

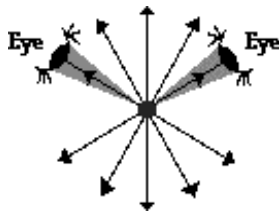
Reflection of Light

Definitions

- **Luminous** objects - generate their own light (the sun)
- **Illuminated** objects - reflect light (the moon)
- **Line of Sight** - a line from an object or image to your eyes (light from the object travels along this line to your eyes)

Slide 2

Line of Sight

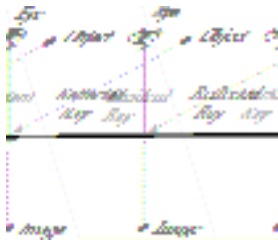


- Both luminous & illuminated objects emit/reflect light in many directions.
- Your eye sees only the very small diverging cone of rays that is coming toward it.

Slide 3

Rays of Light

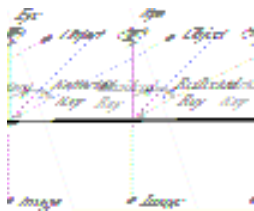
- Incident Ray - leaves the object and strikes the mirror
- Reflected Ray - leaves mirror and strikes your eye
- The reflected ray is on the line of sight from the image to your eye.



Slide 4

Law of Reflection

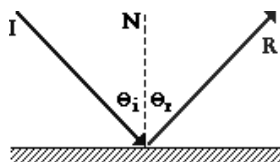
- Angle of incidence equals angle of reflection.



Slide 5

Law of Reflection


- Normal - line perpendicular to the mirror surface
- Angle of incidence - angle between incident ray and normal
- Angle of reflection - angle between reflected ray and normal



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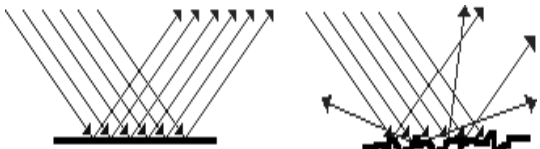
Law of Reflection Animation

$\theta_i = \theta_r$



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Diffuse Reflection

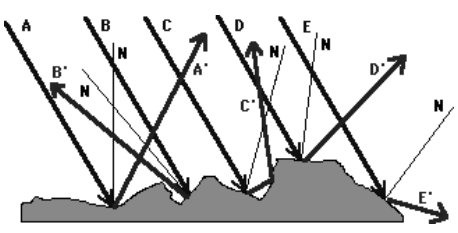


Specular Reflection
(smooth surfaces)

Diffuse Reflection
(rough surfaces)


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Diffuse Reflection

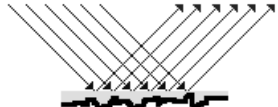


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Wet Road Glare



A dry asphalt roadway diffuses incident light.

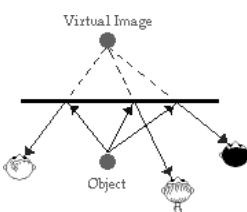


When wet, water fills in the crevices, resulting in specular reflection and a glare.

- Driving at night on a wet roadway results in an annoying glare from oncoming headlights.

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Observing an Image

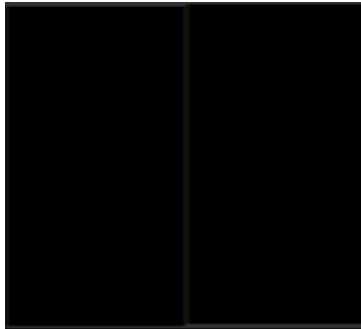


All observers would perceive light to be diverging from the same point - the image point.

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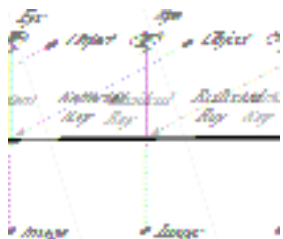
- An image is a position in space from which all reflected light appears to diverge.
- Image formed by a plane mirror is called a virtual image.
- Virtual images are formed in regions where there is actually no light

Image Location



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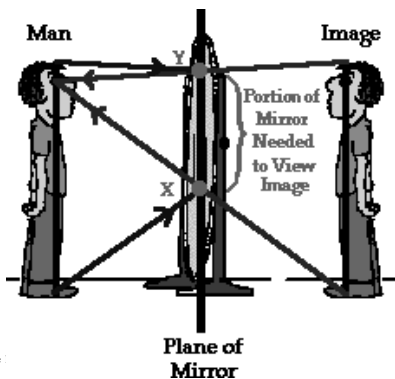
Image Formed By Plane Mirror



- Image is virtual.
- Image is located as far behind the mirror as the object is in front of the mirror.

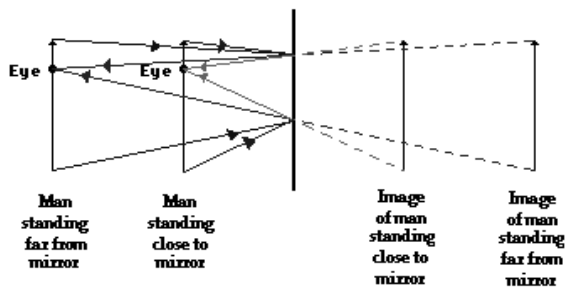
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How Big Must the Mirror Be?



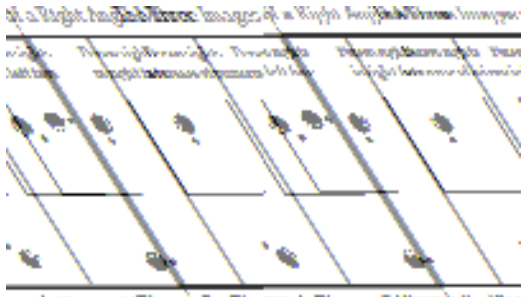
Slide

Distance from Mirror Irrelevant



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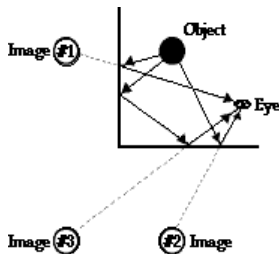
Right Angle Mirror



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The diagram illustrates a right angle mirror system consisting of two perpendicular mirrors. An object is placed in the corner. Multiple reflections are shown as a series of images arranged in a grid pattern, demonstrating how light rays reflect off the mirrors multiple times before reaching the observer's eye.

Right Angle Mirror

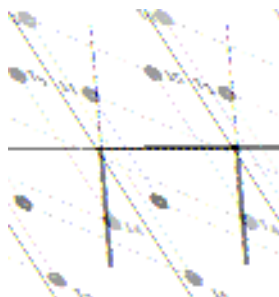


- Formation of primary and secondary images

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The diagram shows a right angle mirror with an object placed in the corner. It labels the 'Object', 'Image #1' (primary image), 'Image #2' (secondary image), and 'Image #3' (tertiary image). An 'Eye' is shown observing the object and its images. Arrows indicate the paths of light rays from the object to the mirrors and back to the eye.

Kaleidoscope



- Angles smaller than 90° produce more than 3 images

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The diagram shows a kaleidoscope with three mirrors meeting at a central point. An object is placed in the center, and its multiple reflections are shown as a complex, repeating pattern of images. The text indicates that angles smaller than 90 degrees result in more than three images.

Kaleidoscope Applets

- [Hinged Mirror Applet](#)
- [Image Formation Applet](#)

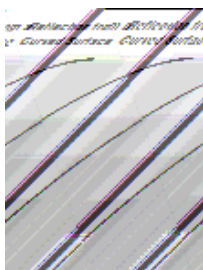
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Reflection Applets

- [Plane Mirror Image Applets](#)
- [Double Mirror Images](#)
- [Hinged Mirror Applet](#)
- [Rainbow Applets](#)

Law of Reflection Curved Mirrors

- Angle of Incidence is equal to the angle of reflection



Converging Mirror

- A series of flat mirrors can be arranged to reflect parallel light through a single point.
- Increasing the number of flat mirrors causes the shape to more closely approximate a parabola and causes the reflected light to converge in a smaller area.

Parabolic vs Spherical

- Close to the axis of the mirror, the parabola and the circle are almost the same shape.
- Farther from axis the parabola flattens out.
- It is easier and less expensive to make spherical mirrors.

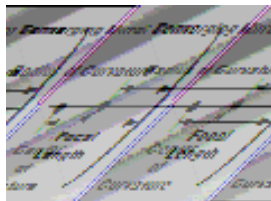
Types of Curved Mirrors

Concave Mirror

Convex Mirror

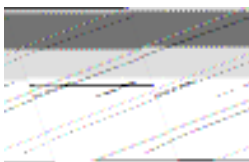
- A concave mirror is silvered on the inside of the sphere.
- A concave mirror is also called a converging mirror because it converges parallel light.
- A convex mirror is silvered on the outside of the bowl.
- A convex mirror is also called a diverging mirror because it diverges parallel light.

Concave Mirror Terms



- Axis
- Center of Curvature
- Radius of Curvature
- Focus
- Focal Length

Three Useful Rays



- Ray parallel to the axis reflects through the focus.
- Ray through the focus reflects parallel to the axis.
- Ray through the center of curvature reflects back on itself.
