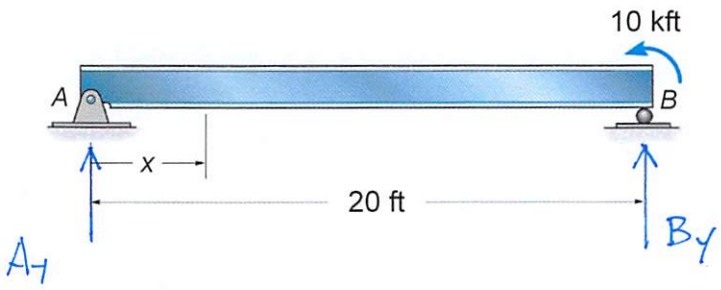
CIVL 3121 Quiz #8 F26 Name: _____

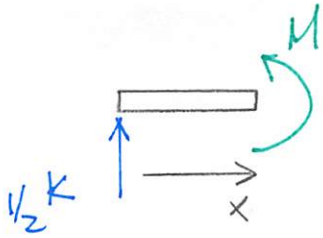
Write the virtual work expression for the displacement at x = 10 ft. Assume EI is constant.



$$\circlearrowleft + \sum M_B = 0 = 10\,\text{kft} - A_y(20\,\text{ft})$$

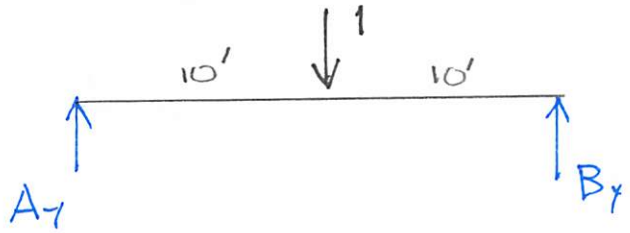
$$A_y = \tfrac{1}{2}\,\text{k}$$

REAL MOMENT



$$\circlearrowleft + \sum M_{CUT} = 0 = M - \tfrac{1}{2}x \qquad M = \frac{x}{2}\,\text{kft}$$

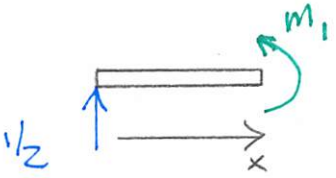
VIRTUAL MOMENT



$$\circlearrowleft + \sum M_B = 0 = 1(10\,\text{ft}) - A_y(20\,\text{ft}) \qquad A_y = \tfrac{1}{2}$$

$$+\uparrow \sum F_y = 0 = A_y + B_y - 1 \qquad B_y = \tfrac{1}{2}$$

$0 \le x \le 10\,\text{ft}$

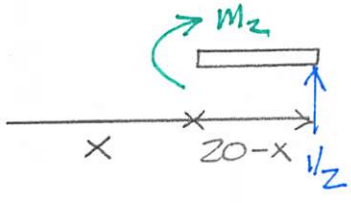


$$\circlearrowleft + \sum M_{CUT} = 0$$

$$= m_1 - \tfrac{1}{2}x$$

$$m_1 = x/2$$

$10 \le x \le 20\,\text{ft}$



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

$$= -m_2 + \tfrac{1}{2}(20 - x)$$

$$m_2 = \tfrac{1}{2}(20 - x)$$

$$y_{x=10} = \frac{1}{EI}\left[\int_0^{10} M m_1\,dx + \int_{10}^{20} M m_2\,dx\right]^*$$

$$= \frac{1}{EI}\left[\frac{x^3}{12}\Big|_0^{10} + \left[\frac{5x^2}{2} - \frac{x^3}{12}\right]_{10}^{20}\right] = \frac{250\,\text{kft}^3}{EI}$$