13-06

Lens Equation, Magnification Equation

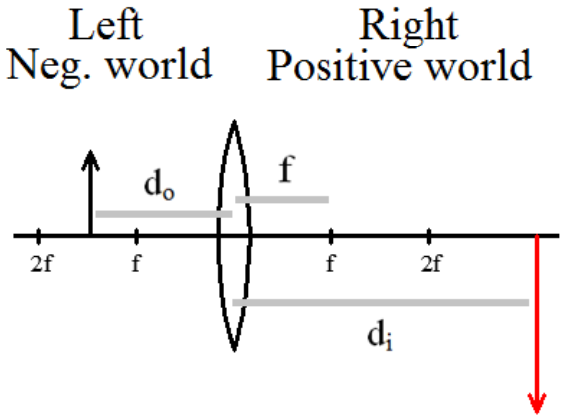
Lens/Magnifcation Equation - symbols

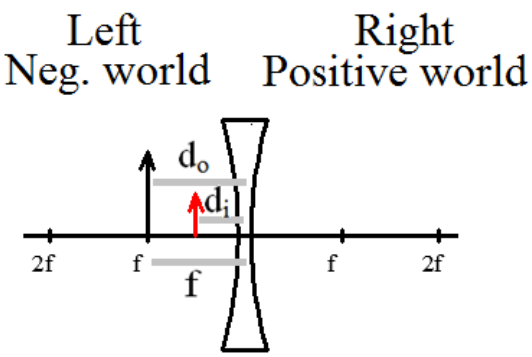
- d = distance, h = height; i = image, o = object
- C = center pt., f = focal pt./focal length
- M = magnification

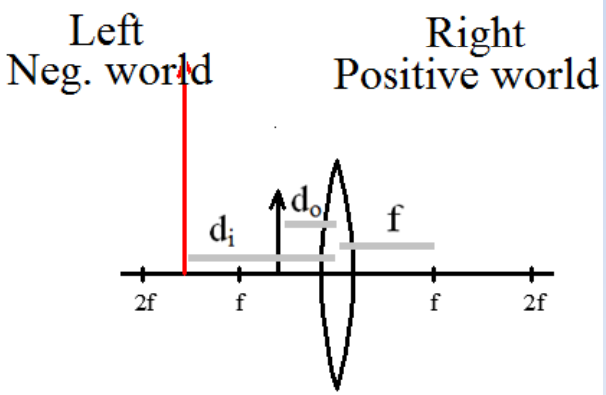
$$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f} \qquad M = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

Lens Equation – Signs (+ or -)

- d_o placed on left & always positive (dist. object to lens ctr.)
- f and d_i – Rule to remember: *"Light should pass through a lens, so f and* d_i *on the right side of the lens is positive"*
- Which f to use (right or left)?
  - Where would a horizontal light ray go?
  - f on right or f on left?
  - Or just memorize: f is pos. for convex lenses



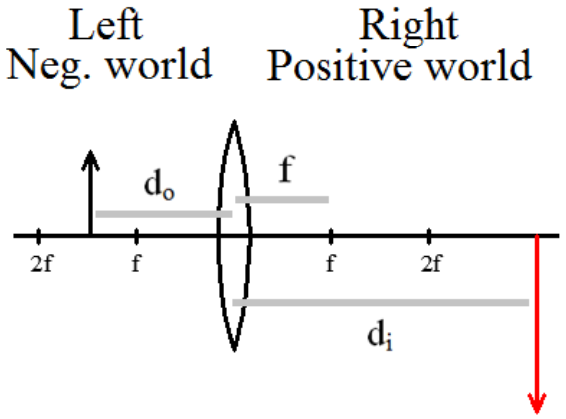


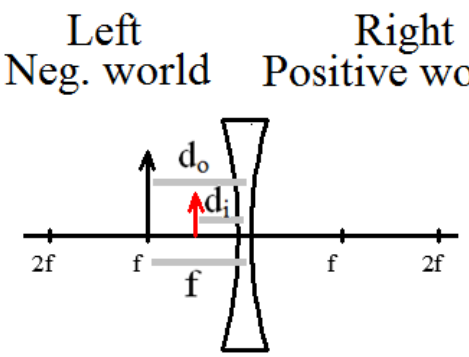


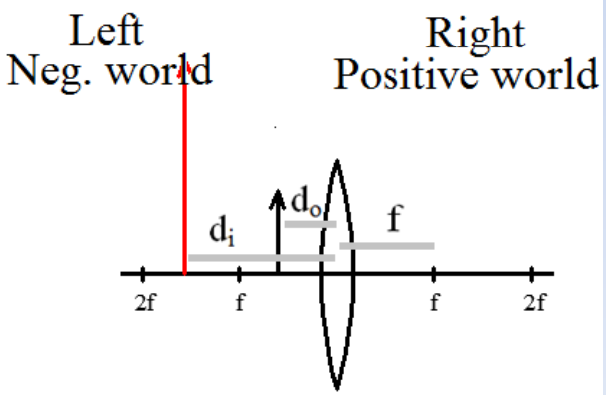
Lens Equation – strategy for understanding

- Same as for mirrors
- These ARE NOT just a bunch of numbers
- These tell us what to expect for a mirror's image
  - Big M = Big image (enlarged)
  - Negative M = inverted & real image
  - Positive M = upright & virtual image

$$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f} \qquad M = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$







Lens Equation – strategy for understanding

- For each below:
  - Comment on relative values of di, do, f **&** neg or pos
  - Three properties (e/r, v/r, u/i); would M be pos? neg?