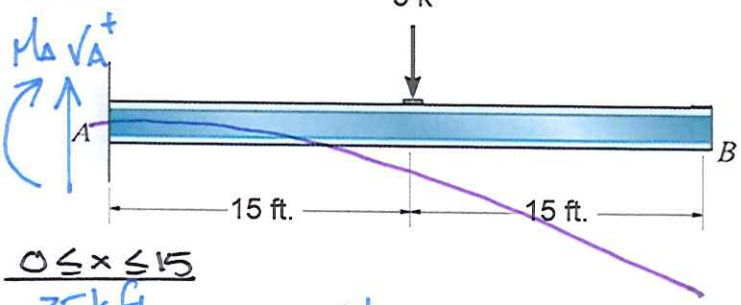
Example 8b-0: Determine the slope and the displacement at point B for the following beam. Assume that E = 30,000 ksi and I = 800 in^4.

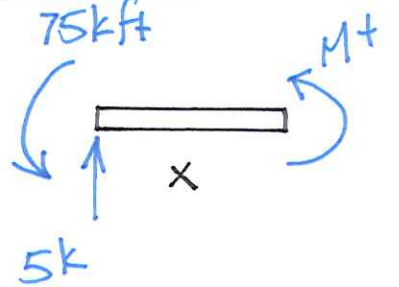
REAL



$$\overset{+}{\circlearrowleft}\Sigma M_A = 0 = -M_A - 5^k(15') \qquad M_A = -75 \text{ k-ft}$$

$$+\uparrow \Sigma F_y = 0 = V_A - 5^k \qquad V_A = 5^k$$

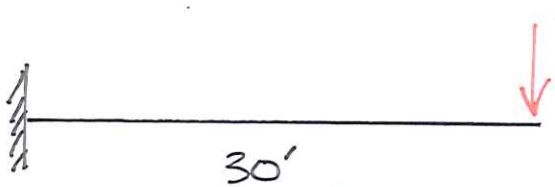
$0 \le x \le 15$

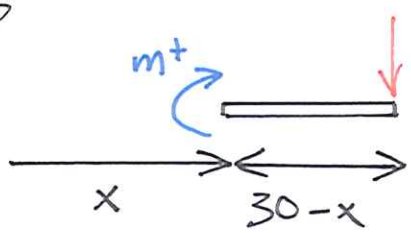


$$\overset{+}{\circlearrowleft}\Sigma M_{CUT} = 0 = M + 75 \text{ k-ft} - 5x$$

$$M = [5x - 75] \text{ k-ft}$$

VIRTUAL BEAM

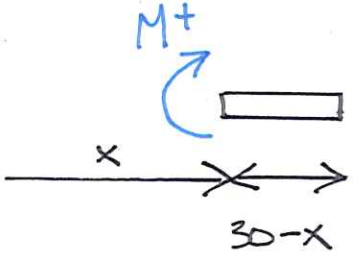




$$\overset{+}{\circlearrowleft}\Sigma M_{CUT} = 0 = -m - (30 - x)$$

$$m = [x - 30] \text{ ft}$$

$15 \le x \le 30$



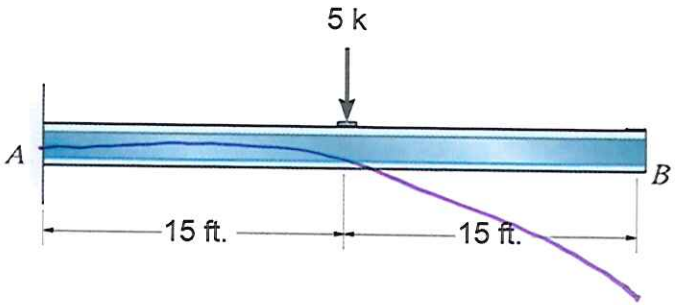
$$\overset{+}{\circlearrowleft}\Sigma M_{CUT} = 0 = -M$$

$$EI\Delta_B = \int_0^{15} [5x - 75][x - 30]\,dx = \int_0^{15} (5x^2 - 225x + 2250)\,dx$$

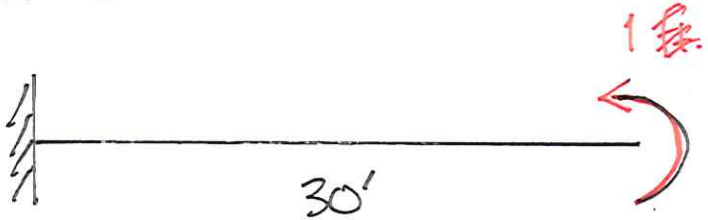
$$= \frac{5x^3}{3} - \frac{225x^2}{2} + 2250x \Big|_0^{15} = 14{,}062.5 \text{ k-ft}^3$$

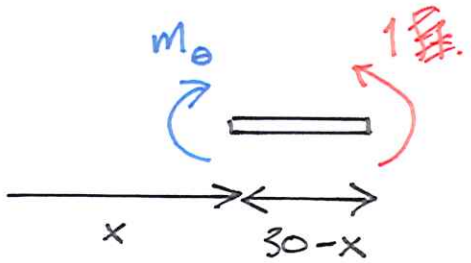
$$\Delta_B = \frac{14{,}062.5 \text{ k-ft}^3}{EI} = \frac{14{,}062.5 \text{ k-ft}^3}{30{,}000^k/\text{in}^2 \cdot 800 \text{ in}^4} \cdot \frac{1{,}728 \text{ in}^3}{\text{ft}^3} = 1.01 \text{ in}$$

Example 8b-0: Determine the slope and the displacement at point B for the following beam. Assume that E = 30,000 ksi and I = 800 in^4.



VIRTUAL BEAM





$$\circlearrowleft + \Sigma M_{CUT} = 0$$

$$= -m_\theta + 1$$

$$m_\theta = 1 \text{ k-ft}$$

$$EI\theta_B = \int_0^{15} [5x - 75]\,dx = \frac{5x^2}{2} - 75x \Big|_0^{15} = -562.5 \text{ k-ft}^2$$

$$\theta_B = \frac{-562.5 \text{ k-ft}^2}{30{,}000 \text{ k/in}^2 \cdot 800 \text{ in}^4} \cdot \frac{144 \text{ in}^2}{1 \text{ ft}^2} = -0.0034 \text{ RADIANS}$$