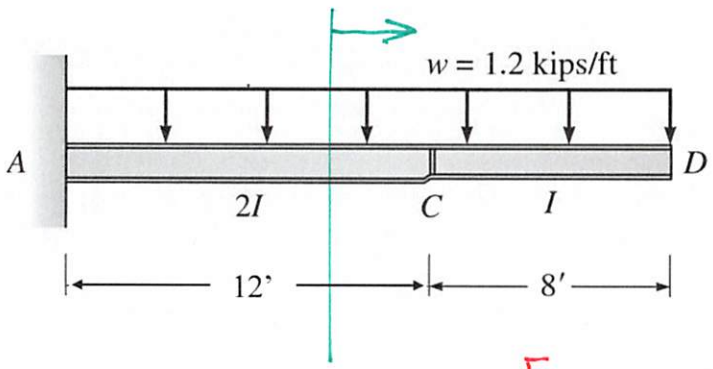
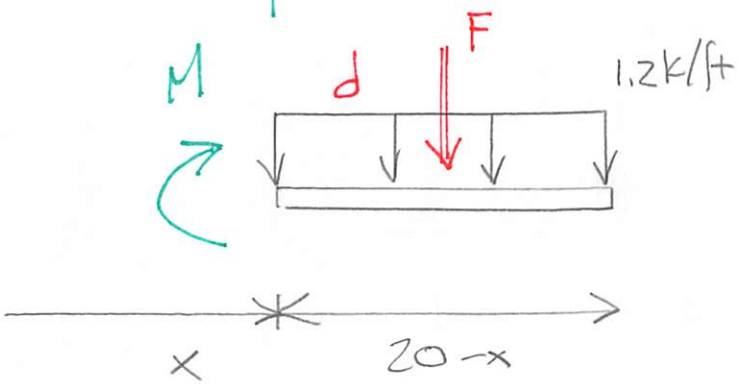
Example 8b-2: Determine the displacement at *D*. Assume $I = 400\ in^4$, $E = 29(10^3)\ ksi$.

Real loads





$$\overset{+}{\circlearrowleft}\sum M_{cut} = 0 = -M - Fd \qquad M = -Fd$$

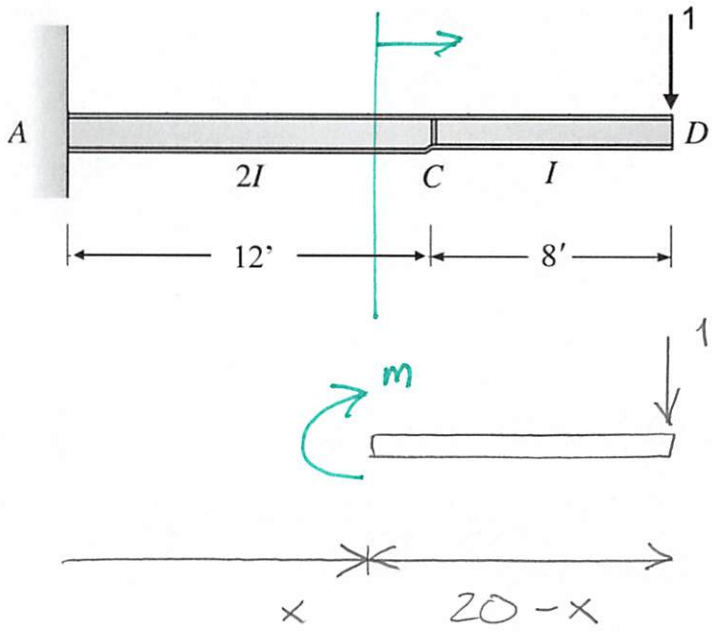
$$M(x) = \left[-0.6(20-x)^2\right] k\text{-}ft$$

$$F = 1.2(20-x)$$

$$d = \frac{1}{2}(20-x)$$

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

Virtual load



$$\circlearrowleft + \sum M_{CUT} = 0 = -m - 1(20 - x)$$

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

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

$$= \frac{1}{EI}\left[-\frac{3(x-20)^4}{40}\Big|_0^{12} - \frac{3(x-20)^4}{20}\Big|_{12}^{20} \right] = \frac{61{,}536\ k\text{-}ft^3}{5EI}$$

$$= \frac{61{,}536\ k\text{-}ft^3}{29{,}000\ k/in^2 \cdot 400\ in^4} \left(\frac{12\ in}{ft}\right)^3 = 1.83\ in$$