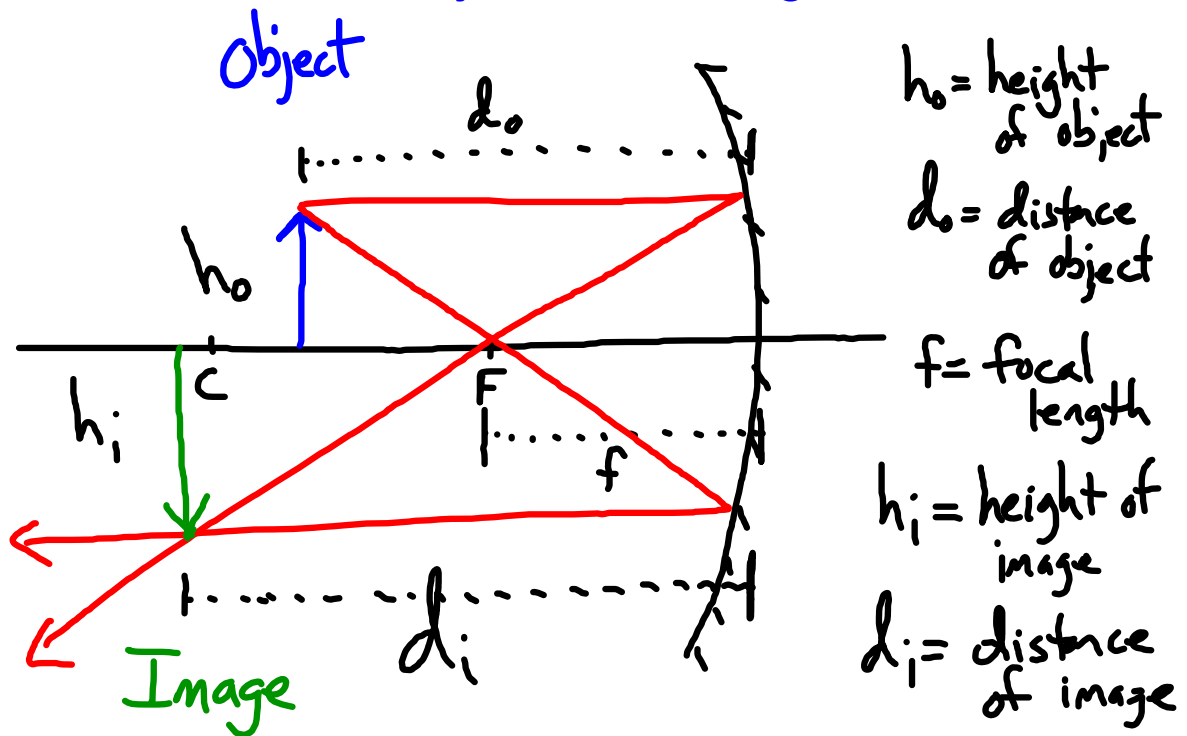
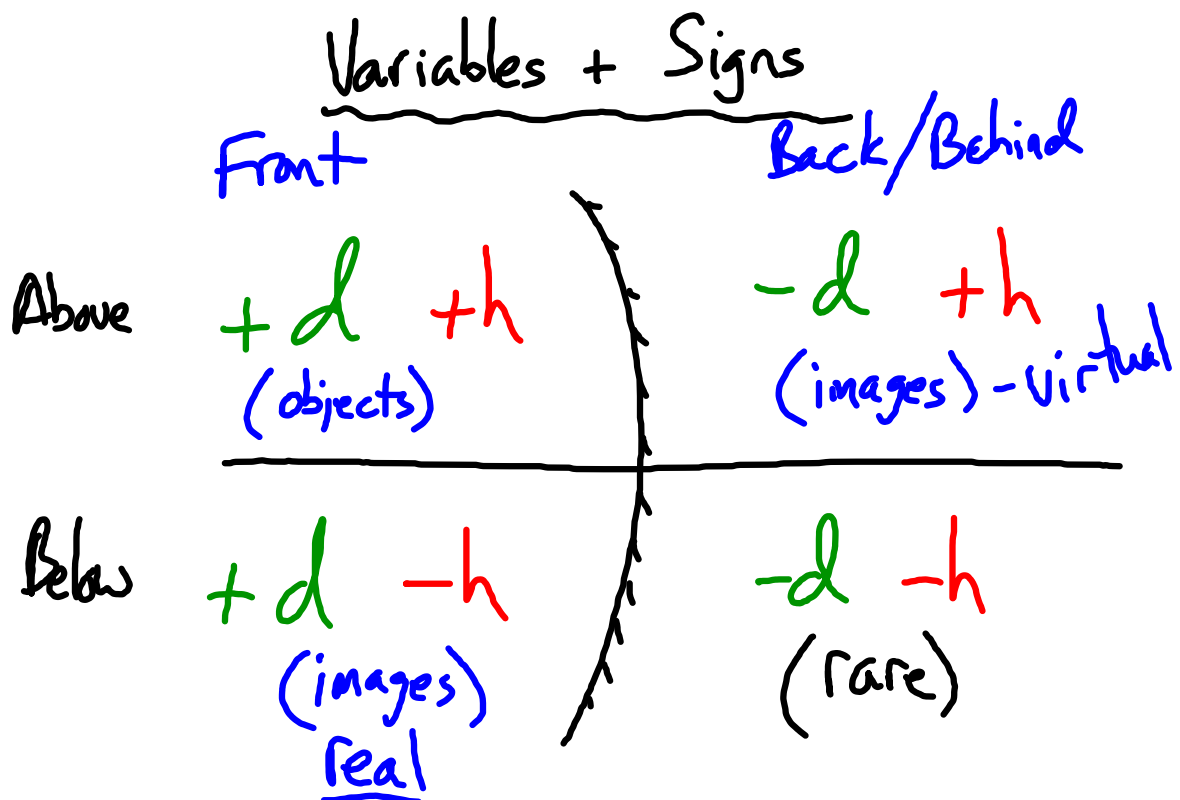


Mathematical Relationships between objects and images



Dec 8-9:00 AM



Oct 30-8:04 AM

Magnification

$$\frac{h_i}{h_o} = M = \frac{-(d_i)}{d_o}$$

- units of measurement need to be the same
- There is no unit for magnification

Oct 29-8:44 AM

A concave mirror produces an image on a wall that is 30.0 cm high from an object that is 6.5 cm high. What is the magnification of the mirror?

$$h_i = 30.0 \text{ cm}$$

$$h_o = 6.5 \text{ cm}$$

$$M = ?$$

$$M = \frac{h_i}{h_o}$$

$$= \frac{30.0 \cancel{\text{cm}}}{6.5 \cancel{\text{cm}}}$$

$$= 4.6153846$$

$$= 4.6$$

Nov 21-9:30 AM

A camera creates a real image of a tree 40 m away. The image is formed 3.0 cm behind the lens. Find the magnification.

$$d_o = +40 \text{ m} \rightarrow 4000 \text{ cm}$$

$$d_i = +3.0 \text{ cm}$$

$$M = ?$$

$$M = -\frac{d_i}{d_o}$$

$$= -\frac{(+3 \text{ cm})}{4000 \text{ cm}}$$

$$M = -0.00075$$

$$= -7.5 \times 10^{-4} \times$$

Nov 21-9:36 AM

A concave mirror creates a virtual image of a candle flame that is 10 cm high. If the magnification of the mirror is 12.5, what is the height of the candle flame?

$$h_i = 10 \text{ cm}$$

$$M = 12.5$$

$$h_o = ?$$

$$h_o = \frac{h_i}{M} \quad M = \frac{h_i}{h_o}$$

$$h_o = \frac{10 \text{ cm}}{12.5}$$

$$= 0.8 \text{ cm}$$

Nov 21-9:44 AM

A lens produces a real image that is 23 times bigger than the object. If the object is 14 cm away, how far away is the image?

$$M = -23$$

$$d_o = 14 \text{ cm}$$

$$d_i = ?$$

$$M = \frac{-(d_i)}{d_o}$$

$$-d_i = -M \times d_o$$

$$= 23 \times 14 \text{ cm}$$

$$d_i = +322 \text{ cm}$$

Nov 21-9:51 AM

Magnification compares the image height to the object height

$$h_o = \frac{h_i}{m} \quad m = \frac{h_i}{h_o} \quad h_i = M \times h_o$$

Magnification compares the image distance to the object distance

$$m = \frac{-d_i}{d_o}$$

Oct 30-11:42 AM

11.1

Practice Problems

1. A microscope produces an image that is 1.00×10^{-4} m high from an object that is 4.00×10^{-7} m high. What is the magnification of the microscope?
2. A concave mirror produces an image on a wall that is 30.0 cm high from an object that is 6.5 cm high. What is the magnification of the mirror?
3. A pinhole camera produces a 2.34×10^{-2} m image of a building that is actually 50.0 m high. What is the magnification of the camera?

250

4.6

 4.68×10^{-4}

$$h_i = 1.00 \times 10^{-4} \text{ m}$$

$$h_o = 4.00 \times 10^{-7} \text{ m}$$

$$m = \frac{1.00 \times 10^{-4} \text{ m}}{4.00 \times 10^{-7} \text{ m}}$$

$$= \frac{1 \text{ EF } (-) 4}{4 \text{ EF } (-) 7} =$$

0.000468

Oct 31-7:54 AM

11.2

Practice Problems

1. An object is placed 75 cm from a concave mirror. A real image is produced 50 cm away. What is the magnification?
2. A person standing 3.00 m from a glass window sees her virtual image 3.00 m on the other side. What is the magnification of the window?
3. A camera creates a real image of a tree 40 m away. The image is formed 3.0 cm behind the lens. Find the magnification.

0.67

0.66

1

0.00075

Oct 31-7:54 AM

11.3

Practice Problems

1. A slide projector has a magnification of 50. How wide will the projected image be if the slide is 2.8 cm wide?
2. A concave mirror creates a virtual image of a candle flame that is 10 cm high. If the magnification of the mirror is 12.5, what is the height of the candle flame?
3. A magnifying glass will magnify 6 times. If the magnifying glass is held over a page and magnifies a letter that is 2 mm tall, how big is the image?

140 cm

0.8 cm

12 mm

Oct 31-7:54 AM

11.4

Practice Problems

1. An insect is magnified 12 times by a concave mirror. If the image is real, inverted, and 6 cm from the mirror, how far away is the insect?
2. A lens produces a real image that is 23 times bigger than the object. If the object is 14 cm away, how far away is the image?
3. A human hair is placed 3 mm from a powerful microscope lens that has a magnification of 40 times. How far from the lens will the image be formed?

0.5 cm

322 cm

120 mm

Oct 31-7:54 AM