Physics 1C - Discussion 8 Name: UID:

Spherical Mirrors

Consider the following combination of convex mirrors that are placed parallel to each other. If an object is placed at a distance $\frac{3f}{2}$ from mirror 1 and the real image after reflection from mirror 1 followed by mirror 2 falls at the same location as the object, calculate the value of d and calculate the net magnification m of the image.

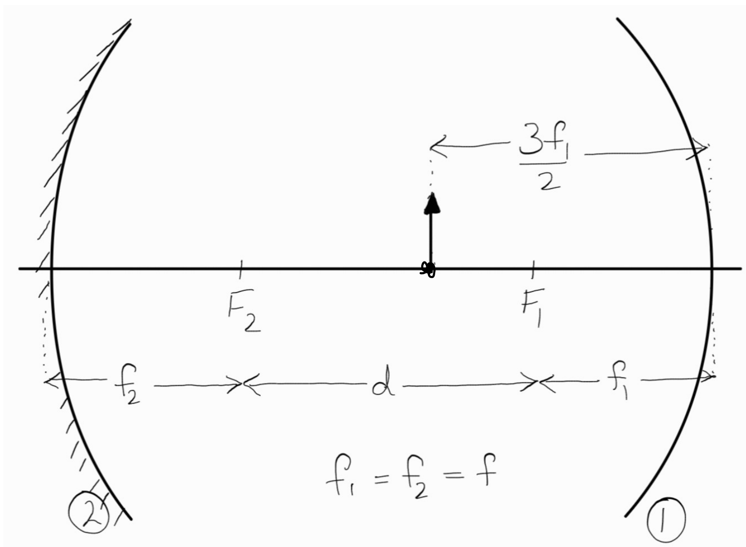


Figure 1: Spherical Mirrors

Solution:

$S_1 = \frac{3}{2} f$ $\therefore$ $\frac{1}{\frac{3f}{2}} + \frac{1}{S_1'} = \frac{1}{f} \Rightarrow S_1' = \left(\frac{1}{f} - \frac{2}{3f}\right)^{-1} = \left(\frac{1}{3f}\right)^{-1} = 3f$

$\Rightarrow m_1 = -\frac{S_1'}{S_1} = -\frac{3f}{\frac{3f}{2}} = -\frac{6f}{3f} = -2$

* Assuming $d \geq f$
ELSE: S_1' would be behind 2

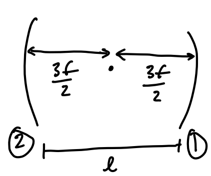
$S_1' = S_2$ s.t. $\frac{1}{3f} + \frac{1}{S_2'} = \frac{1}{f} \Rightarrow S_2' = \left(\frac{1}{f} - \frac{1}{3f}\right)^{-1} = \left(\frac{2}{3f}\right)^{-1} = \frac{3f}{2}$

$\Rightarrow m_2 = -\frac{S_2'}{S_2} = -\frac{\frac{3f}{2}}{3f} = -\frac{3f}{6f} = -\frac{1}{2}$

$\boxed{\therefore m_{tot} = m_1 m_2 = (-2)\left(-\frac{1}{2}\right) = 1}$

S_1' lies on the mirror

$\Rightarrow S_2' = \frac{3f}{2} = S_1 \Longleftarrow$



$\therefore \ell = \frac{3f}{2} \cdot 2 = 3f = 2f + d$

$\boxed{d = f}$