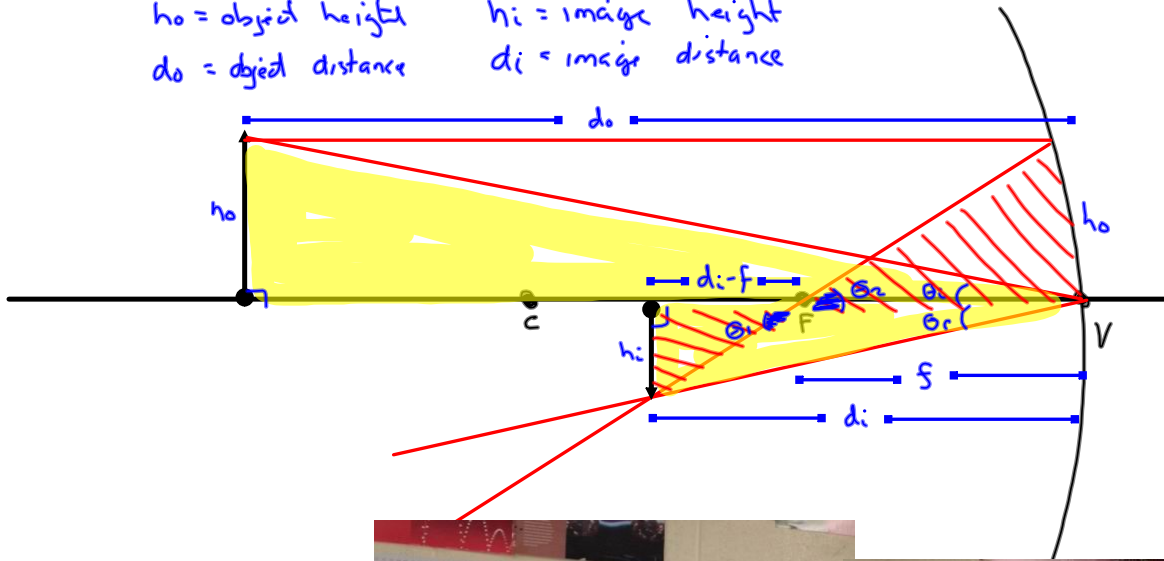


Proof of Mirror Formula

h_o = object height
 d_o = object distance

h_i = image height
 d_i = image distance



Law of reflect

$$\theta_i = \theta_r$$

$$\tan \theta_i = \tan \theta_r$$

$$\frac{h_o}{d_o} = \frac{h_i}{d_i}$$

$$\frac{d_i}{d_o} = \frac{h_i}{h_o}$$

7 dwarf formula.

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o}$$

M → magnification

opp \angle π π

$$\theta_i = \theta_r$$

$$\tan \theta_i = \tan \theta_r$$

$$\frac{h_i}{d_i - f} = \frac{h_o}{f}$$

$$\frac{h_i}{h_o} = \frac{d_i - f}{f}$$

it follows that

$$\frac{d_i}{d_o} = \frac{d_i - f}{f}$$

$$\frac{d_i}{d_o} = \frac{d_i - f}{f}$$

$$\frac{d_i}{d_o} = \frac{d_i}{f} - \frac{f}{f}$$

$$\left(\frac{d_i}{d_o} = \frac{d_i}{f} - \frac{f}{f} \right) \frac{1}{d_i}$$

$$\frac{d_i}{d_o} = \frac{d_i}{d_i f} - \frac{f}{d_i f}$$

Mirror Formula

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o}$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

e.g. An object is placed 20 cm from a concave mirror whose focal length is 8 cm . Find the image distance.

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\frac{1}{8} = \frac{1}{20} + \frac{1}{d_i}$$

$$\frac{1}{8} - \frac{1}{20} = \frac{1}{d_i} \quad \frac{5}{40} - \frac{2}{40} = \frac{3}{40}$$

$$\frac{20 - 8}{(8)(20)} = \frac{1}{d_i}$$

$$\frac{12}{160} = \frac{1}{d_i}$$

$$\frac{160}{12} = \frac{d_i}{1}$$

$$d_i = 13.3\text{ cm}$$

Sign Conventions for Mirrors

d_o } \oplus always
 h_o }

d_i } \oplus REAL
 h_i } \ominus VIRTUAL
 m }

f } \oplus CONCAVE
 r } \ominus CONVEX

