Mirror Equations

The Variables

f = **focal length**

p = **object distance to mirror**

q = **image distance to mirror**

h_o = **height of the object**

h_i = **height of the image**

The Mirror Equation

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

f, p, and q are measured from the mirror along the principle axis
h_i and h_o are measured up or down starting at the principle axis

Sign conventions: **Anything that is behind the mirror or inverted is negative!**

p and h_o will always be positive for our problems

q is + if the image is a real image and located (in front of) / behind the mirror

q is – if the image is a virtual image and located in front of / (behind the mirror)

h_i is + when the image is (upright) / inverted

h_i is – when the image is upright / (inverted) upside down

f is + for (concave) / convex mirrors

f is – for concave / (convex) mirrors **You will have to make it negative if it's a given.

Magnification (m) - (Curved mirror images are not the same size as the object)

m = the ratio of the size of the image (h_i) to the size of the object (h_o)

$m = \frac{h_i}{h_o}$ and $m = \frac{-q}{p}$ so $\frac{h_i}{h_o} = \frac{-q}{p}$

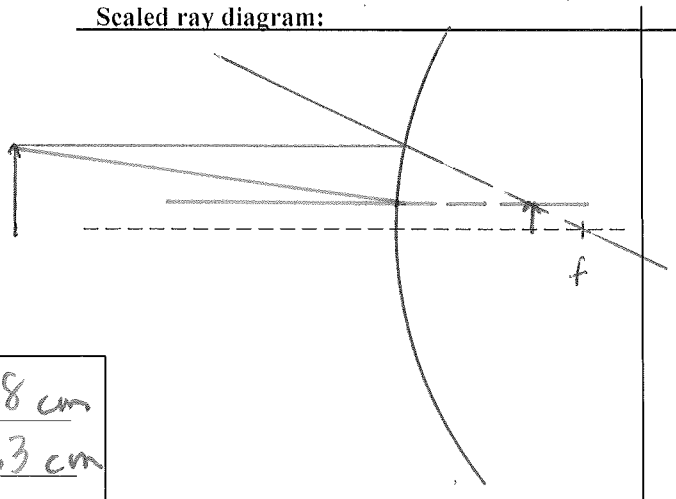
Sign conventions:

m is positive if the image is (upright) / inverted

m is negative if the image is upright / (inverted)

Example 1 A 1-cm tall small plastic pig is placed a distance of 5 cm from a convex mirror which has a focal length of 2.5 cm. Find q and hi using a scaled ray diagram AND equations.

Scaled ray diagram:



q = -1.8 cm

hi = 0.3 cm

Equations:

$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$

$\frac{1}{-2.5} = \frac{1}{5} + \frac{1}{q}$

$-.6 = \frac{1}{q}$

$q = -1.67\text{cm}$

$\frac{h_i}{h_o} = \frac{-q}{p}$

$\frac{h_i}{1} = \frac{+1.67}{5}$

$h_i = 0.33$

q = -1.67 cm

hi = 0.33 cm