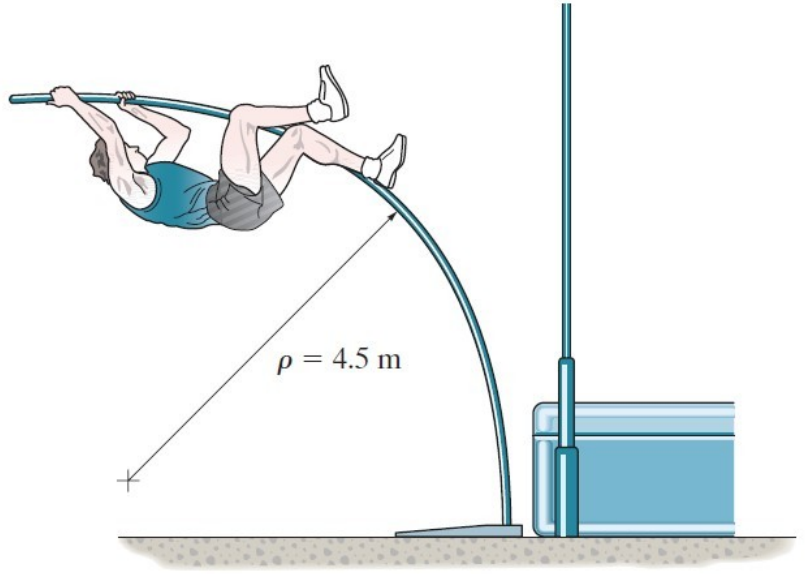
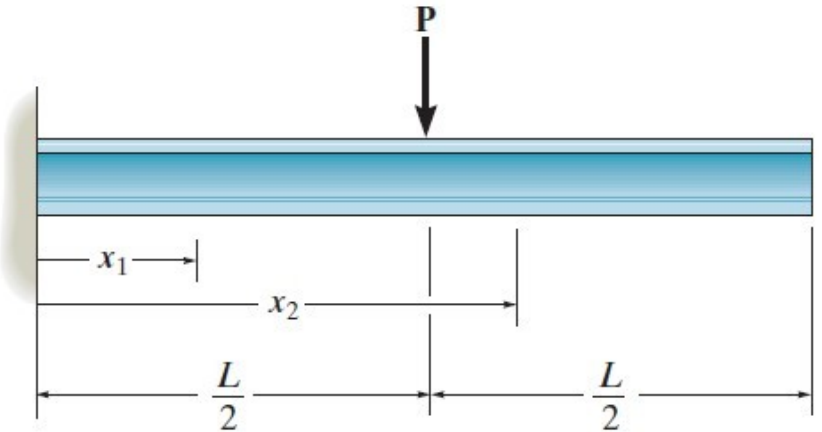
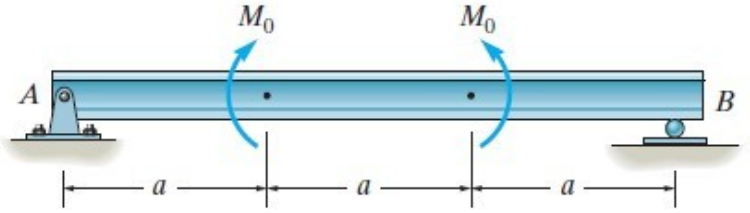
12–3. A picture is taken of a man performing a pole vault, and the minimum radius of curvature of the pole is estimated by measurement to be 4.5 m. If the pole is 40 mm in diameter and it is made of a glass-reinforced plastic for which $E_g = 131$ GPa, determine the maximum bending stress in the pole.



12–9. Determine the equations of the elastic curve for the beam using the x_1 and x_2 coordinates. EI is constant.



12–13. Determine the maximum deflection of the beam and the slope at A. EI is constant.



$$M_1 = 0$$

$$EI\frac{d^2v_1}{dx_1^2} = 0; \qquad EI\frac{dv_1}{dx_1} = C_1$$

$$EIv_1 = C_1x_1 + C_2$$

At $x_1 = 0$, $\quad v_1 = 0$; $\quad C_2 = 0$

$$M_2 = M_0; \qquad EI\frac{d^2v_1}{dx_2^2} = M_0$$

$$EI\frac{dv_2}{dx_2} = M_0x_2 + C_2$$

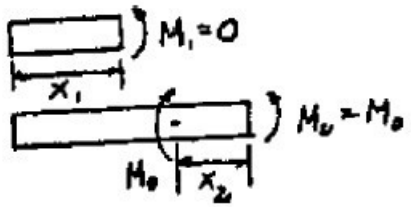
$$EI\,v_2 = \frac{1}{2}M_0x_2^2 + C_3x_2 + C_4$$

At $x_2 = \frac{a}{2}$, $\quad \frac{dv_2}{dx_2} = 0$; $\qquad C_1 = \frac{-M_0a}{2}$

At $x_1 = a$, $\quad x_2 = 0$, $\quad v_1 = v_2$, $\quad \frac{dv_1}{dx_1} = \frac{dv_2}{dx_2}$

$$C_1a = C_a$$

$$C_1 = \frac{-M_0a}{2}, \qquad C_a = \frac{-M_0a^2}{2}$$



At $x_1 = 0$,

$$EI\frac{dv_1}{dx_1} = -\frac{M_0 a}{2}$$

$$\boldsymbol{\theta}_A = -\frac{M_0 a}{2EI}$$ **Ans.**

At $x_2 = \frac{a}{2}$,

$$EI\, v_{\max} = \frac{1}{2}M_0\left(\frac{a^2}{4}\right) - \frac{M_0 a}{2}\left(\frac{a}{2}\right) - \frac{M_0 a^2}{2}$$

$$v_{\max} = -\frac{5M_0 a^2}{8EI}$$ **Ans.**