

56. (a) The mirror has focal length $f = 12$ cm. With $m = +3$, we have $i = -3p$. We substitute this into Eq. 35-4:

$$\begin{aligned}\frac{1}{p} + \frac{1}{i} &= \frac{1}{f} \\ \frac{1}{p} + \frac{1}{-3p} &= \frac{1}{12} \\ \frac{2}{3p} &= \frac{1}{12}\end{aligned}$$

with the unit cm understood. Consequently, we find $p = 2(12)/3 = 8.0$ cm.

- (b) With $m = -3$, we have $i = +3p$, which we substitute into Eq. 35-4:

$$\begin{aligned}\frac{1}{p} + \frac{1}{i} &= \frac{1}{f} \\ \frac{1}{p} + \frac{1}{3p} &= \frac{1}{12} \\ \frac{4}{3p} &= \frac{1}{12}\end{aligned}$$

with the unit cm understood. Consequently, we find $p = 4(12)/3 = 16$ cm.

- (c) With $m = -1/3$, we have $i = p/3$. Thus, Eq. 35-4 leads to

$$\begin{aligned}\frac{1}{p} + \frac{1}{i} &= \frac{1}{f} \\ \frac{1}{p} + \frac{3}{p} &= \frac{1}{12} \\ \frac{4}{p} &= \frac{1}{12}\end{aligned}$$

with the unit cm understood. Consequently, we find $p = 4(12) = 48$ cm.