

PhyzGuide: Lens Lengths & Eqns

VIRTUAL SIDE OF LENS

Object distance is **positive** on this side, but focal length and image distance are **negative** on this side of the lens

REAL SIDE OF LENS

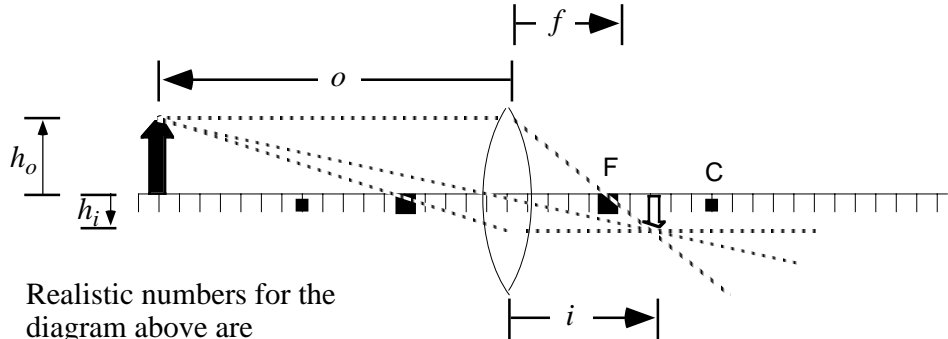
focal length and image distance are **positive** on this side of the lens

A. CONVERGING LENSES (aka convex, positive lenses)

FOR ALL LENSES

PLACES
 F = focal point
 C = center

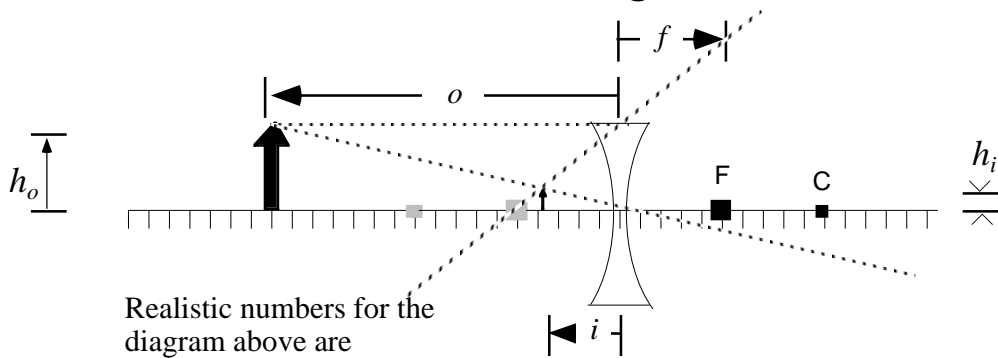
DISTANCES
 f = focal length = $r/2$
 r = center length = $2f$
 o = object distance
 i = image distance
 h_o = object height
 h_i = image height



Realistic numbers for the diagram above are

$f = +5.0\text{cm}$	$r = +10.0\text{cm}$
$o = +17.0\text{cm}$	$i = +7.1\text{cm}$
$h_o = +4.0\text{cm}$	$h_i = -1.7\text{cm}$

B. DIVERGING LENSES (aka concave, negative lenses)



Realistic numbers for the diagram above are

$f = -5.0\text{cm}$	$r = -10.0\text{cm}$
$o = +17.0\text{cm}$	$i = -3.9\text{cm}$
$h_o = +4.0\text{cm}$	$h_i = +0.9\text{cm}$

IMPORTANT LENS EQUATIONS

Image distance, **object** distance and **focal** distance are related by the equation.....

$$\frac{1}{f} = \frac{1}{o} + \frac{1}{i}$$

The **image height** is related to the **object height** by this expression. The negative sign indicates whether or not the image will be erect or inverted.....

$$\frac{h_i}{h_o} = \frac{-i}{o}$$

The **magnification** factor of a lens is defined as.....

$$m = \frac{h_i}{h_o} = \frac{-i}{o}$$