

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

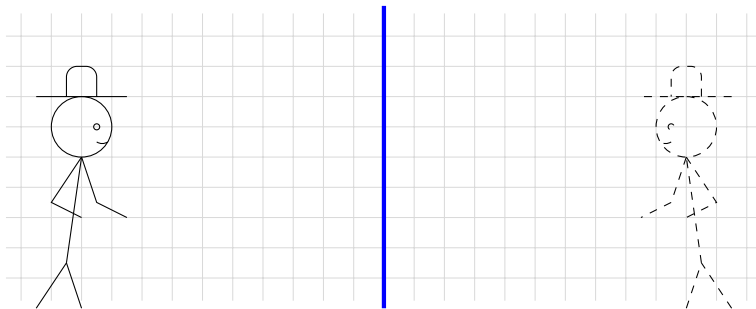
# Geometric Optics

## The Ray Model of Light

### Reflection

#### The Law of Reflection

The angle of incidence is \_\_\_\_\_ to the angle of Reflection



### Diffuse and Specular Reflection

#### Curved Mirrors



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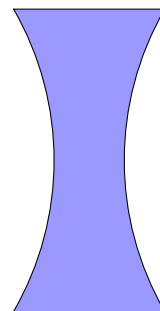
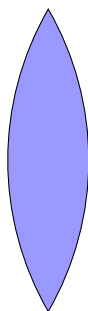
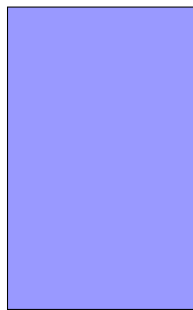
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## Refraction

- when light slows down, it bends \_\_\_\_\_ normal.
- when light speeds up, it bends \_\_\_\_\_ normal.

## Total Internal Reflection

## Lenses



Name:

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## Refraction Practice Problems

1. The speed of light in ice is  $2.29 \times 10^8$  m/s. What is the index of refraction of ice?
2. A flashlight beam strikes the surface of a pane of glass ( $n=1.56$ ) at an angle of  $67^\circ$  to the normal. What is the angle of refraction?
3. A diver shines a flashlight upward from beneath the water ( $n = 1.33$ ) at an angle  $35^\circ$  to the vertical. At what angle does the light leave the water?
4. What is the critical angle for the interface between acrylic plastic ( $n = 1.49$ ) and water ( $n = 1.33$ ). To be internally reflected, the light must start out in which medium?

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## Images

An image is the point where light rays \_\_\_\_\_.

### virtual images

rays of light appear to intersect at a location, but in reality there is \_\_\_\_\_ at that location.

\_\_\_\_\_ focused on a screen

### real images

rays of light really do \_\_\_\_\_ at a point in space

\_\_\_\_\_ focused on a screen

## Equations for Locating Images

### Sign Conventions

$d_o$  distance between mirror/lens and object

$d_i$  distance between mirror/lens and image

$f$  focal length

$h_o$  height of object

$h_i$  height of image

$m$  magnification

Name: \_\_\_\_\_

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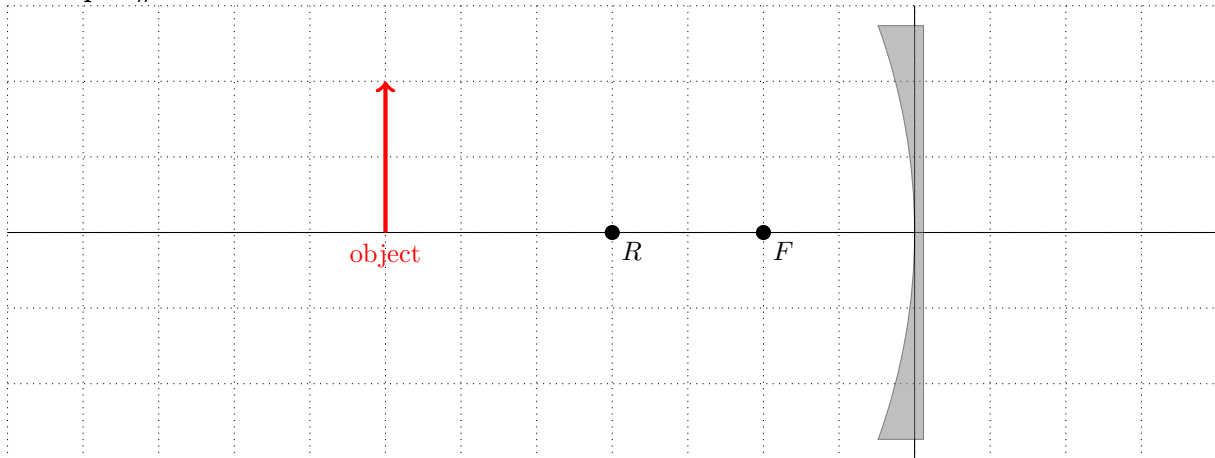
Period: \_\_\_\_\_

## Image Formation in Mirrors

### Three (Four?) Principle Rays

1. A ray travelling parallel to the principal axis gets reflected to \_\_\_\_\_
2. A ray traveling through the focal point gets reflected \_\_\_\_\_
3. A ray that goes through center of curvature gets reflected \_\_\_\_\_
4. A ray that hits the precise center of the mirror gets reflected \_\_\_\_\_

### Example #1

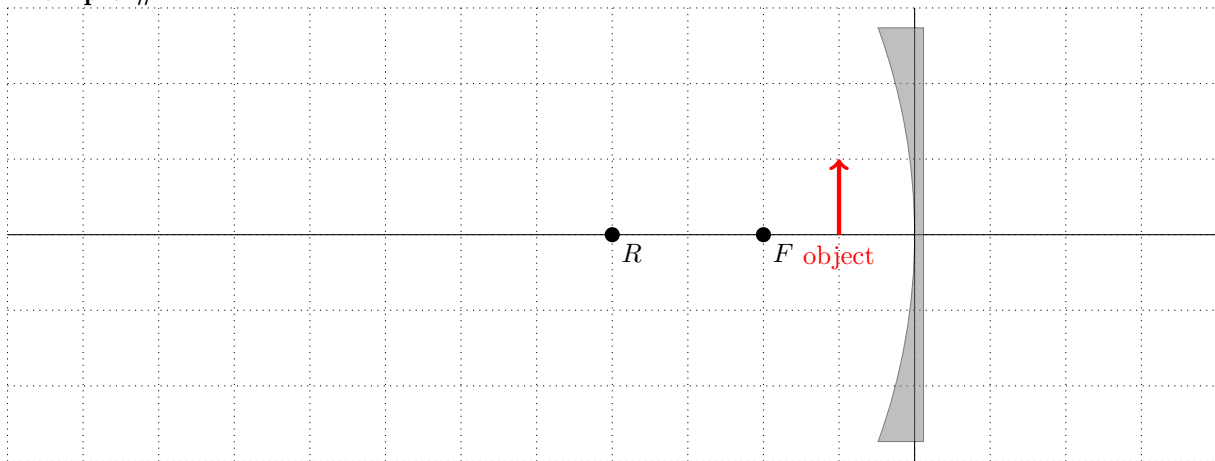


Name: \_\_\_\_\_

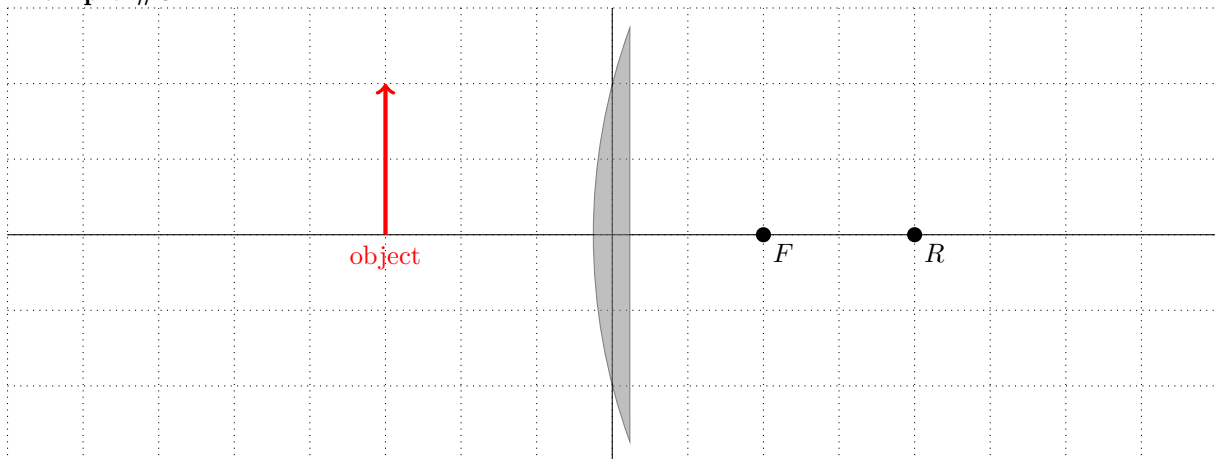
Date: \_\_\_\_\_

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**Example #2**



**Example #3**



Name: \_\_\_\_\_

Date: \_\_\_\_\_

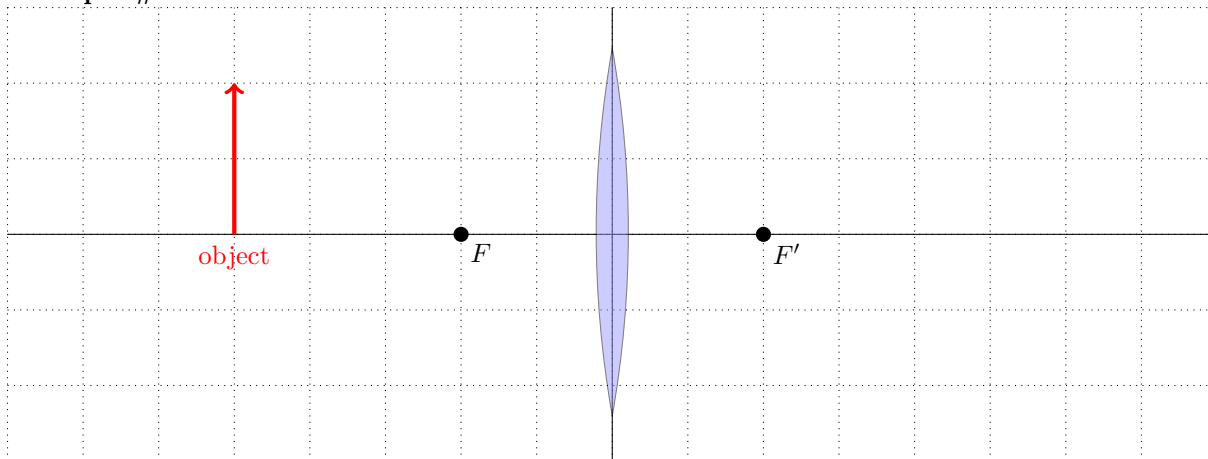
Period: \_\_\_\_\_

## Image Formation in Lenses

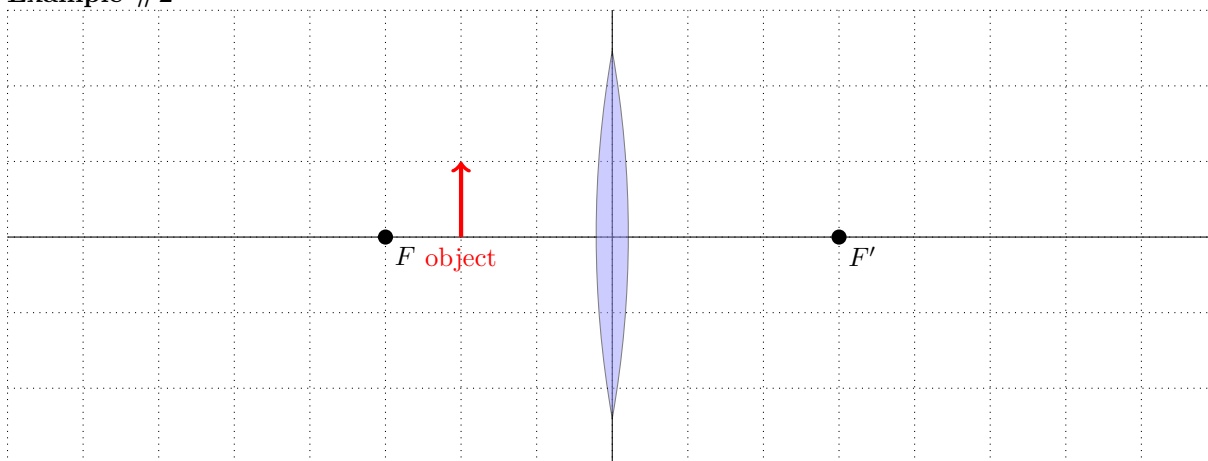
### Three Principle Rays

1. A ray travelling parallel to the principal axis gets refracted to \_\_\_\_\_
2. A ray traveling through the focal point gets refracted \_\_\_\_\_
3. A ray that goes through center of optical center \_\_\_\_\_

### Example #1



### Example #2

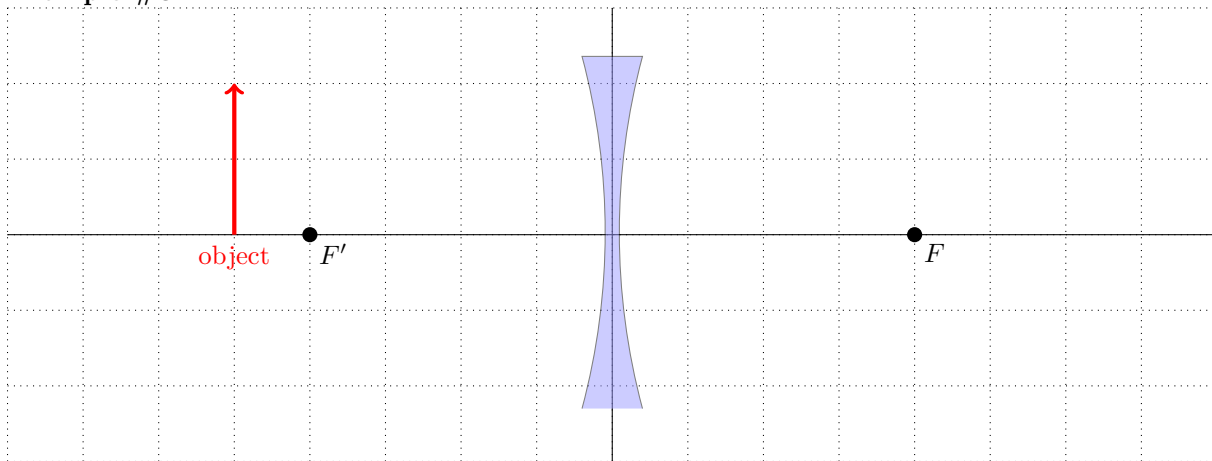


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### Example #3



### Lens Equation Practice Problems

1. A rutabaga, which has a height of 44 cm is placed 10 cm in front of a converging lens. The image produced has a height of 66 cm and is *inverted*.
  - (a) What is the image distance?
  - (b) What is the power of the lens?
2. A diverging lens has a focal length of 9.0 cm, and an object is placed 3.0 cm from the lens.
  - (a) What would be the distance of the image from the lens?
  - (b) What is the magnification of the image?
  - (c) Will the image be real or virtual, upright or inverted? How do you know?
  - (d) What is the power of the lens?
3. A lens has a power of 0.1 Diopters. Locate the image of an antelope placed upright 30.0 m from the lens. Find the magnification of the image.