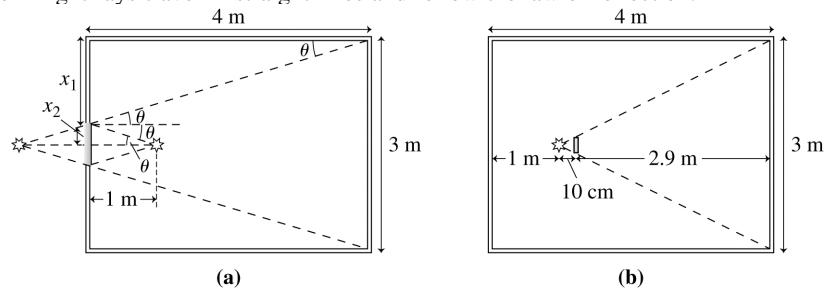


23.8. Model: Light rays travel in straight lines and follow the law of reflection.

Visualize:



Solve: (a) The top edge of the mirror reflects a ray of light toward the right wall's top edge. Similarly, the bottom edge of the mirror reflects the light toward the right wall's bottom edge. The top edge of the mirror is a distance x_1 below the ceiling. The distance of the upper edge of the mirror to a perpendicular line from the light to the mirror is x_2 . From the geometry of the diagram,

$$\frac{x_1}{4 \text{ m}} = \frac{x_2}{1 \text{ m}} \quad x_1 + x_2 = \frac{3 \text{ m}}{2} = 1.5 \text{ m}$$

$$\Rightarrow x_2 = 1.5 \text{ m} - x_1 \Rightarrow x_1 = 4(1.5 \text{ m} - x_1) \Rightarrow x_1 = 1.2 \text{ m} \Rightarrow x_2 = \frac{x_1}{4} = \frac{1.2 \text{ m}}{4} = 0.30 \text{ m}$$

Thus the top edge of the mirror is 1.20 m from the ceiling and the height of the mirror is 0.60 m.

(b) Let the shadow's length be s . Using the geometry of the rays,

$$\frac{s}{2.9 \text{ m} + 0.1 \text{ m}} = \frac{10 \text{ cm}}{10 \text{ cm}} \Rightarrow s = 3.0 \text{ m}$$

This means the shadow is the height of the right wall, 3.0 m.