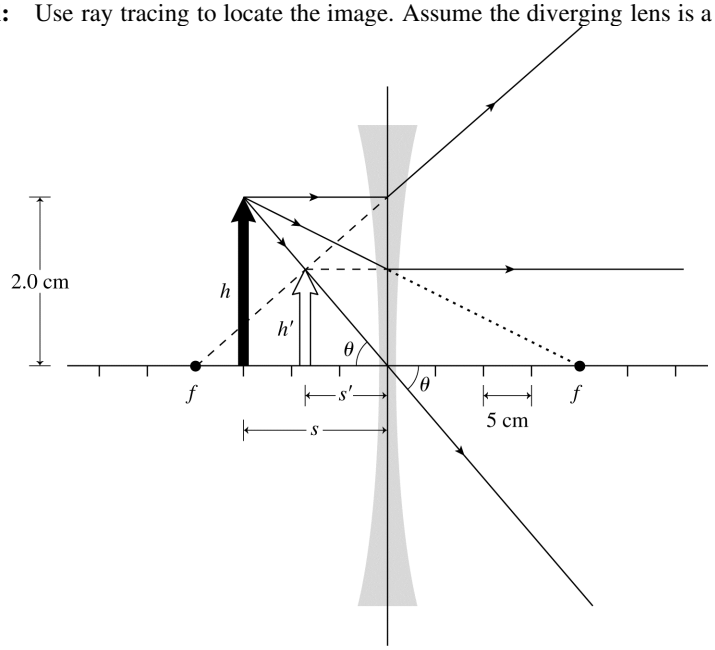
23.63. **Model:** Use ray tracing to locate the image. Assume the diverging lens is a thin lens.
Solve: **(a)**



The figure shows the ray-tracing diagram using the steps of Tactics Box 23.3. After refraction, the three special rays do not converge. The rays, on the other hand, appear to meet at a point that is 8.5 cm on the same side of the lens as the object. So $s' = -8.5\ \text{cm}$. The image is upright and has a height of 1.1 cm.
(b) Using the thin-lens formula,

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f} \Rightarrow \frac{1}{15\ \text{cm}}+\frac{1}{s'}=\frac{1}{-20\ \text{cm}} \Rightarrow \frac{1}{s'}=-\frac{7}{60\ \text{cm}} \Rightarrow s'=-\frac{60}{7}\ \text{cm} = -8.6\ \text{cm}$$

The image height is obtained from

$$M=-\frac{s'}{s}=-\frac{(-60/7\ \text{cm})}{15\ \text{cm}}=+\frac{4}{7}=0.57$$

Thus, the image is 0.57 times larger than the object, or $h' = Mh = (0.57)(2.0\ \text{cm}) = 1.14\ \text{cm}$. The image is upright because M is positive. These values agree, within measurement accuracy, with those obtained in part (a).