

Physics 11**Lecture Example 2 Solution**

(a) Use the lens equation with $d_o = 40$ cm and $f = +20$ cm:

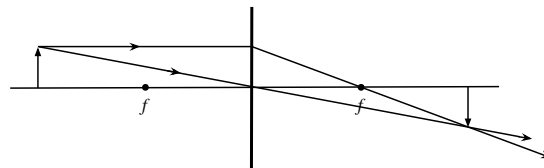
$$\frac{1}{d_i} = \frac{1}{20} - \frac{1}{40} \longrightarrow d_i = 40\text{cm}$$

(b) The image is real, since $d_i > 0$ (this means the image is formed on the side of the lens that light is traveling away from the lens. The magnification is

$$m = -\frac{d_i}{d_o} = -\frac{40}{40} = -1$$

So, the image is inverted and it is the same size as the object.

(c) The ray diagram confirms the analysis:



(d) Use the lens equation with $d_o = 10$ cm and $f = +20$ cm:

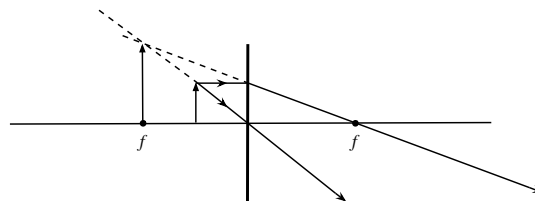
$$\frac{1}{d_i} = \frac{1}{20} - \frac{1}{10} \longrightarrow d_i = -20\text{cm}$$

The image is virtual, since $d_i < 0$ (this means the image is formed on the side of the lens that light is traveling toward the lens. The magnification is

$$m = -\frac{d_i}{d_o} = -\frac{-20}{10} = +2$$

So, the image is upright and it is 2 times the size of the object.

The ray diagram confirms the analysis:



Thus, we see that a magnifying glass is a converging lens with the object placed inside the focal length—the image is viewed from the side opposite the locations of the object and image.