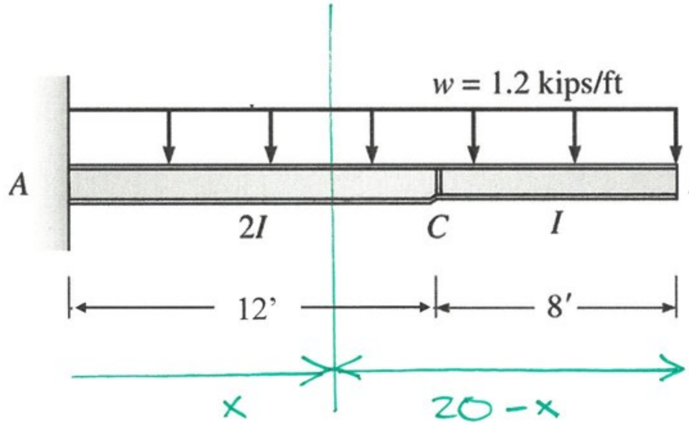
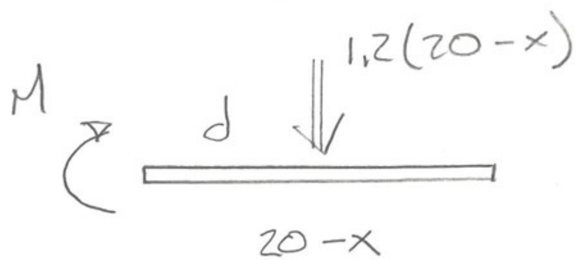
Example 8b-2: Determine the displacement at *D*. Assume $I = 400\ \text{in}^4$, $E = 29(10^3)\ ksi$.

Real loads





$$d = \frac{20-x}{2}$$

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

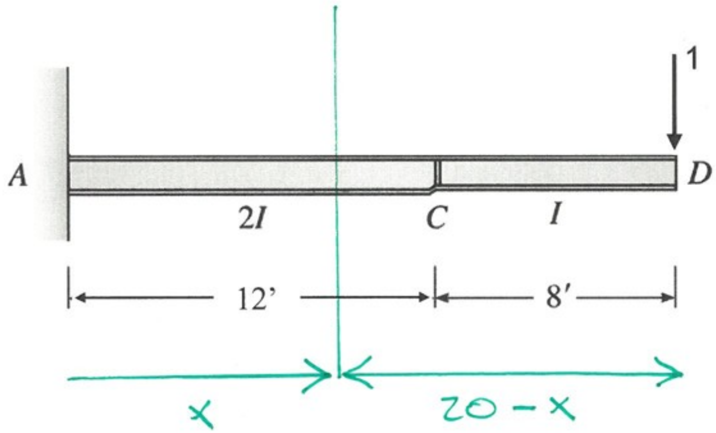
$$= -M - 1.2(20-x)\frac{20-x}{2}$$

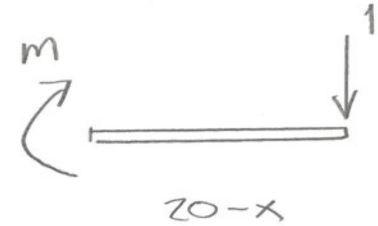
$$\underline{M(x) = -0.6(20-x)^2} \qquad \underline{0 \le x \le 20}$$

$$M(x=20) = 0 \ \checkmark$$

Example 8b-2: Determine the displacement at *D*. Assume $I = 400$ in^4, $E = 29(10^3)$ *ksi*.

Virtual load





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

$= -m - 1(20-x)$

$\underline{m = -1(20-x)} \qquad 0 \le x \le 20$

$*$

VIRTUAL WORK EQUATION

$$\underline{Y_D = \int_0^{20} \frac{Mm}{EI}\,dx = \int_0^{12}\frac{Mm}{2EI}\,dx + \int_{12}^{20}\frac{Mm}{EI}\,dx}$$

$$= \frac{1}{EI}\left[\int_0^{12} 0.3(20-x)^3\,dx + \int_{12}^{20} 0.6(20-x)^3\,dx\right]$$

$$= \frac{1}{EI}\left[-\frac{3(20-x)^4}{40}\Bigg|_0^{12} - \frac{6(20-x)^4}{40}\Bigg|_{12}^{20}\right] = \frac{58{,}464 + 3{,}072}{5EI} = \frac{61{,}536\,k\,ft^3}{5EI}$$

$$= \frac{61{,}536\,k\,ft^3}{} \cdot \frac{IN^2}{29{,}000\,k} \cdot \frac{}{400\,IN^4} \cdot \frac{(12\,IN)^3}{ft^3} = \underline{\underline{1.83\,IN}}$$