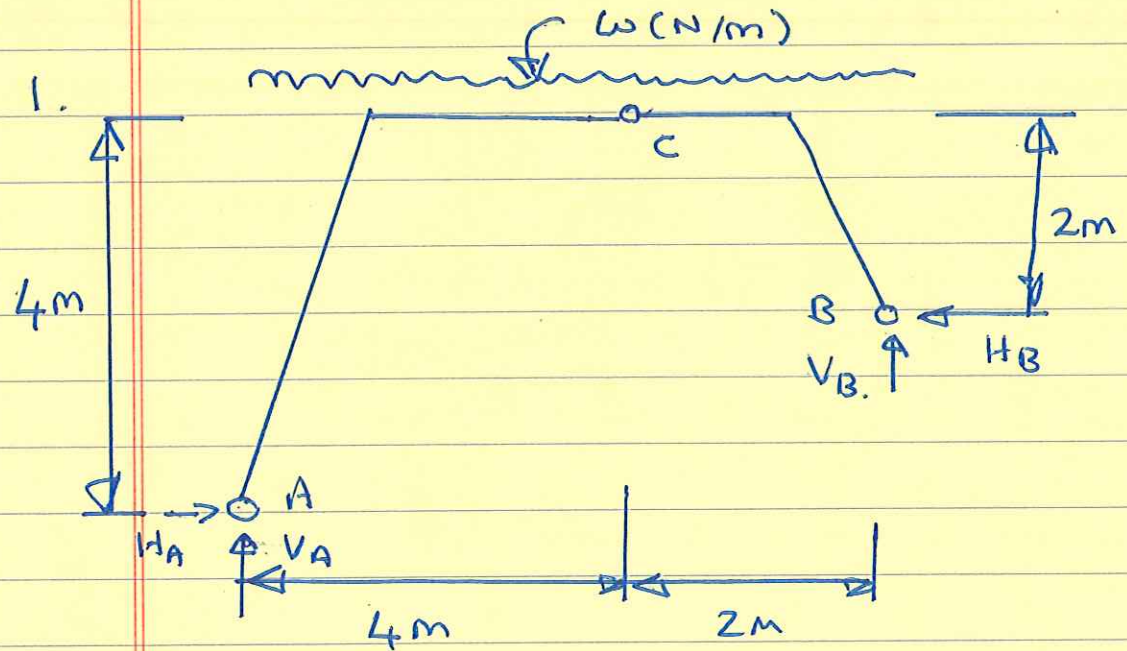
ENCE 353: Homework 3 Sol'ns.

1.



$\sum H = 0 \Rightarrow H_A = H_B$

$\sum V = 0 \Rightarrow V_A + V_B = 6w$

$\sum M_{C(rhs)} = 0 \Rightarrow 2w + 2H_B = 2V_B$

$\sum M_{C(lhs)} = 0 \Rightarrow 8w + 4H_A = 4V_A$

$\Rightarrow V_A = \frac{7}{2}w, \quad V_B = \frac{5}{2}w, \quad H_A = H_B = \frac{3}{2}w.$

2. $\frac{d^2y}{dx^2} = \frac{w(x)}{H}$ where $w(x) = w_0\left[\frac{x}{30}\right]$.

$\Rightarrow \frac{dy}{dx} = \frac{w_0 x^2}{60H} + A$

$\Rightarrow y(x) = \frac{w_0 x^3}{180H} + Ax + B.$

Boundary conditions $y(0) = 0 \Rightarrow B = 0$

$y(30) = 30 \Rightarrow A = \left[1 - \frac{5w_0}{H}\right]$

(2)

hence

$$y(x) = \frac{w_0 x^3}{180H} + \left(1 - \frac{5w_0}{H}\right)x. \qquad \text{— (1)}$$

(2b). If cable profile is a min value at $x = 10$,

$$\left.\frac{dy}{dx}\right|_{x=10} = 0 \Rightarrow 0 = \frac{w_0 10^2}{60H} + 1 - \frac{5w_0}{H}$$

$$\Rightarrow H = \frac{20}{6} w_0 \qquad \text{— (2)}$$

(2c) From the derivation of the cable equations

$$V = H\frac{dy}{dx} \Rightarrow V = H\left[\frac{w_0 x^2}{60H} + 1 - \frac{5w_0}{H}\right].$$

At $x = 0$, $H = \frac{20}{6} w_0$

$$\Rightarrow V = -\frac{10}{6} w_0.$$

At $x = 30$ $H = \frac{20}{6} w_0$,

$$\Rightarrow V = -\frac{80}{6} w_0.$$