Concave/Convex Mirrors

Concave Mirrors

Ray number

1) Leaves tip of arrow image, **travels parallel** with the principal axis, and reflects and passes through the **focal point**.

2) Leaves tip of arrow image, passes through the **focal point**, and **reflects parallel** with the principal axis.

3) Leaves tip of arrow image, passes through the **radius of curvature**, and reflects back through the **radius of curvature**.

Convex Mirrors

Ray number

1) Leaves tip of arrow image, **travels parallel** with the principal axis, and reflects off the mirror **directly away from the focal point**.

2) Leaves tip of arrow image, **travels in the direction of the focal point**, and reflects off the mirror **parallel** to the **principal axis**.

3) Leaves tip of arrow image, travels in the direction of the **radius of curvature,** and reflects off the mirror in the **same direction** **away from the radius of curvature**.

Convex/Concave Lenses

Convex Lenses

Ray number

1) Leaves tip of arrow image, **travels parallel** with the principal axis, and bends (refracts) and passes **through the focal point**.

2) Leaves tip of arrow image, passes **through the** **focal point**, and bends (refracts) **parallel with the principal axis**.

3) Leaves tip of arrow image, passes through the **middle-center of your lens**, and leaves in this straight line.

Concave Lenses

Ray number

1) Leaves tip of arrow image, **travels parallel** with the principal axis, and bends (refracts) **away from the focal point** (located on same side of the object) from behind.

2) Leaves tip of arrow image, travels **directly towards the focal point** located on the other side of the lens, and bends (refracts) **parallel with the principal axis**.

3) Leaves tip of arrow image, passes through the **middle-center of your lens**, and leaves in this straight line.

*To locate the image behind the mirror/lens, trace the rays leaving the mirror/lens back into the mirror/lens. Where these traced lines meet is the location of your image (tip of arrow image).*

Lens/Mirror equation

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

Magnification equation

$$M = \frac{h\_{i}}{h\_{o}} = -\frac{d\_{o}}{d\_{i}}$$

Focal point summary table

|  |  |  |
| --- | --- | --- |
| *f* (+/-) | Concave | Convex |
| Mirrors | Positive (+) | Negative (-) |
| Lens | Negative (-) | Positive (+) |

*di* summary table

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Positive value | Negative value |
| Mirrors | Concave | Located on same side as object | Located behind the mirror |
| Convex | Located on same side as object | Located behind the mirror |
| Lens | Concave | Located on the opposite side as the object | Located on the same side as the object |
| Convex | Located on the opposite side as the object | Located on the same side as the object |

*hi* summary table

|  |  |
| --- | --- |
| Positive | Upright |
| Negative | Inverted |