Name:

Solve the following problem:

1) Assume the moment of inertia is $300 \times 10^6 \text{ mm}^4$ and modulus of elasticity is 200 GPa. What is the angular rotation in radians at B on segment AB for $P = 60 \text{ kN}$ and $u = 2 \text{ m}$? (Potter 58)

Use virtual work. First determine moment function for real load. $M = 60x - 120,000 \text{ kN-mm}$ for segment $AB$; $M = 0$ for segment $BC$. Then remove real load and impose a virtual unit moment at $B$. Determine the moment function for the virtual load; $m = 1$ for segment $AB$; $m = 0$ for segment $BC$:

$$\Delta = \int (mM/EI) \, dx$$

$$= \int 1 \left(60x - 120,000\right) \, dx / (300 \times 10^6 \times 200)$$

$$= -120 \times 10^5 / (300 \times 10^6 \times 200) = 0.002 \text{ radians}$$

Note: $\Delta$ can represent any type of deformation; here it represents rotation.

Works Cited