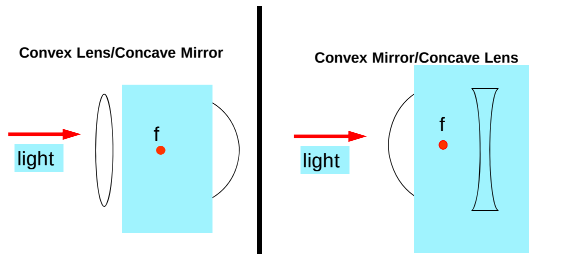
Convex Lens/Concave Mirror

Convex Mirror/Concave Lens



+f (made by real rays)
converge light
can make any image

-f (made by virtual rays)
diverge light
only makes Virtual, Erect, Mini images

Concave Mirrors:
Converge light
Have + focal points

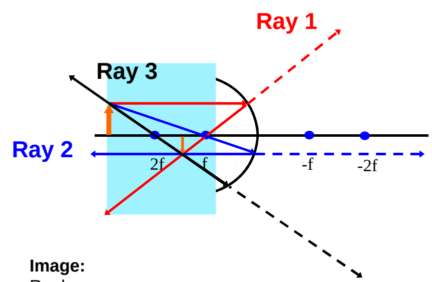


Image:
Real
Inverted
Minimized

Convex lenses:
Converge light
Have + focal points

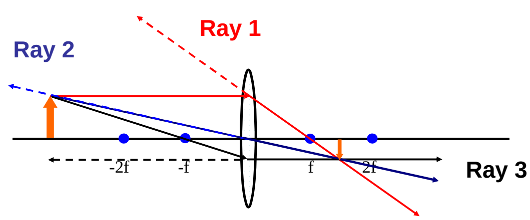


Image:
Real
Inverted
Minimized

EQUATIONS

$1 / D_i + 1 / D_o = 1 / f$

$-(D_i) / D_o = H_i / H_o = m$

- D_i = distance from the lens or mirror to the image
- D_o = distance from the lens or mirror to the object (always POSITIVE)
- f = distance from the lens or mirror to the focal point (focal length) **be sure to plug in the correct sign!!!!!!**
- m = magnification
- H_i = height of image
- H_o = height of object

EQUATIONS

- If you get:

- **+ D_i** then the image is **REAL**
- **- D_i** then the image is **VIRTUAL**

- **+ H_i** then the image is **UPRIGHT**
- **- H_i** then the image is **INVERTED**

- the absolute value of **$H_i < H_o$** then the image is **MINIMIZED**
- the absolute value of **$H_i > H_o$** then the image is **MAGNIFIED**
- the absolute value of **$H_i = H_o$** then the image is the **SAME** size.

SAMPLE PROBLEM

If a diverging lens has a focal length of 6 cm , describe the image formed of a 2 cm tall flower that is 12 cm from the lens.

- D_i = ?
- D_o = 12 cm
- f = - 6 cm

- $1 / D_i + 1 / D_o = 1 / f$
- $1 / D_i + 1 / 12 = 1 / -6$

D_i = - 4 cm. . . . .the image is VIRTUAL

(because D_i is negative)

SAMPLE PROBLEM, cont.

- H_i = ?
- H_o = 2 cm
- D_i = - 4 cm
- D_o = 12 cm

- $-(D_i) / D_o = H_i / H_o$
- $-(-4) / 12 = H_i / 2$

H_i = .667cm. . .the image is **UPRIGHT** (because H_i is positive) and **MINI** (because $H_i < H_o$)

Practice

If a converging lens has a focal length of 10 cm , describe the image formed of a 4 cm tall flower that is 15 cm from the lens.

- D_i = ?
- D_o = 15 cm
- f = 10 cm

- $1 / D_i + 1 / D_o = 1 / f$
- $1 / D_i + 1 / 15 = 1 / 10$

D_i = 30 cm. . . . .the image is Real

(because D_i is positive)

Practice, cont.

- H_i = ?
- H_o = 4 cm
- D_i = 30 cm
- D_o = 15 cm

- $-(D_i) / D_o = H_i / H_o$
- $-(30) / 15 = H_i / 4$

H_i = -8 cm. . .the image is **INVERTED** (because H_i is negative) and **MAX** (because $H_i > H_o$)