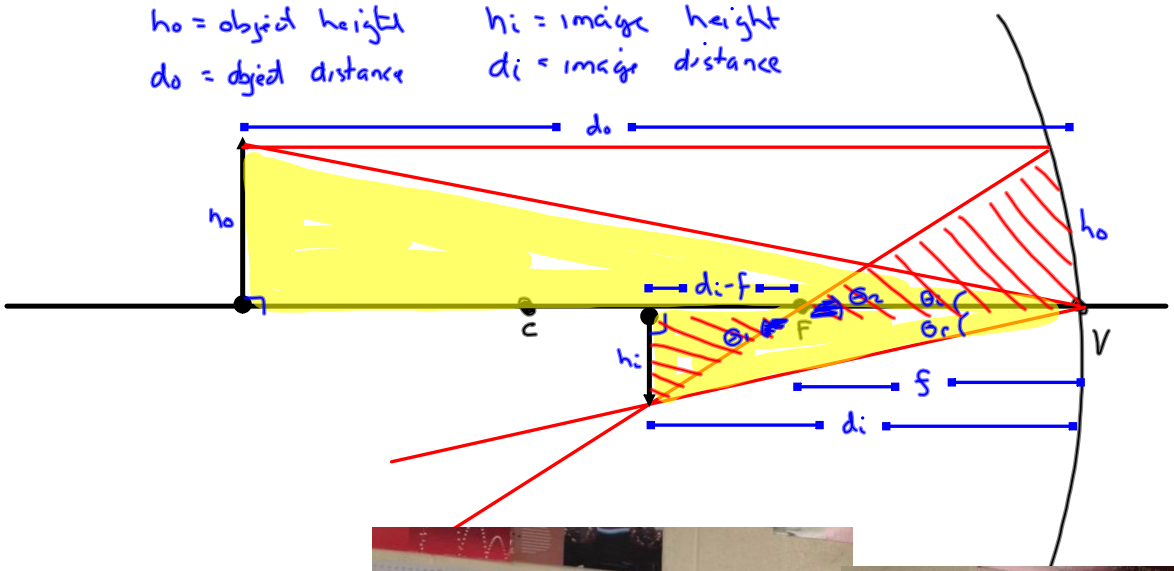
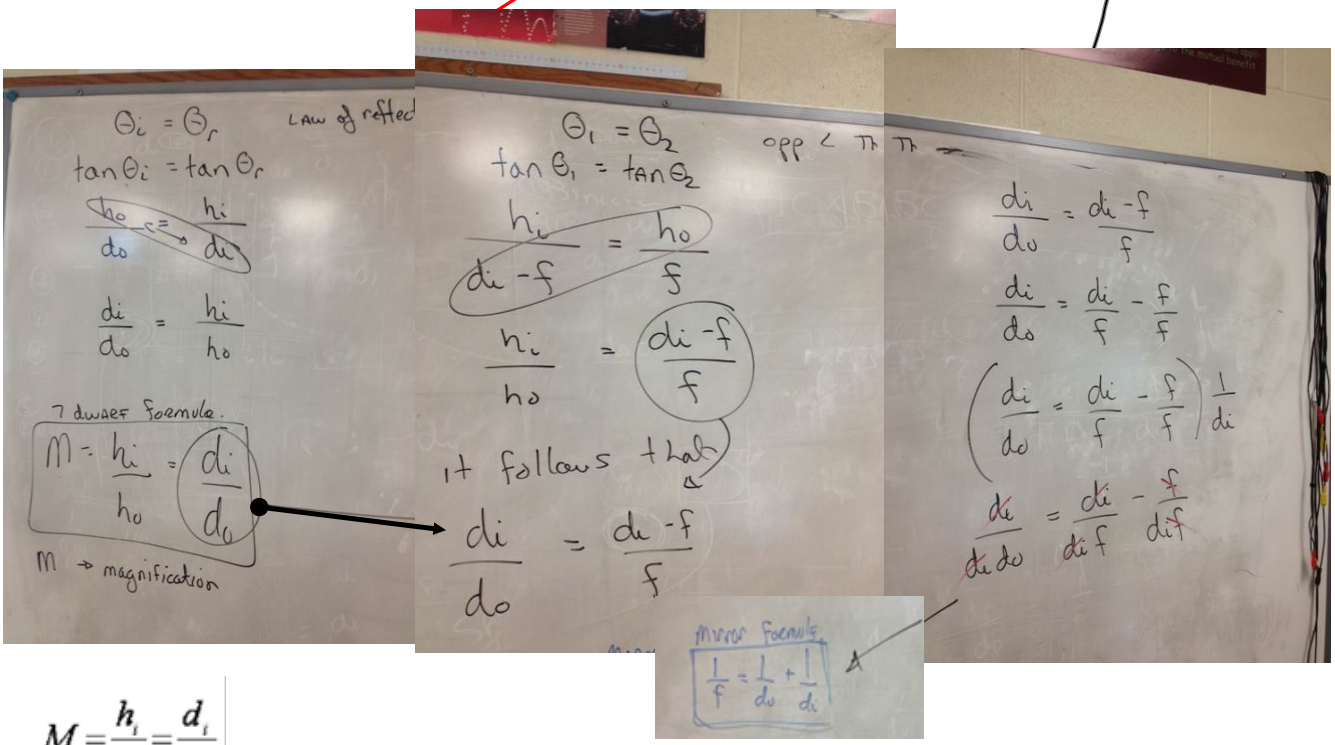
Proof of Mirror Formula

h_o = object height h_i = image height

d_o = object distance d_i = image distance





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

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

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

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

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

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

$$\frac{5}{40} - \frac{2}{40} = \frac{3}{40}$$

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

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

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

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

Sign Conventions for Mirrors

d_o, h_o } ⊕ always

d_i, h_i, m } ⊕ REAL, ⊖ VIRTUAL

f, r } ⊕ CONCAVE, ⊖ CONVEX