

## Ray Optics: Reflection

### *The Reflection of Light:*

⇒ in optics, all angles are measured with respect to the normal

*Law of Reflection:*  $\theta_r = \theta_i$

### *Images from Plane Mirrors:*

⇒ the image created by a plane mirror is virtual, upright, the same size as the object, and as far behind the mirror as the object is in front of it

### *Images from Spherical Mirrors:*

⇒ a convex mirror always produces a virtual, reduced, and upright image

⇒ a concave mirror can produce a:

real, enlarged, inverted image (if object is between C and F)

real, reduced, inverted image (if object is beyond C)

virtual, enlarged, upright image (if object is between F and mirror)

⇒ from a single mirror, real images are always inverted and virtual images are always upright

### *Ray Tracing:*

*Ray 1:* A ray parallel to the principal axis is reflected through the focal point.

*Ray 2:* A ray that passes through the focal point is reflected parallel to the principal axis.

*Ray 3:* A ray that travels along a line that passes through the center of curvature reflects back upon itself.

### *Mirror and Magnification Equations:*

mirror equation:  $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$

magnification equation:  $m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$

$f > 0$  concave mirror

$f < 0$  convex mirror

$d_o > 0$  real object (in front of mirror)

$d_o < 0$  virtual object (behind mirror)

$d_i > 0$  real image (in front of mirror)

$d_i < 0$  virtual image (behind mirror)

$m > 0$  image is upright

$m < 0$  image is inverted

$|m| > 1$  image is enlarged

$|m| < 1$  image is reduced