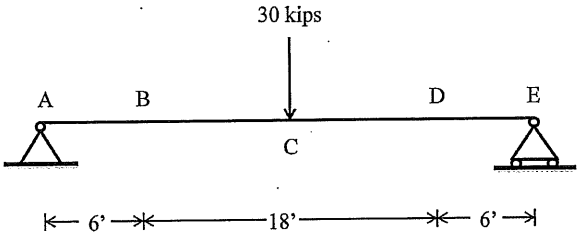
University of Maryland
ENCE353: Introduction to Structural Analysis

Fall 2014
11/5/14

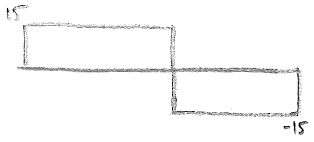
Name: Solution

In-Class Problem #6

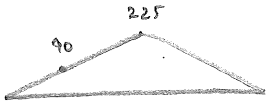
Using the moment-area method, determine θ_A and y_c
$E = 29{,}000$ ksi, $I = 100$ in.^{4}, $(EI)_{AB} = (EI)_{DE} = EI$, $(EI)_{BD} = 2EI$
What is the minimum value of I for a deflection of 1.2 in. at C?



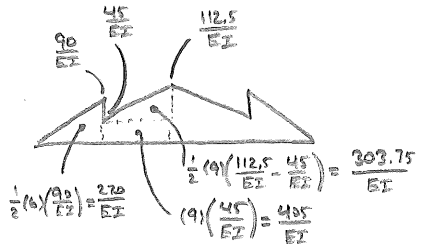
V



M



$\frac{M}{EI}$



Δ

$$\theta_{C/A} = \int_A^C \frac{M}{EI}\,dx = \theta_C - \theta_A$$

$$\Rightarrow \theta_A = -\theta_{C/A} = -\left[\frac{270}{EI} + \frac{303.75}{EI} + \frac{405}{EI}\right] = -\frac{978.75}{EI}$$

$$\Rightarrow \boxed{\theta_A = -\frac{978.75}{EI}(12^2) = -0.0486 \text{ rad}}$$

$$y_c = t_{A/C} = \bar{x}\int_A^C \frac{M}{EI}\,dx = \frac{270}{EI}(4) + \frac{303.75}{EI}(6+6) + \frac{405}{EI}(6+4.5) = \frac{8977.5}{EI}$$

$$\Rightarrow \boxed{y_c = \frac{8977.5}{EI}(12^3) = 5.35 \text{ in.} \downarrow}$$

$$I_{min}: \quad \frac{8977.5}{(29000)\,I}(12^3) = 1.2 \Rightarrow \boxed{I_{min} = 445.78 \text{ in.}^4}$$