Homework 4
(Due: Friday, April 28, 2020)

Question 1: 8 points

The cable structure shown in Figure 1 carries a triangular load that is zero at the left-hand support and increases to w_o N/m at the right-hand support.

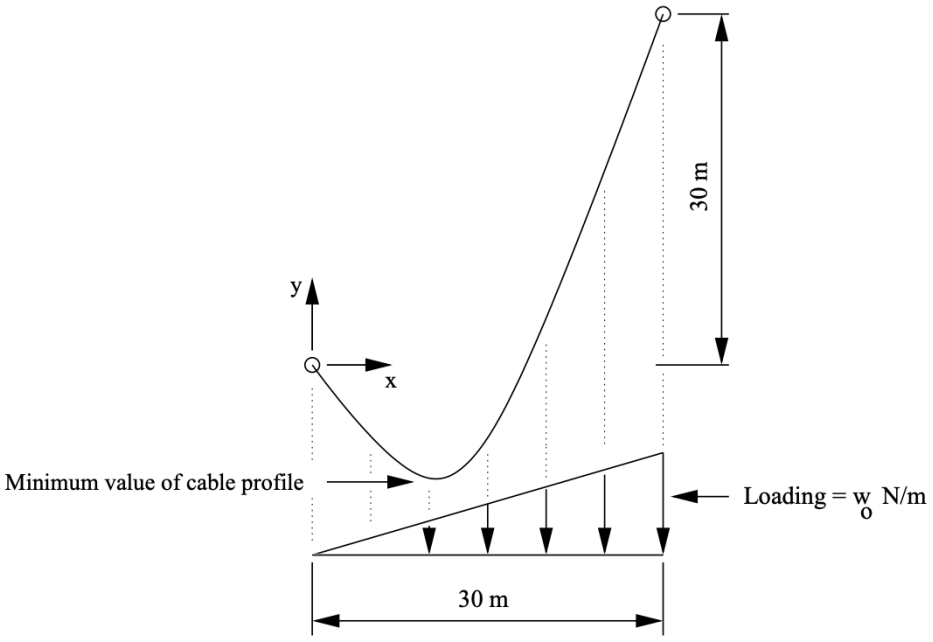

Figure 1: Elevation view of a swing bridge carrying a triangular loading.

a). Starting from first principles (i.e., the differential equation), **show** that cable profile is given by the equation:

$$y(x) = \left(\frac{w_o x^3}{180H}\right) + \left(1 - \frac{5w_o}{H}\right) x. \tag{1}$$

Now let us assume that the minumum value of the cable profile occurs at x = 10.

b). **Show** that the horizontal cable force is:

$$H = \frac{20w_o}{6} \tag{2}$$

c). **Draw and label** a diagram showing the horizontal and vertical components of reaction force at the left- and right-hand cable supports.

Question 2: 6 points

For a cantiliver beam shown below:

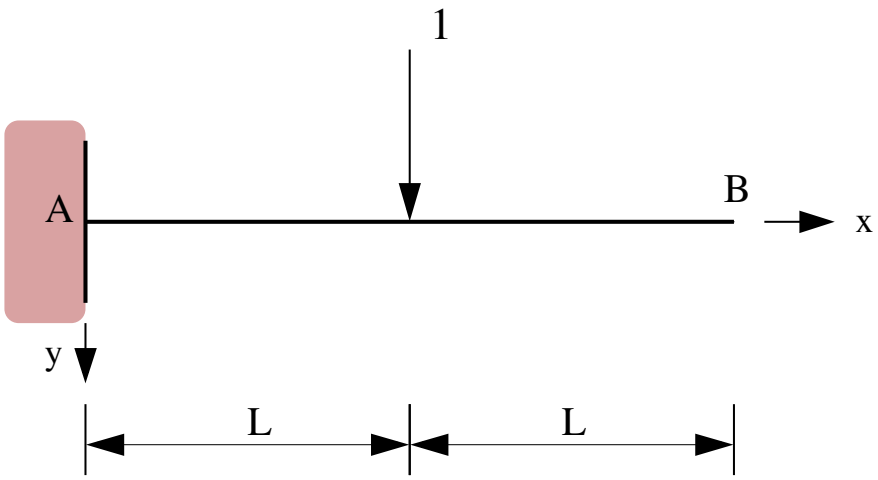

Figure 2: Problem 2 (A)

a). Use the *method of moment-area* to calculate the **vertical displacement** at point B, assuming the EI is constant along the beam.

b). Based on the results of (a), calculate the **reaction force** at point B for the following propped-cantilever beam, assuming the EI is constant along the beam:

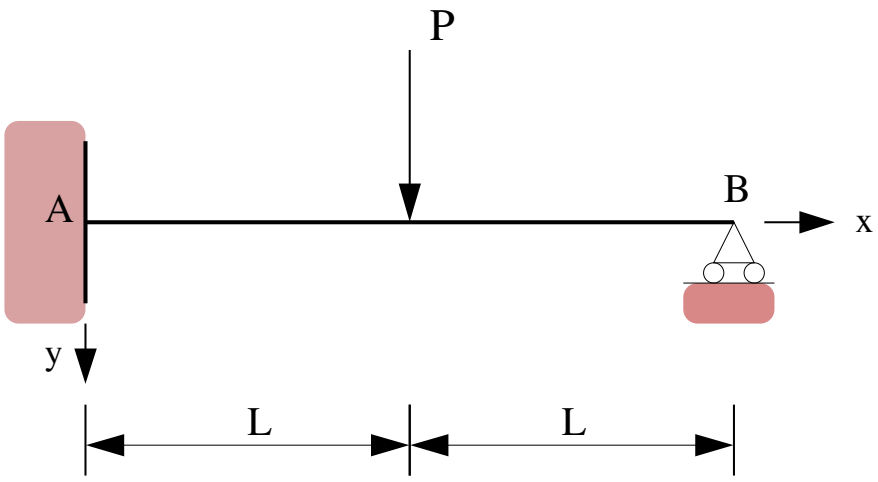

Figure 3: Problem 2 (B)

Question 3: 6 points

Figure 4 is a front elevation view of a simple beam structure carrying two external loads P. The beam has section properties EI near the supports and 2EI in the center section.

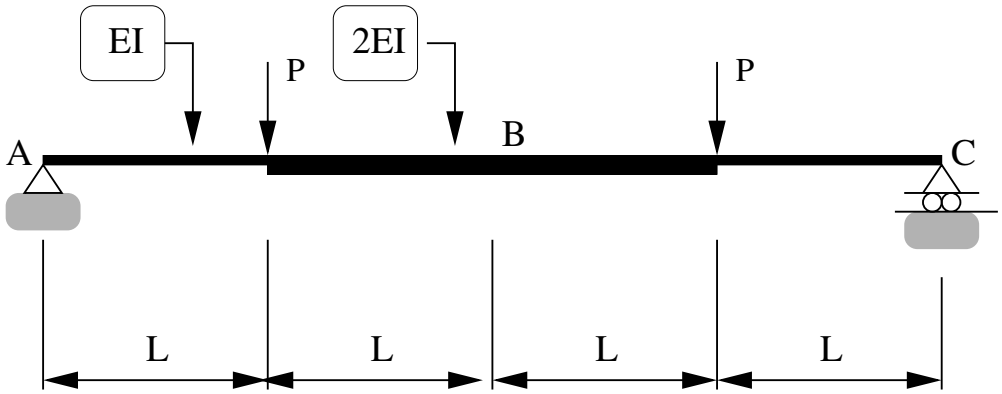

Figure 4: Simple beam structure (symmetric loads P)

a). Use the method of moment area to show that the end rotation at A (measured clockwise) is:

$$\theta_A = \frac{PL^2}{EI} \tag{3}$$

b). Use the method of moment area to show that the vertical beam deflection at B is:

$$\triangle_B = \frac{13}{12}\frac{PL^3}{EI} \tag{4}$$