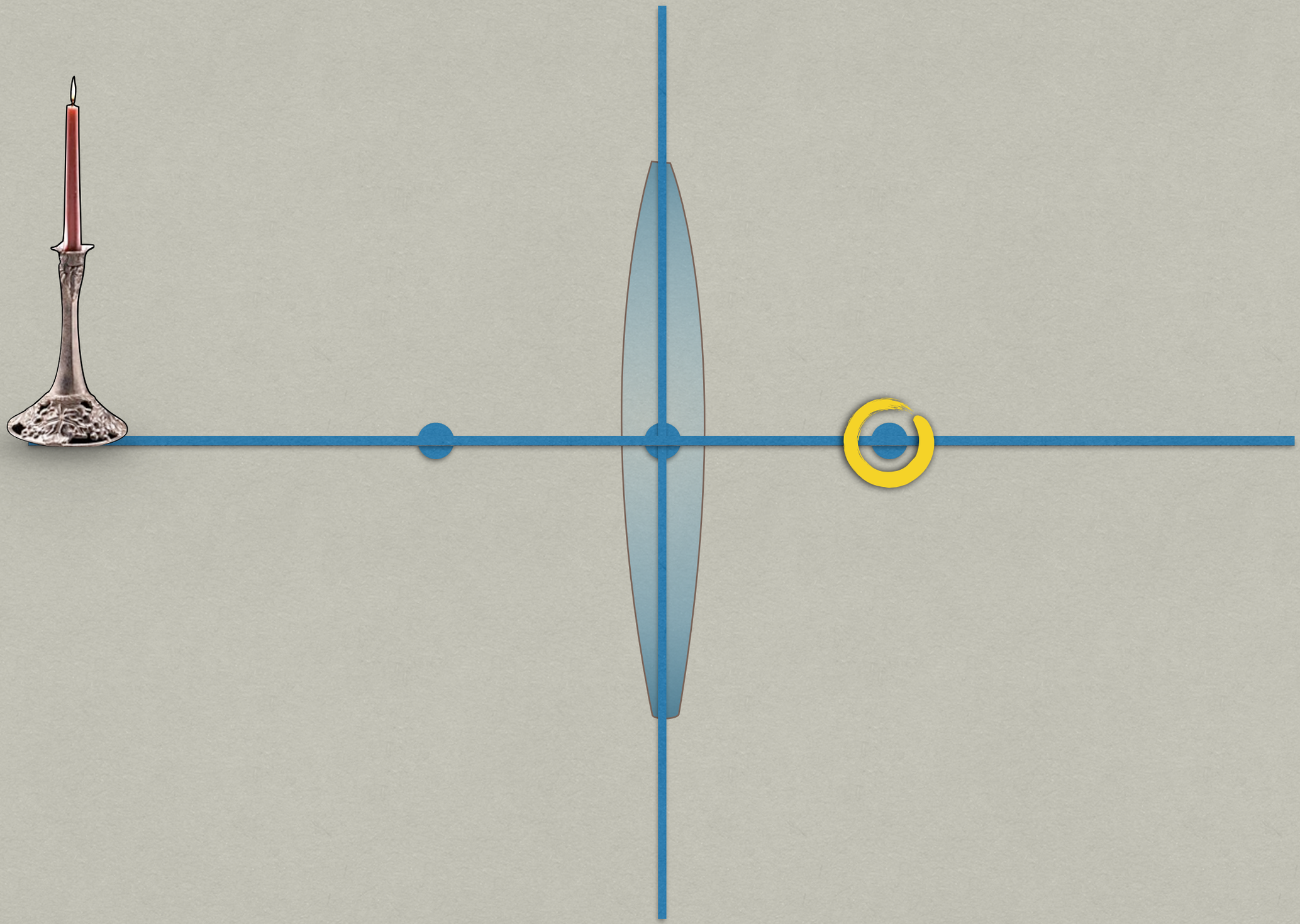
Optics

2014

Thin Lenses

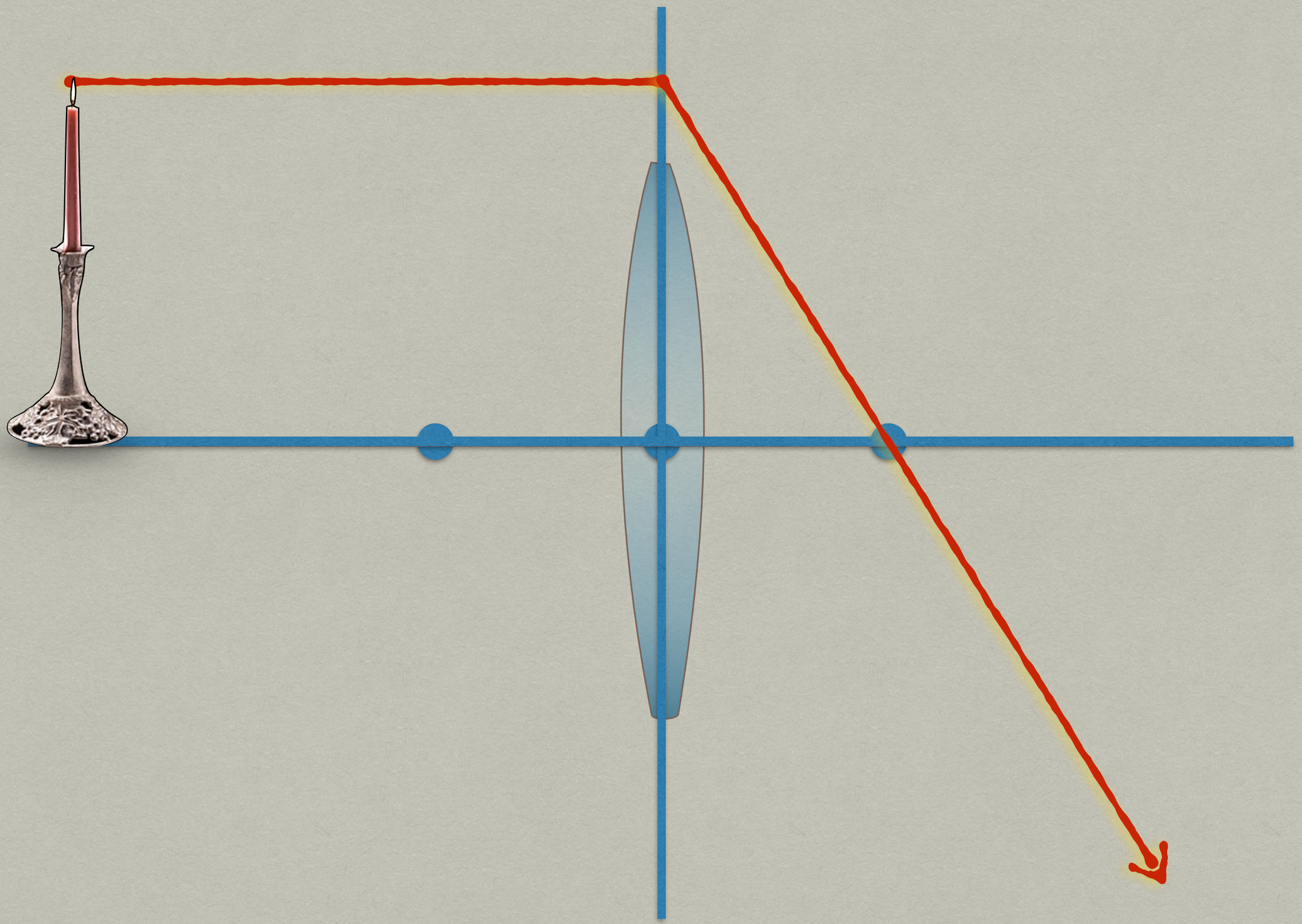
Ray Diagrams

Ray Diagram: Converging Lens



The primary focal point is on the opposite side to the object

Ray Diagram: Converging Lens



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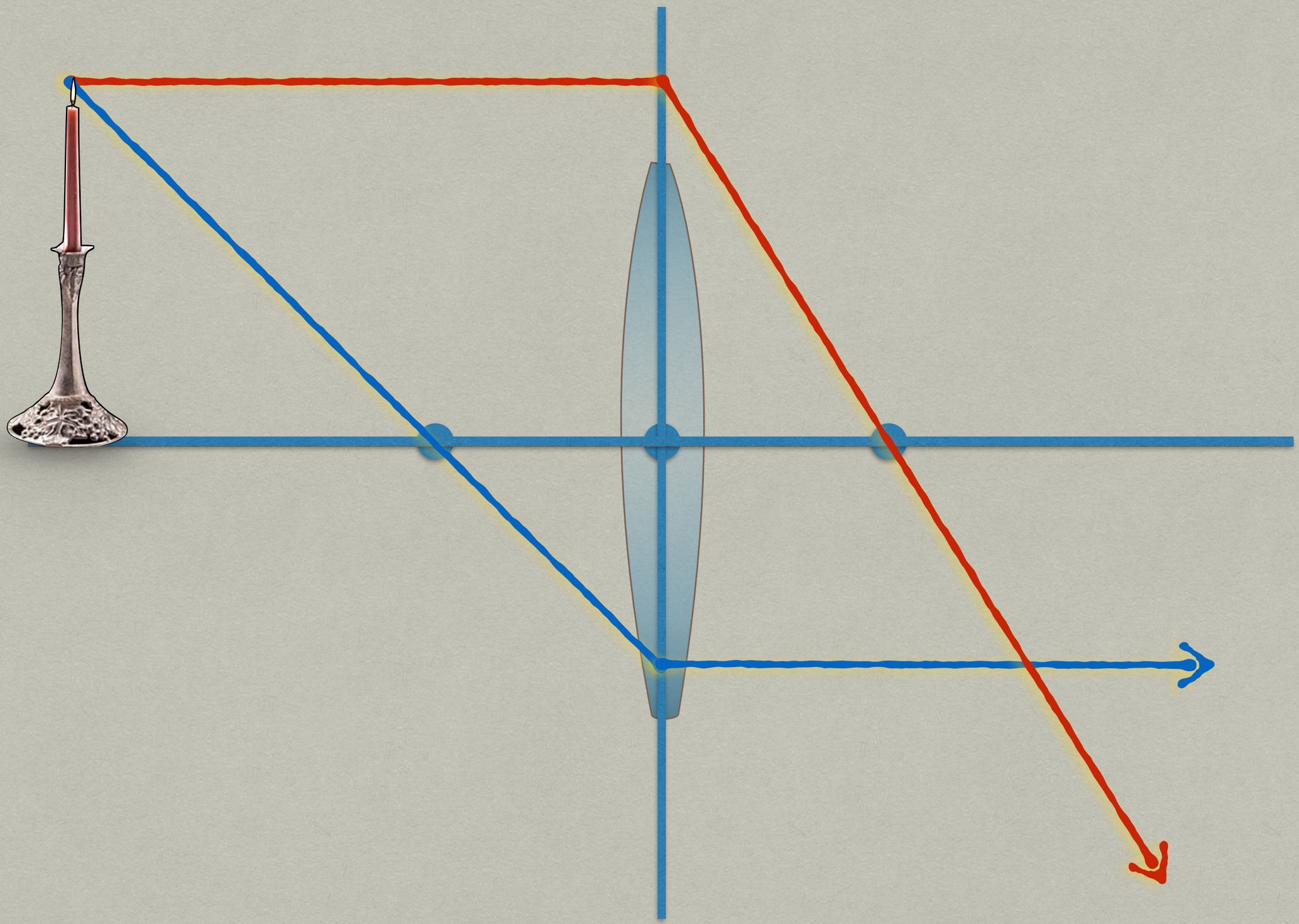

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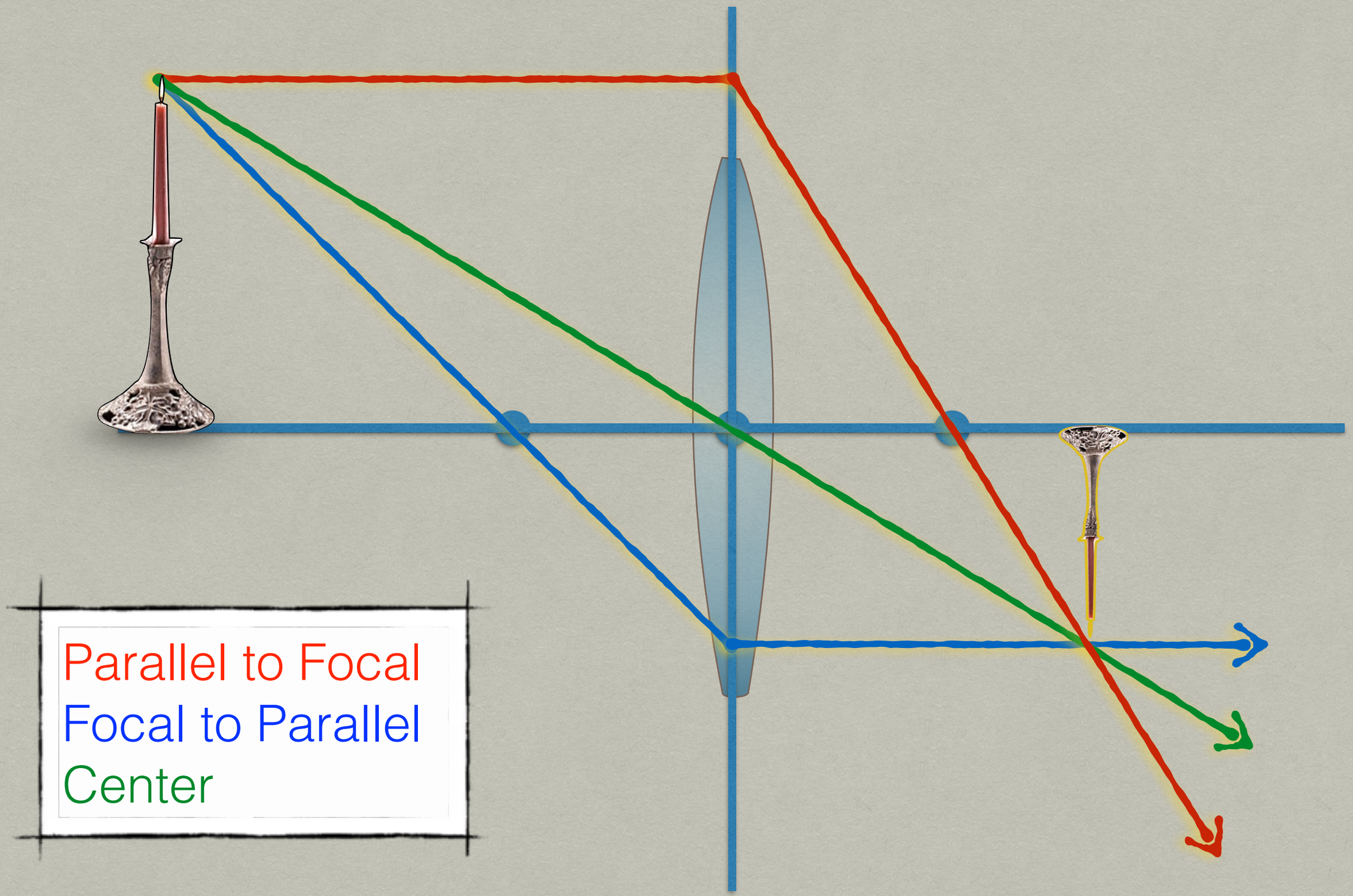
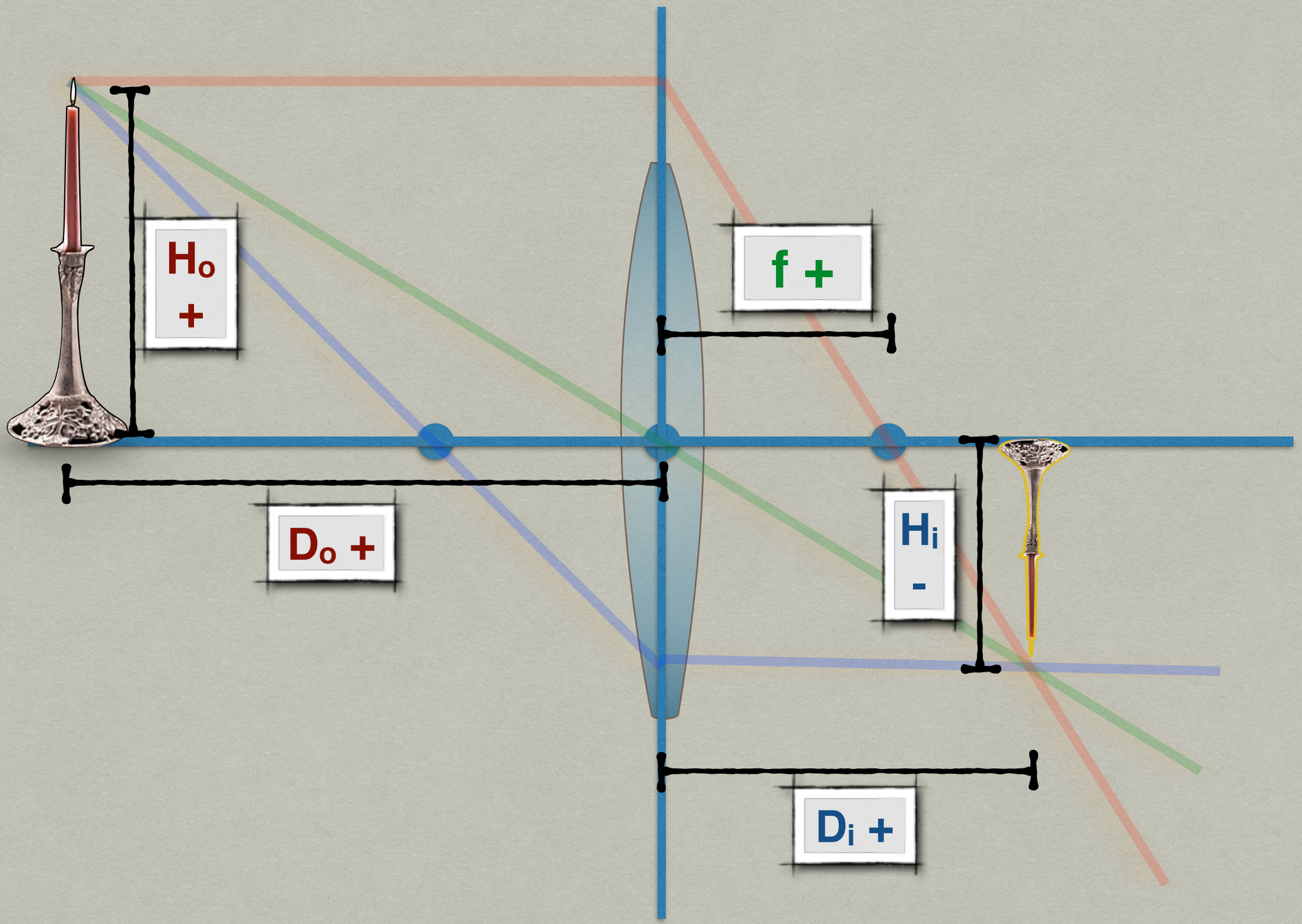
Ray Diagram:
Converging Lens

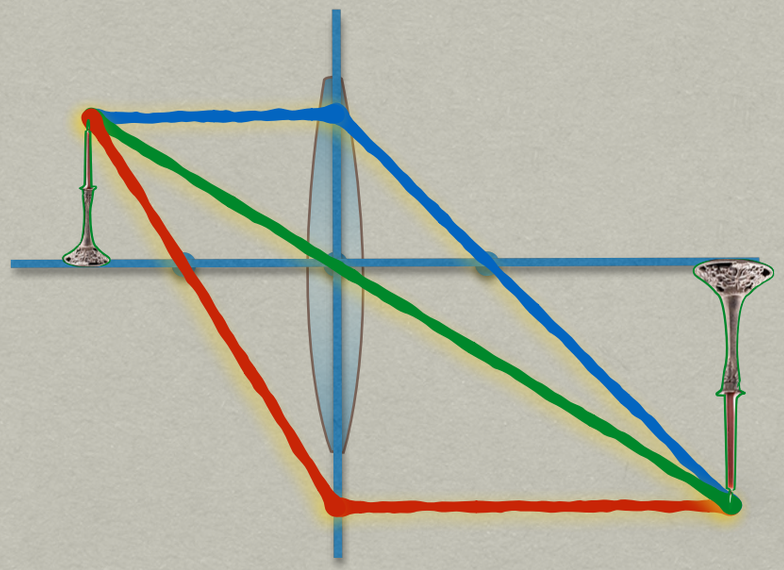


The primary focal point is on the opposite side to the object

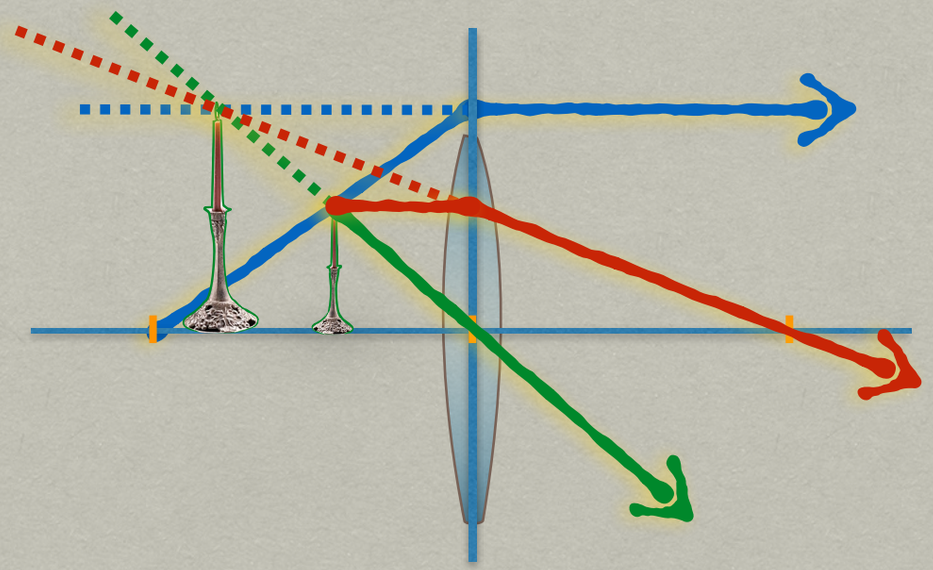
Measurements:
Converging Lens



Still to Come..



If the object is inside two focal lengths, the reverse occurs and thee magnification increases the size of the image



If the object is inside one focal length, a virtual image is formed and the magnification is positive

Equations

$$\frac{1}{f} = \frac{1}{D_i} + \frac{1}{D_o}$$

$$M = \frac{H_i}{H_o} = -\frac{D_i}{D_o}$$

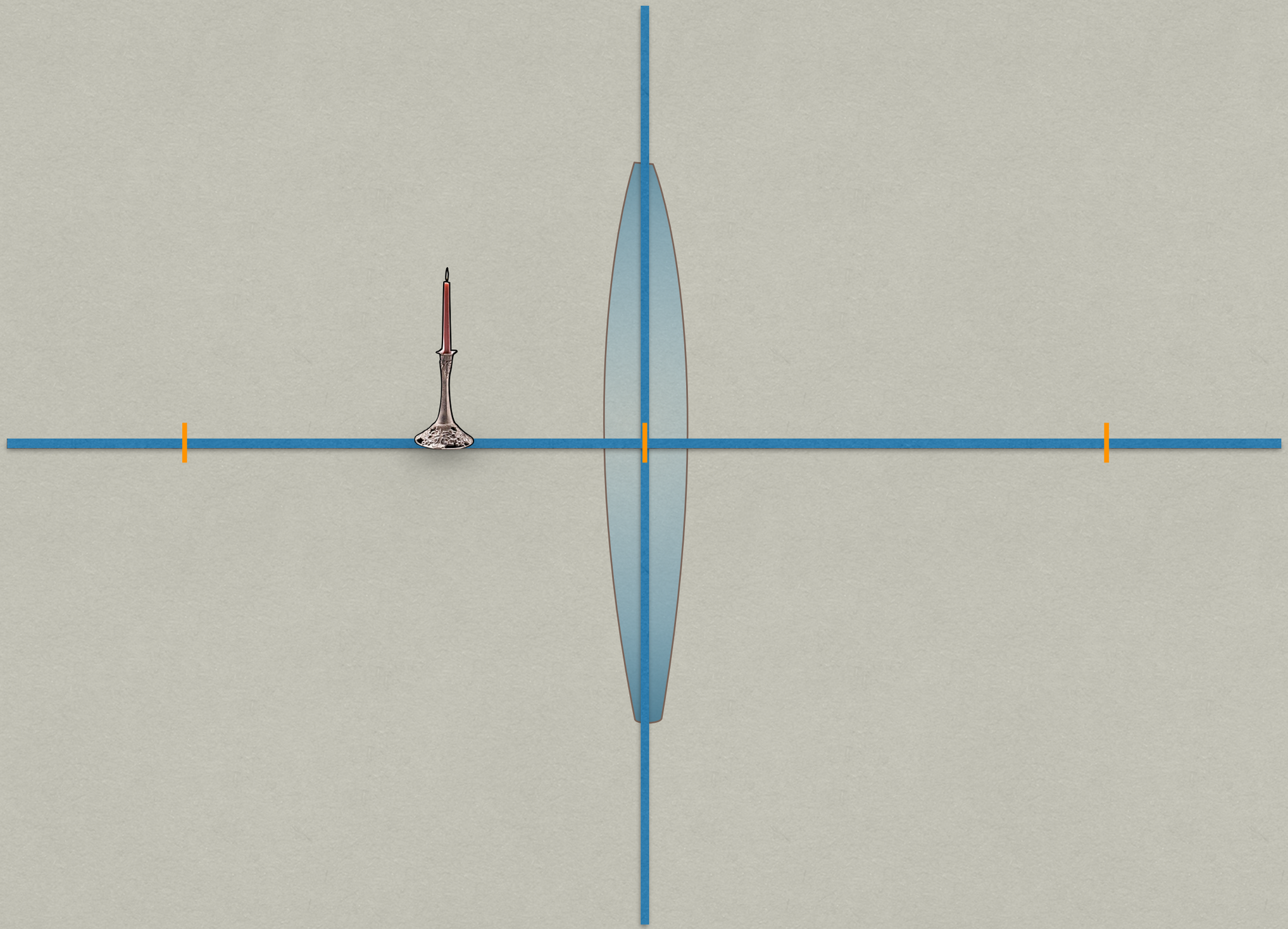
Equations

A 5 cm tall candle is placed 6 cm from a converging lens with a focal length of 30 cm.

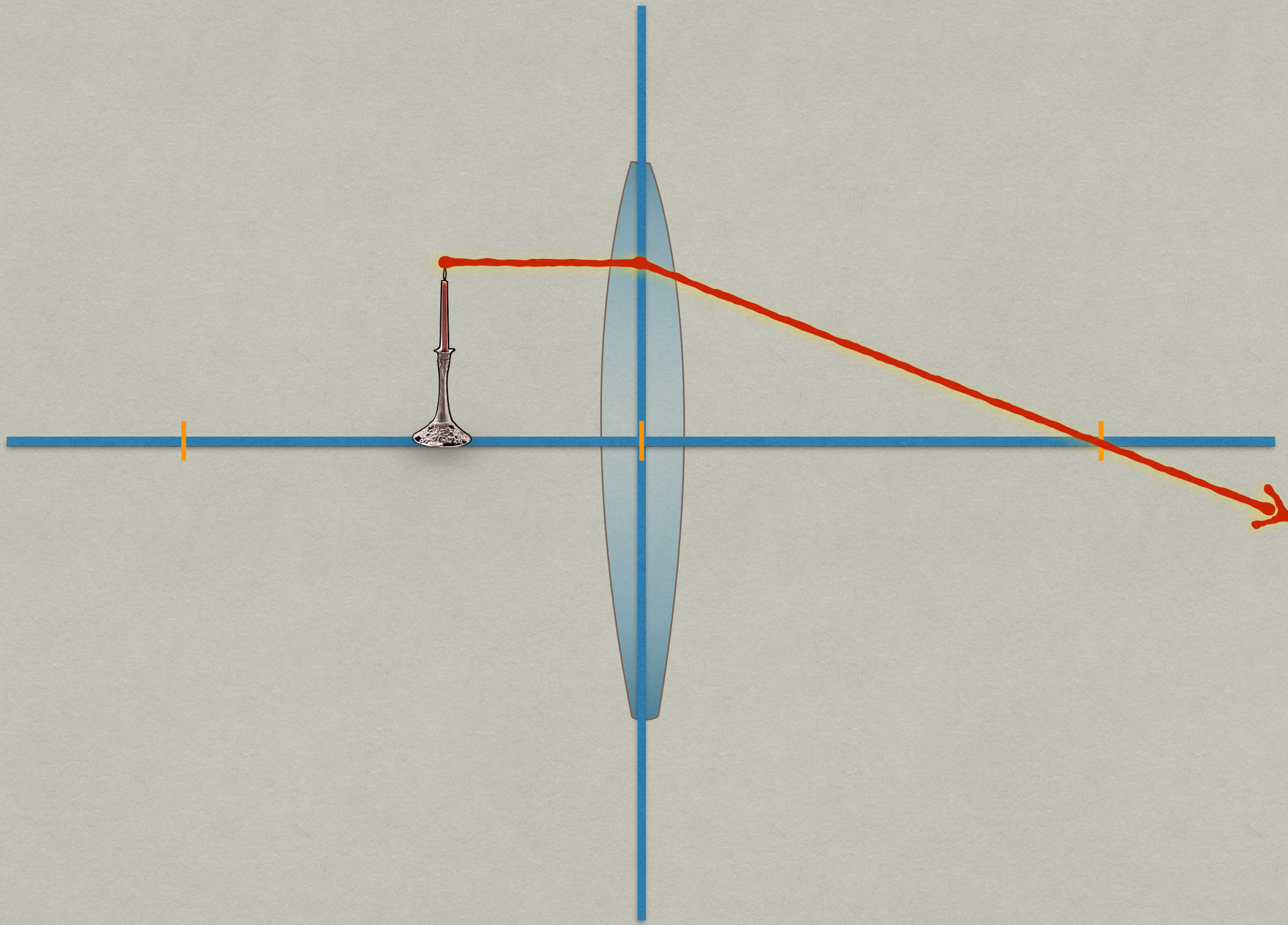
Where is the image formed?

What is the height of the image?

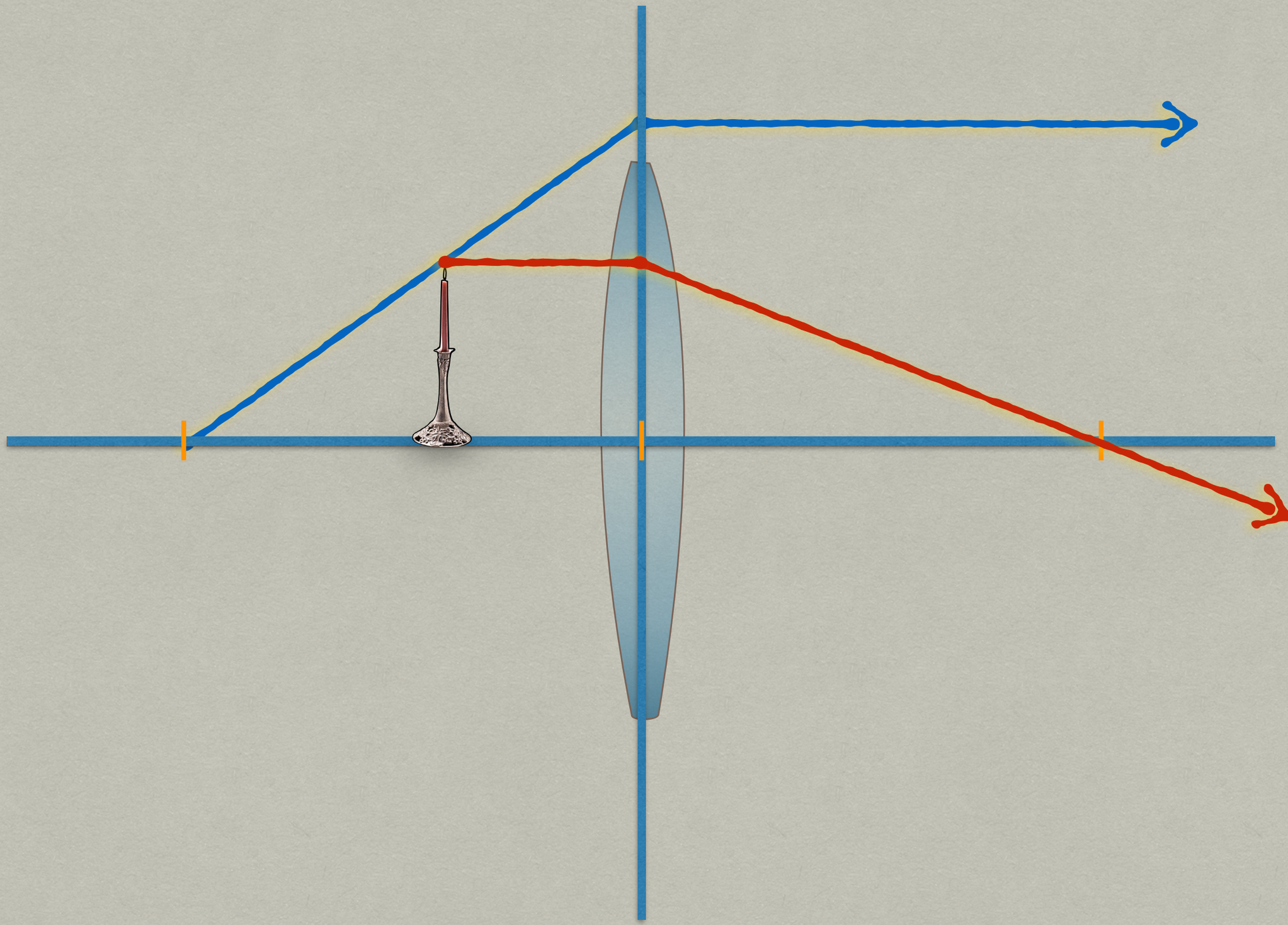
Ray Diagram:
Converging Lens



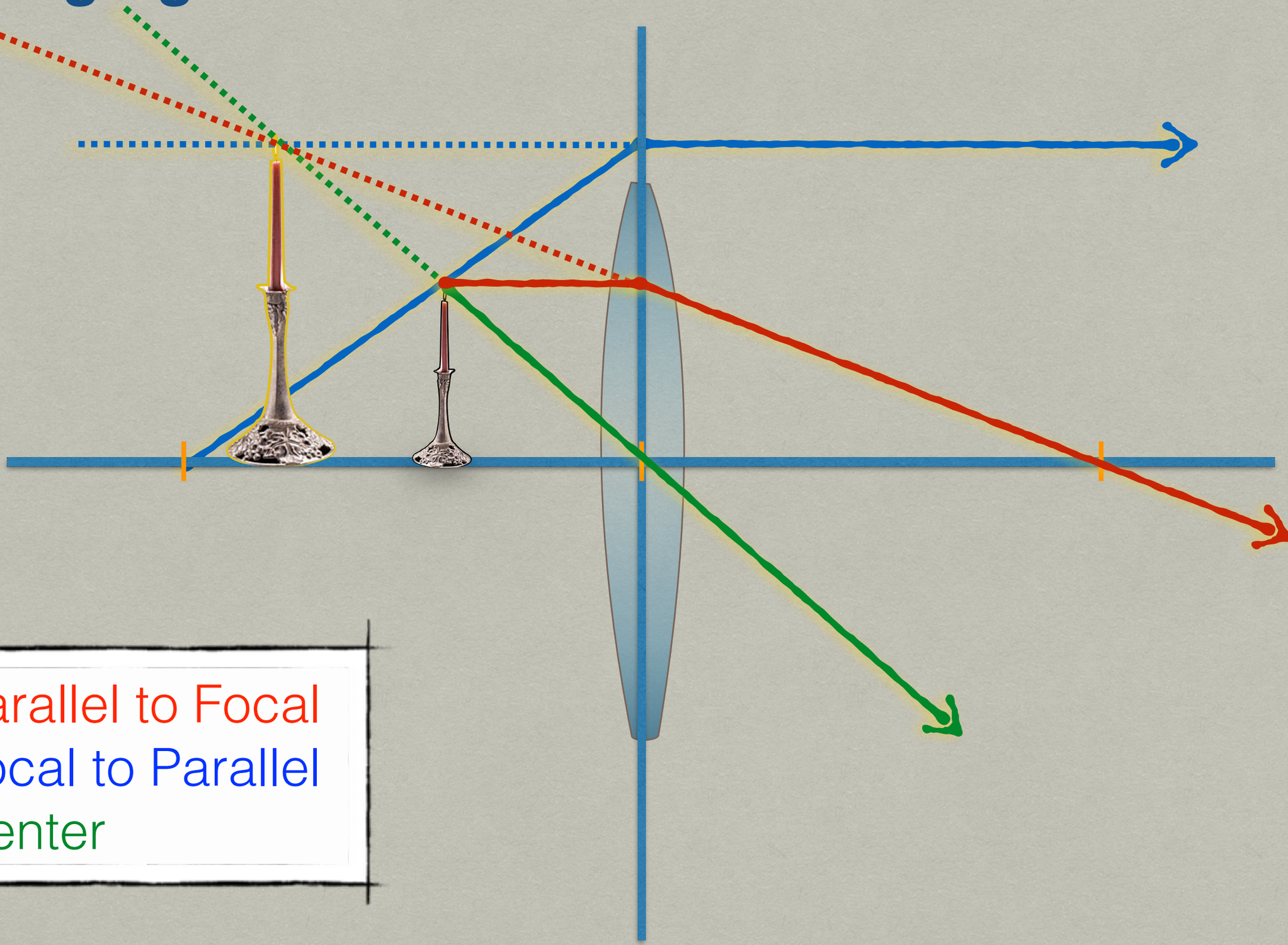
Ray Diagram: Converging Lens



Ray Diagram: Converging Lens

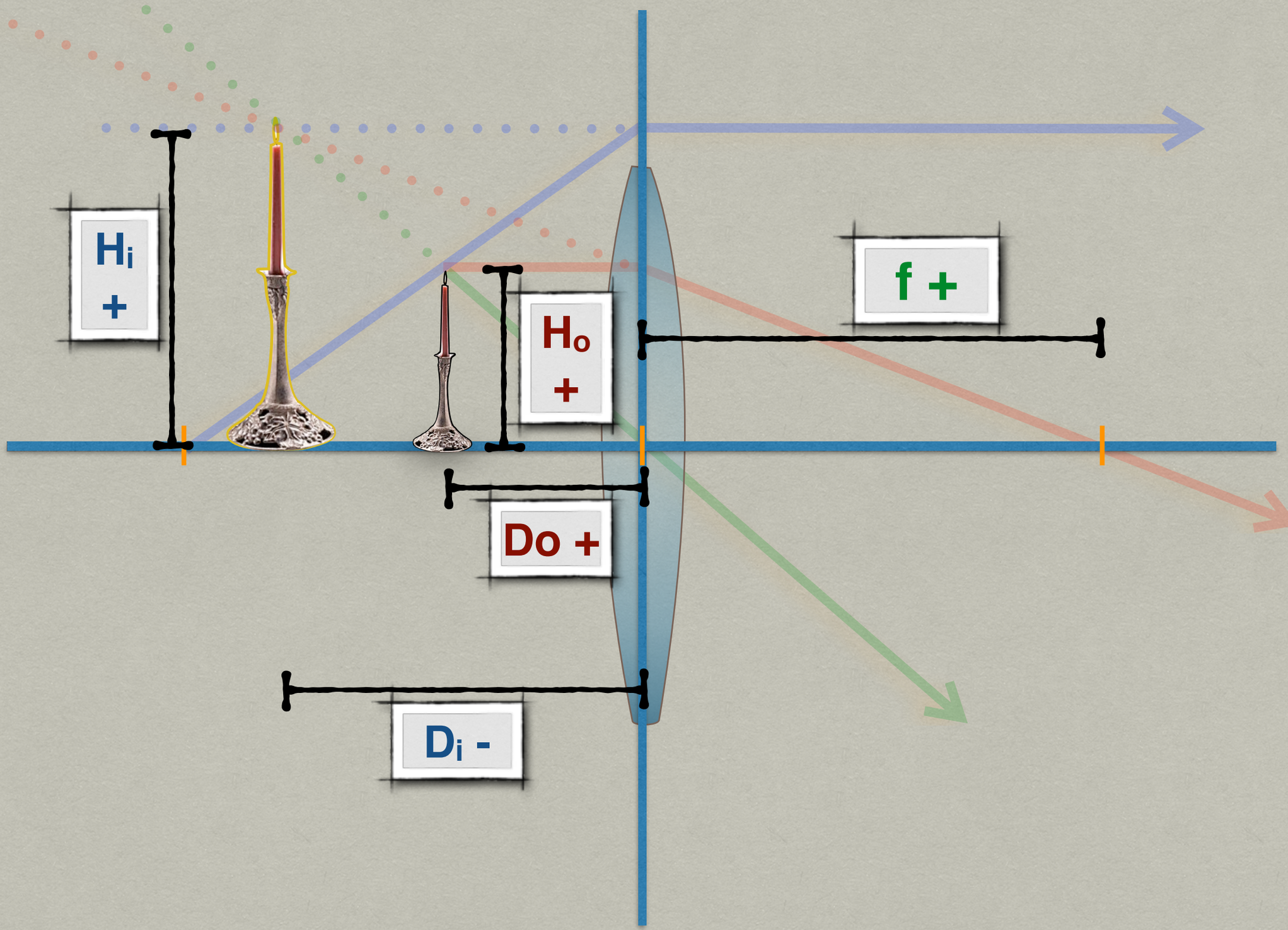


Ray Diagram: Converging Lens

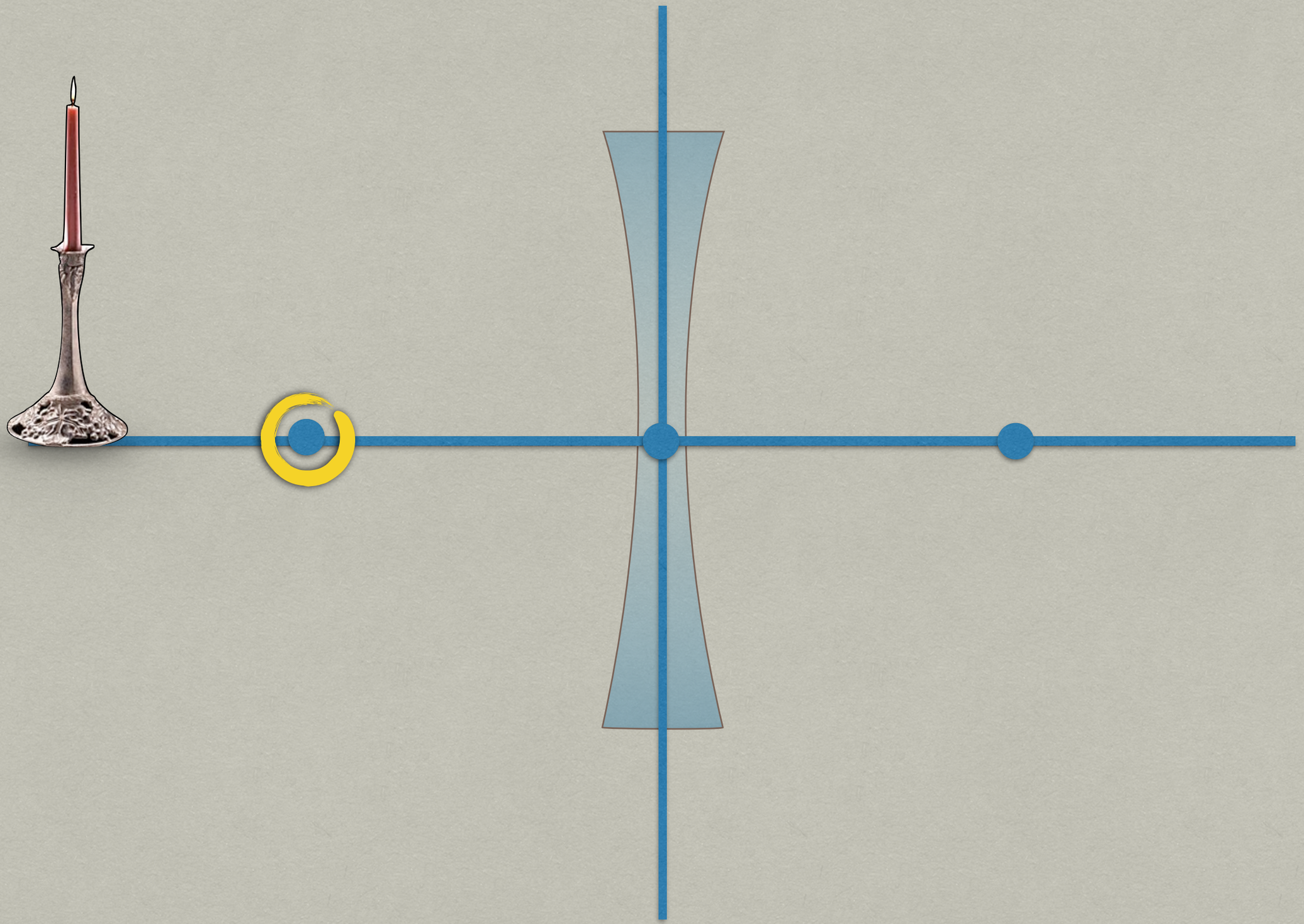


Parallel to Focal
Focal to Parallel
Center

Measurements:
Converging Lens

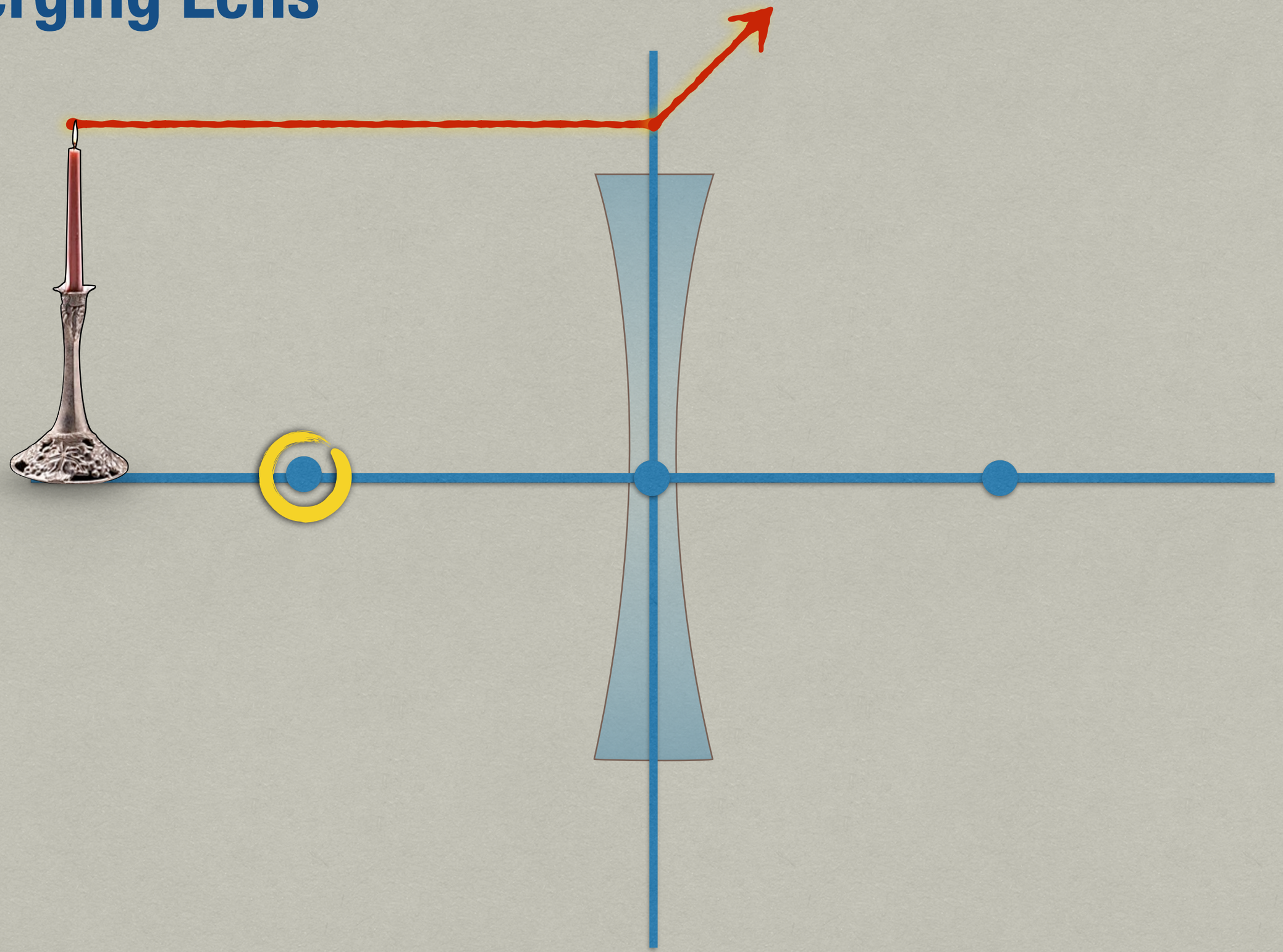


Ray Diagrams:
Diverging Lens



The primary focal point is on the same side as the object

Ray Diagrams:
Diverging Lens



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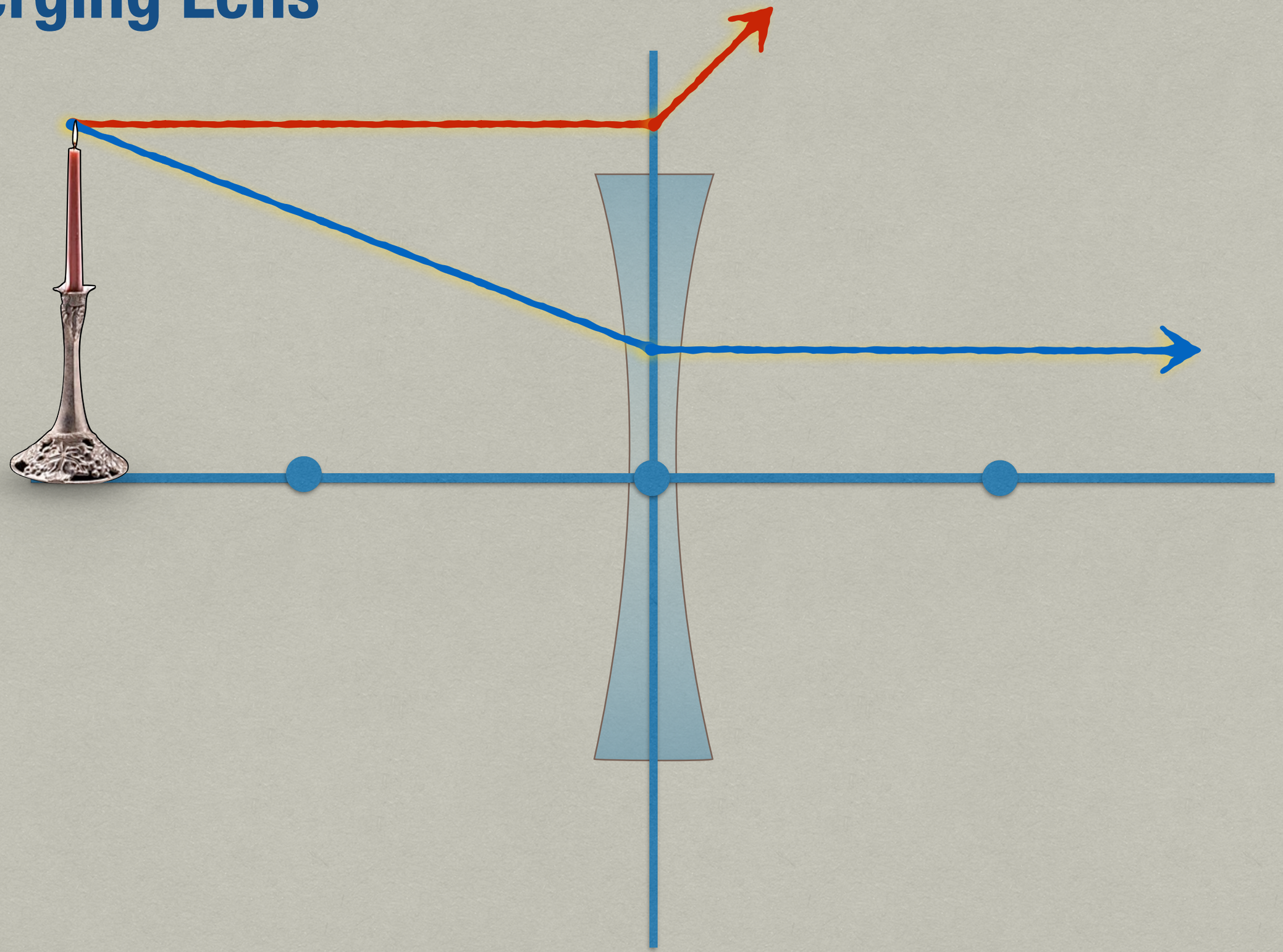
Ray Diagrams:
Diverging Lens



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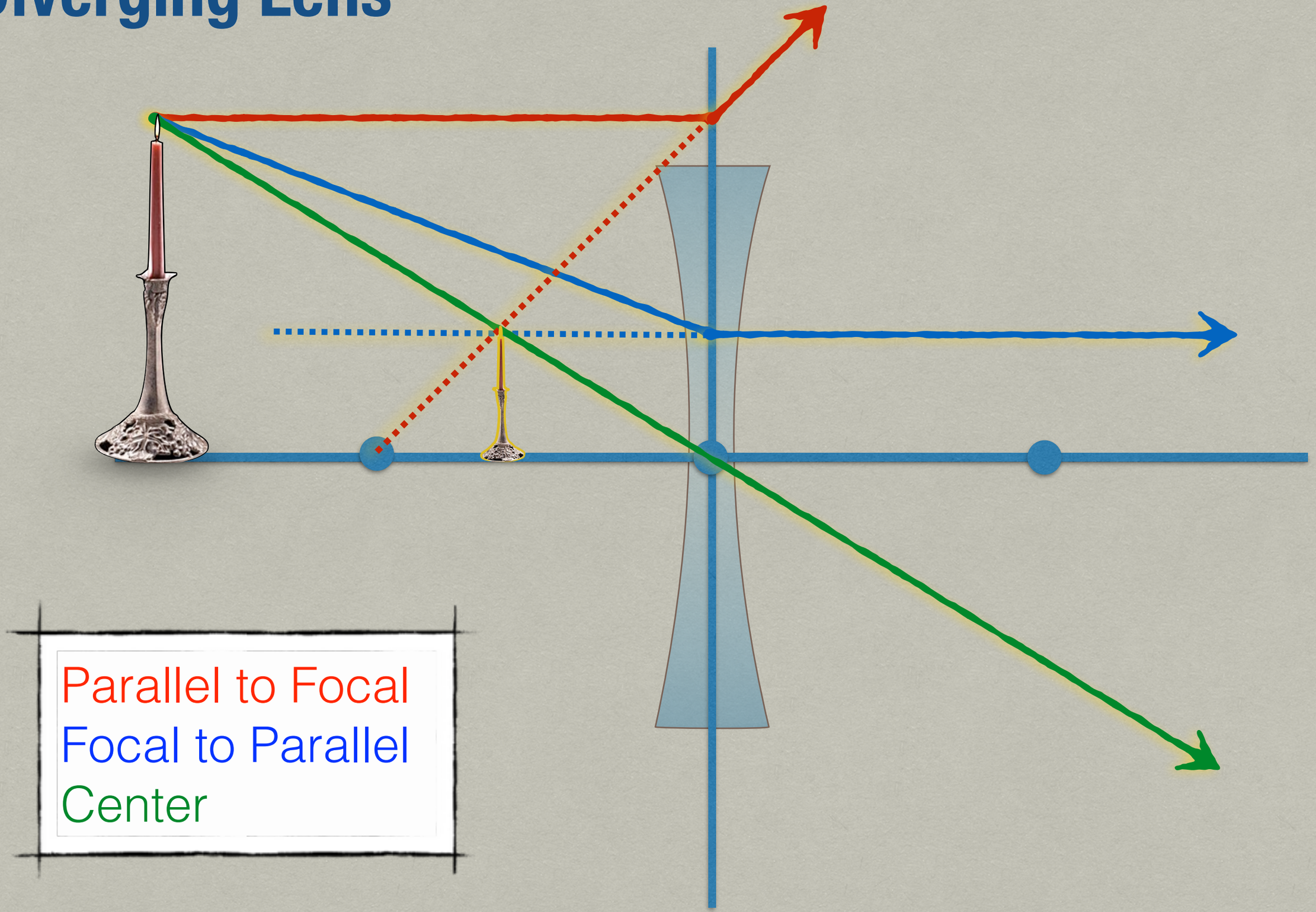
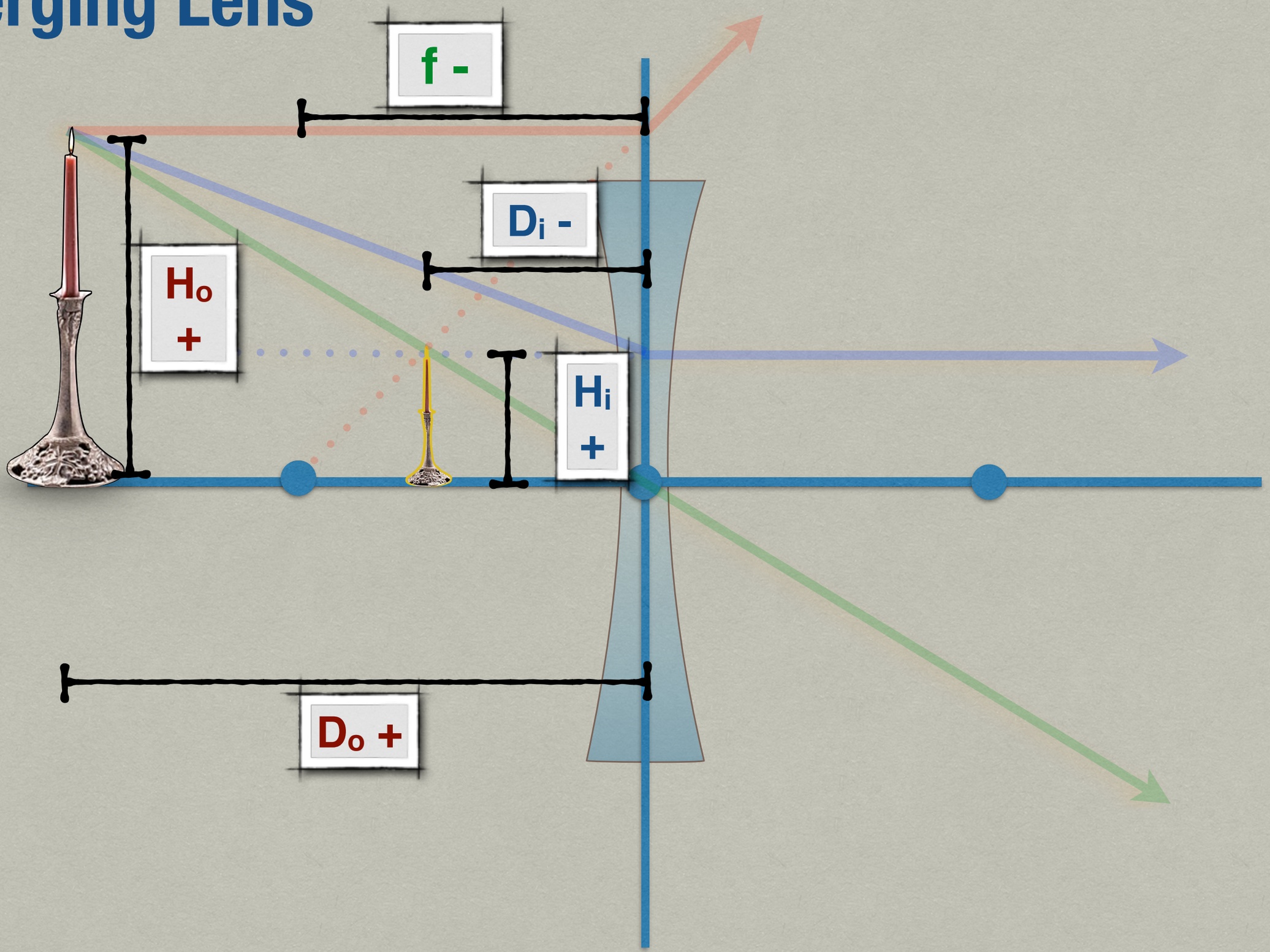
Ray Diagrams:
Diverging Lens



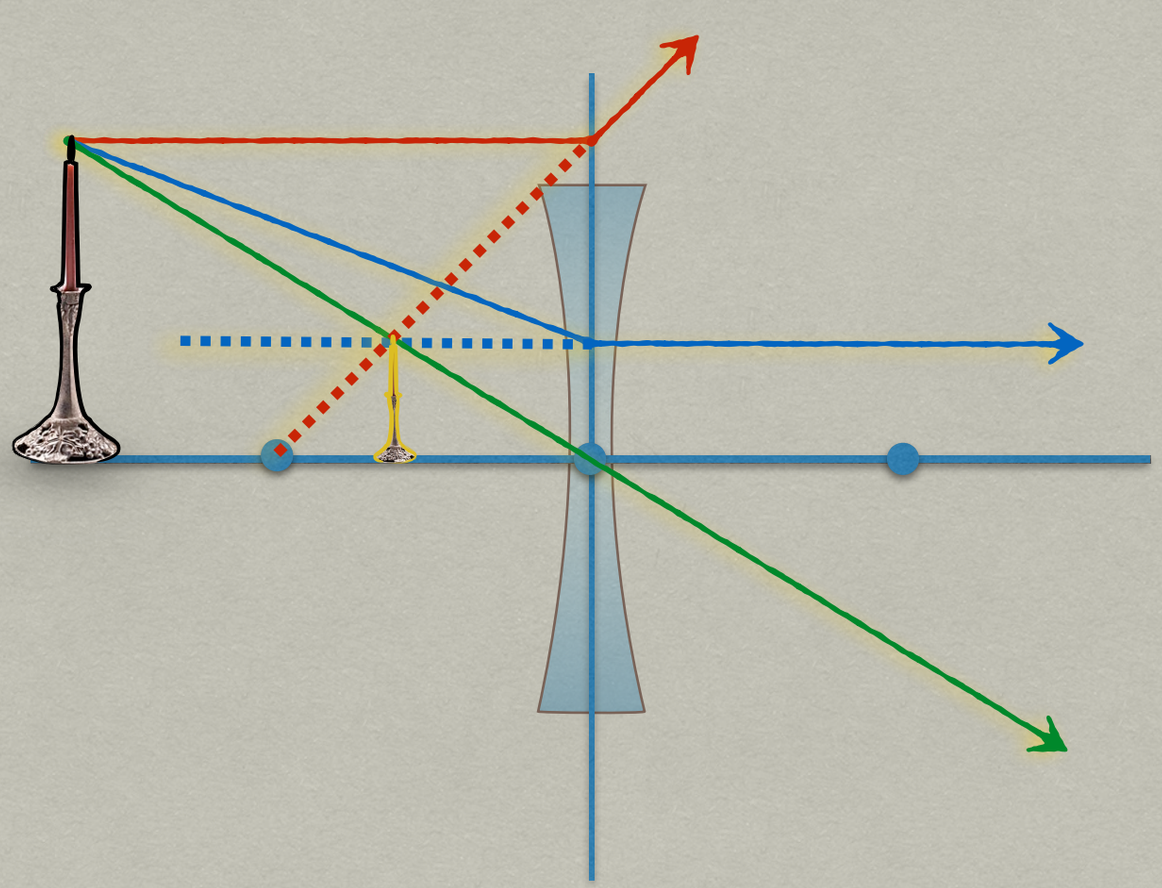
Parallel to Focal
Focal to Parallel
Center

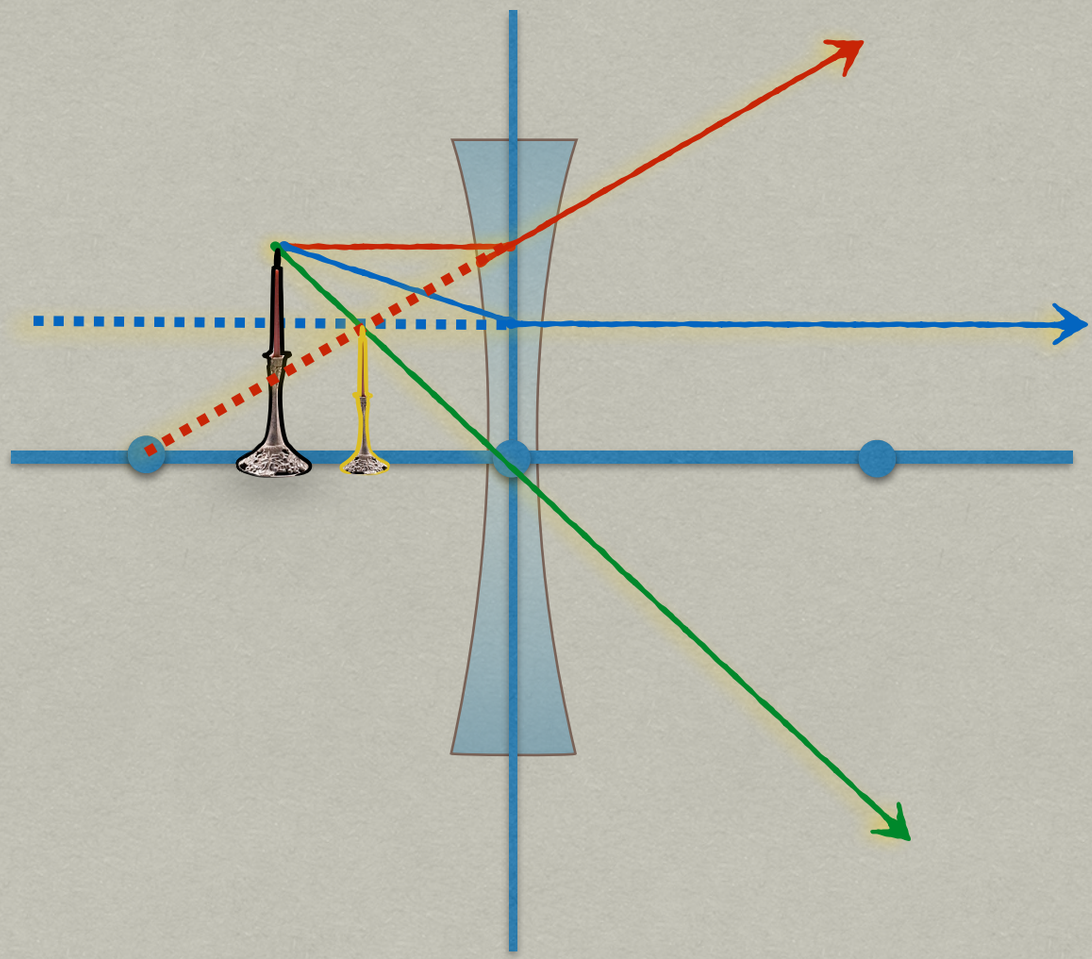
The primary focal point is on the same side as the object

Measurements: Diverging Lens



Ray Diagrams:
Diverging Lens



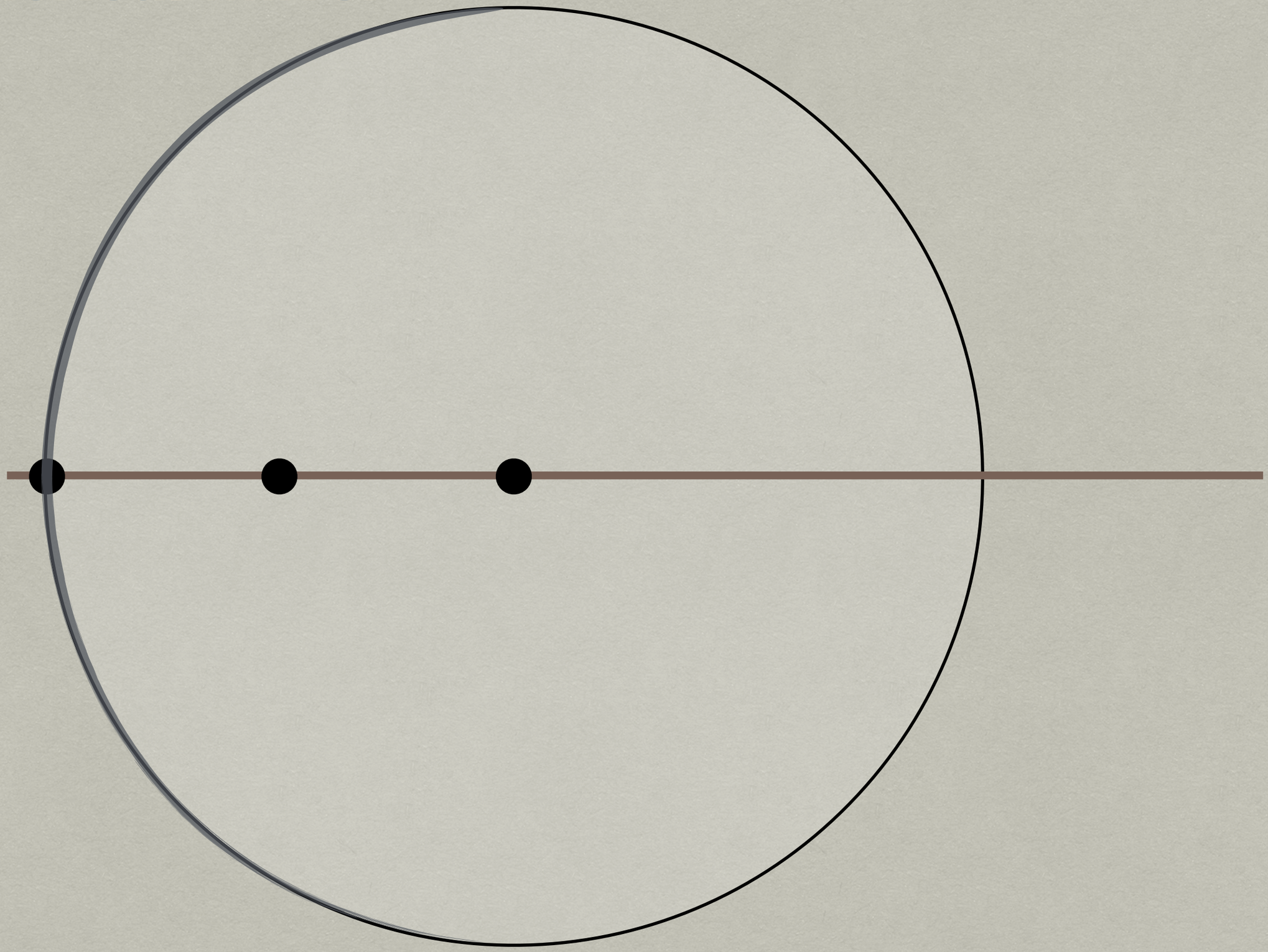


the image is similar with the object on either side of the focal point

Spherical Mirrors

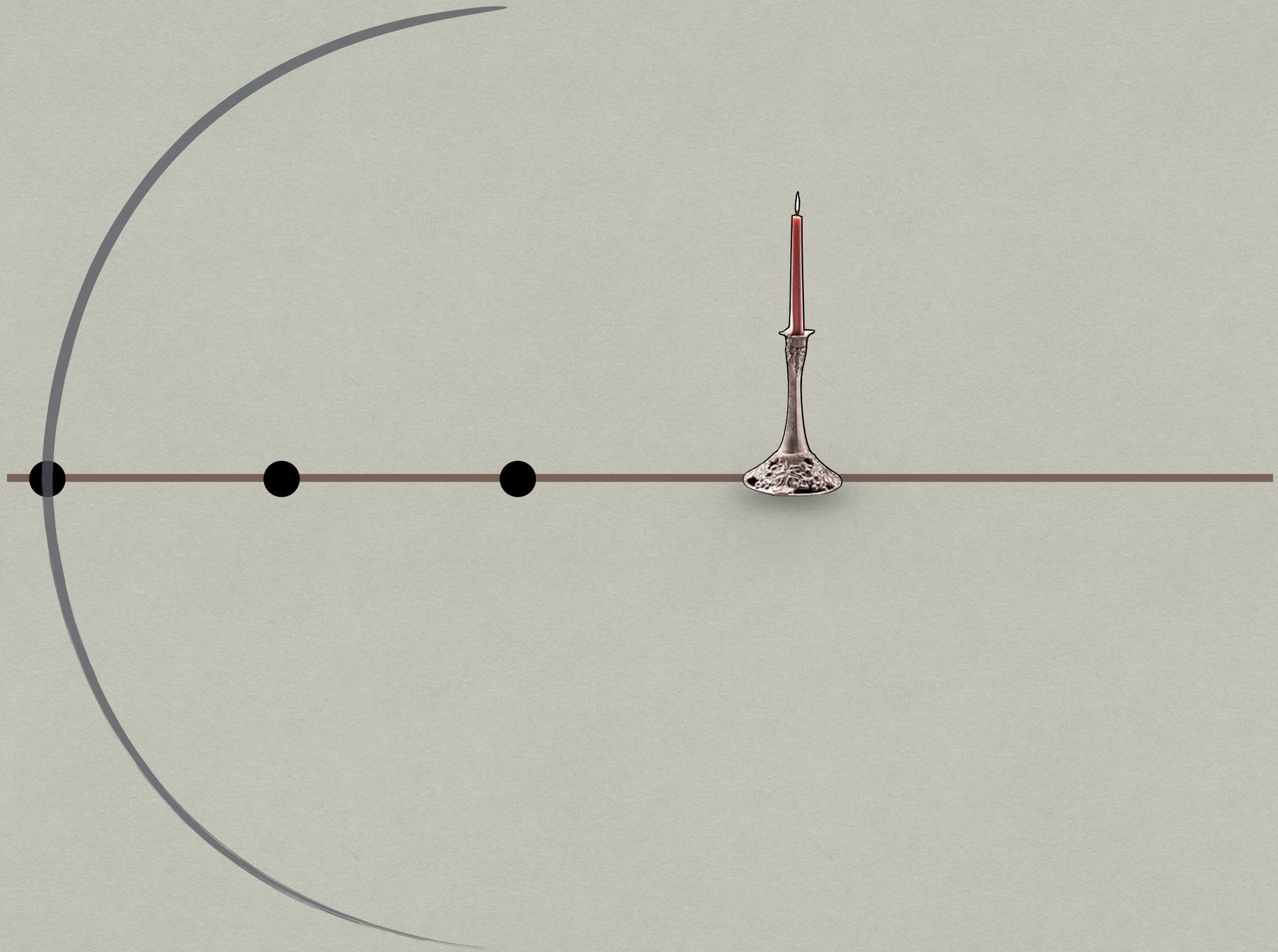
$$f = \frac{r}{2}$$

Ray Diagram: Spherical Mirror



There is only one focal point, halfway between the mirror and the center.

Ray Diagram: Spherical Mirror



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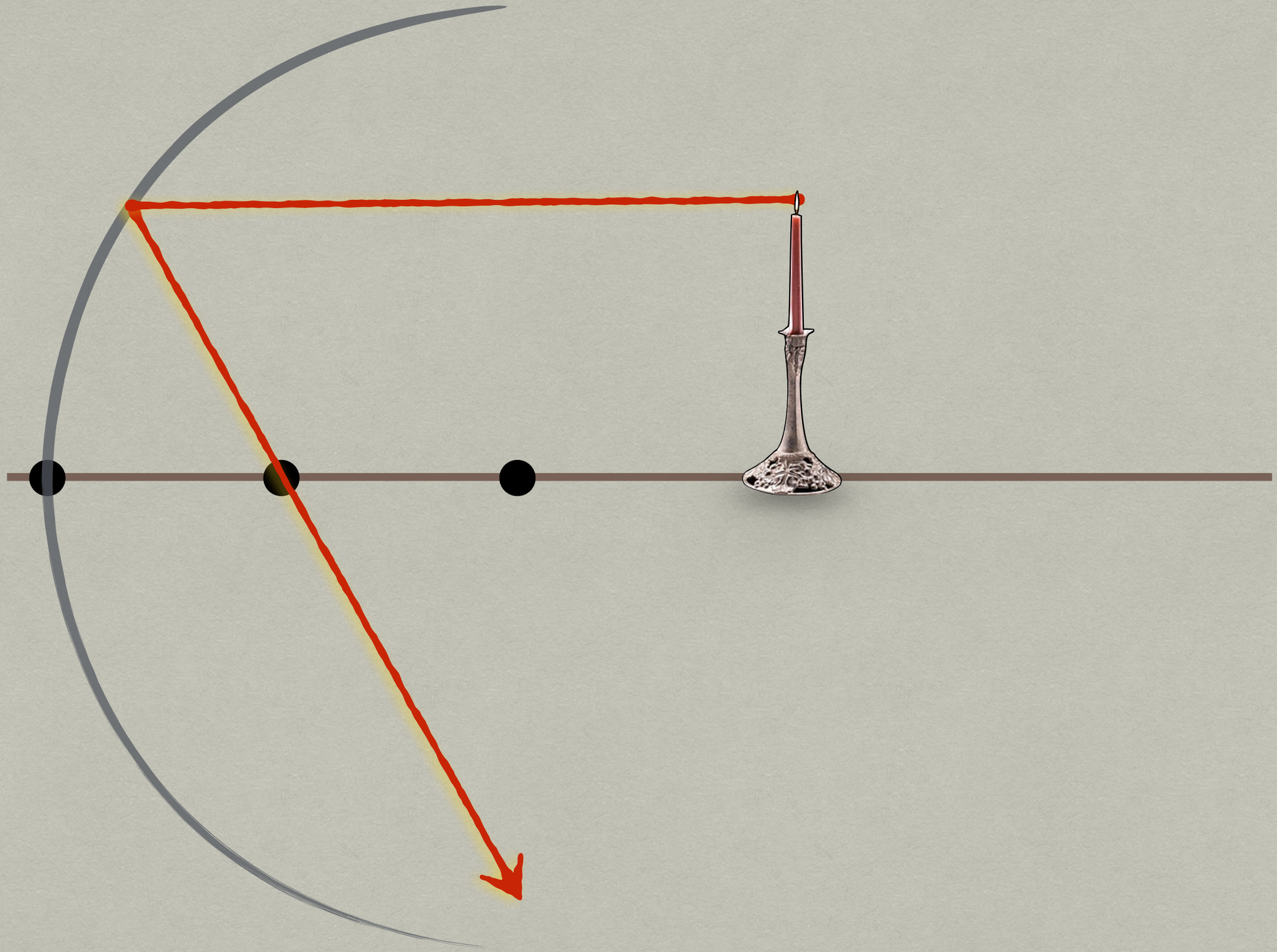
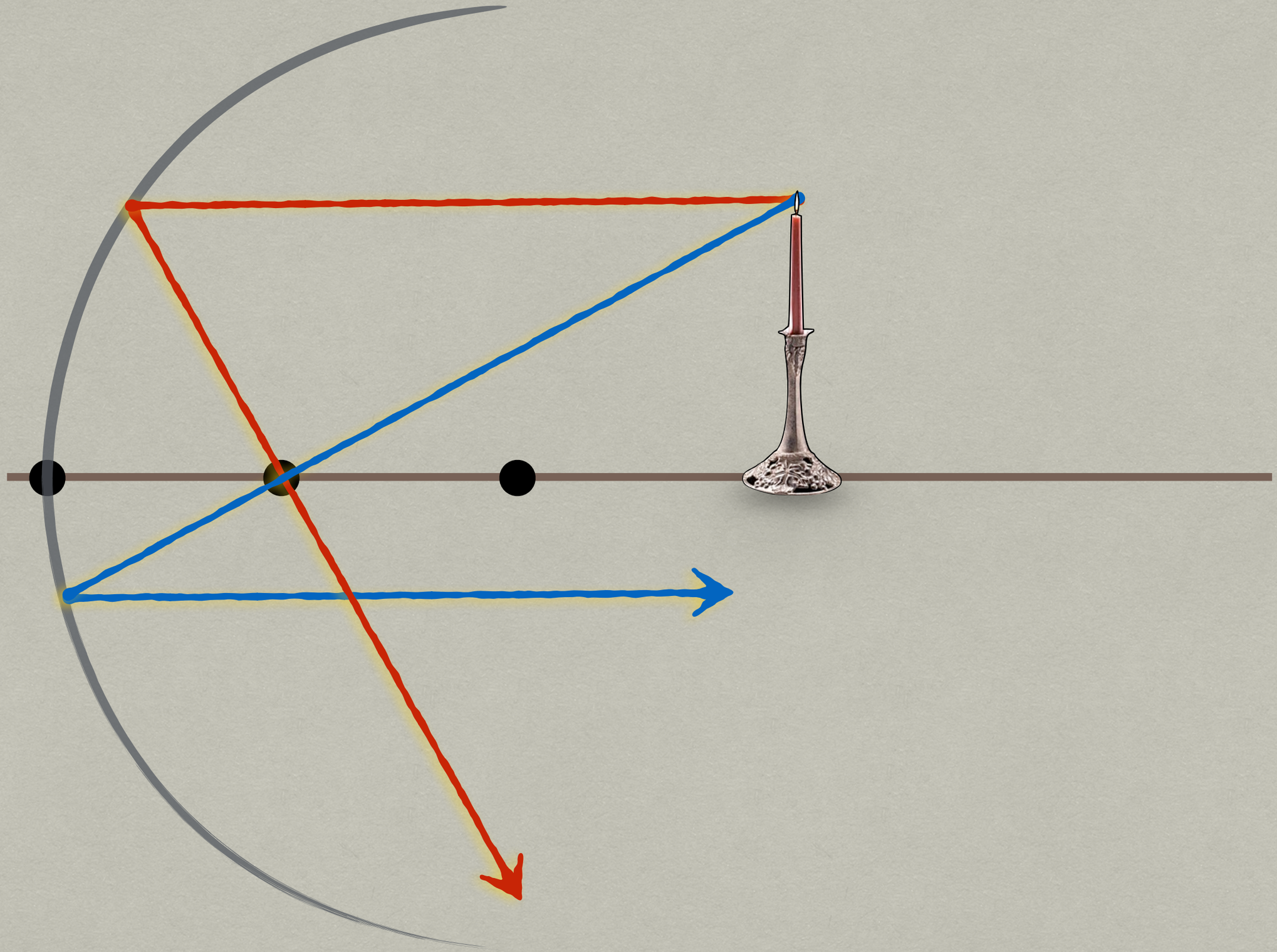
Ray Diagram: Spherical Mirror



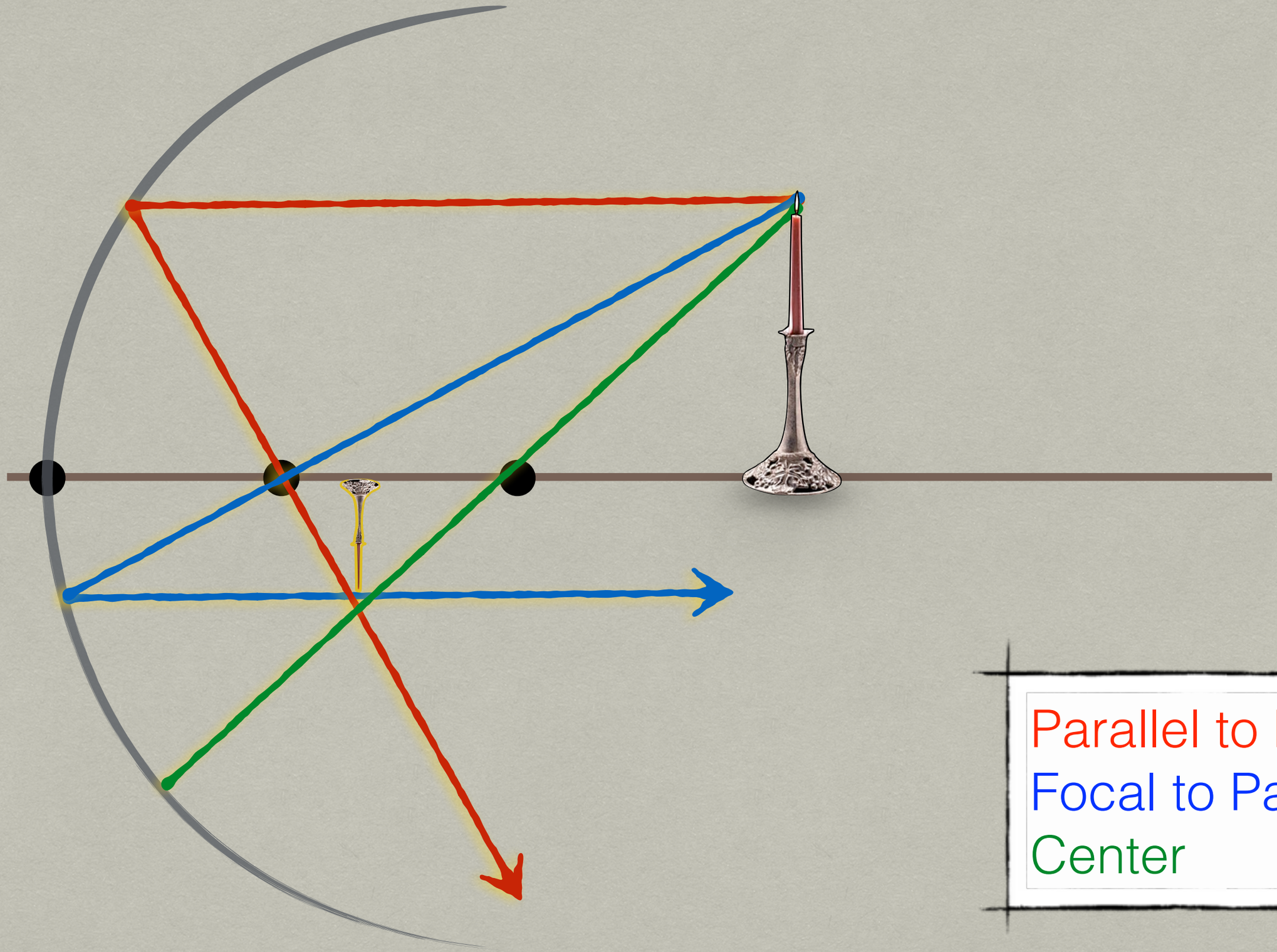
There is only one focal point, halfway between the mirror and the center.

Ray Diagram: Spherical Mirror



There is only one focal point, halfway between the mirror and the center.

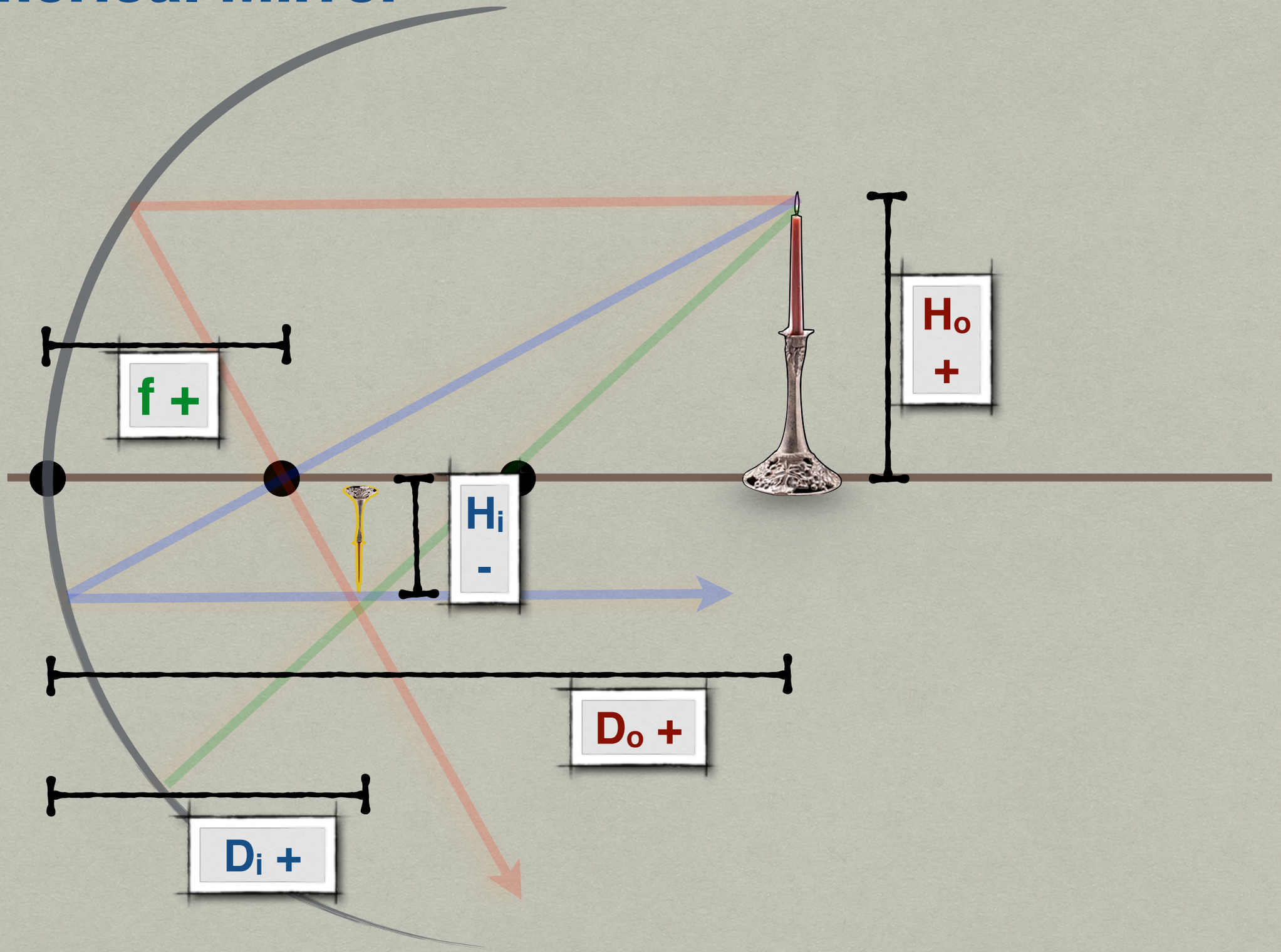
Ray Diagram:
Spherical Mirror



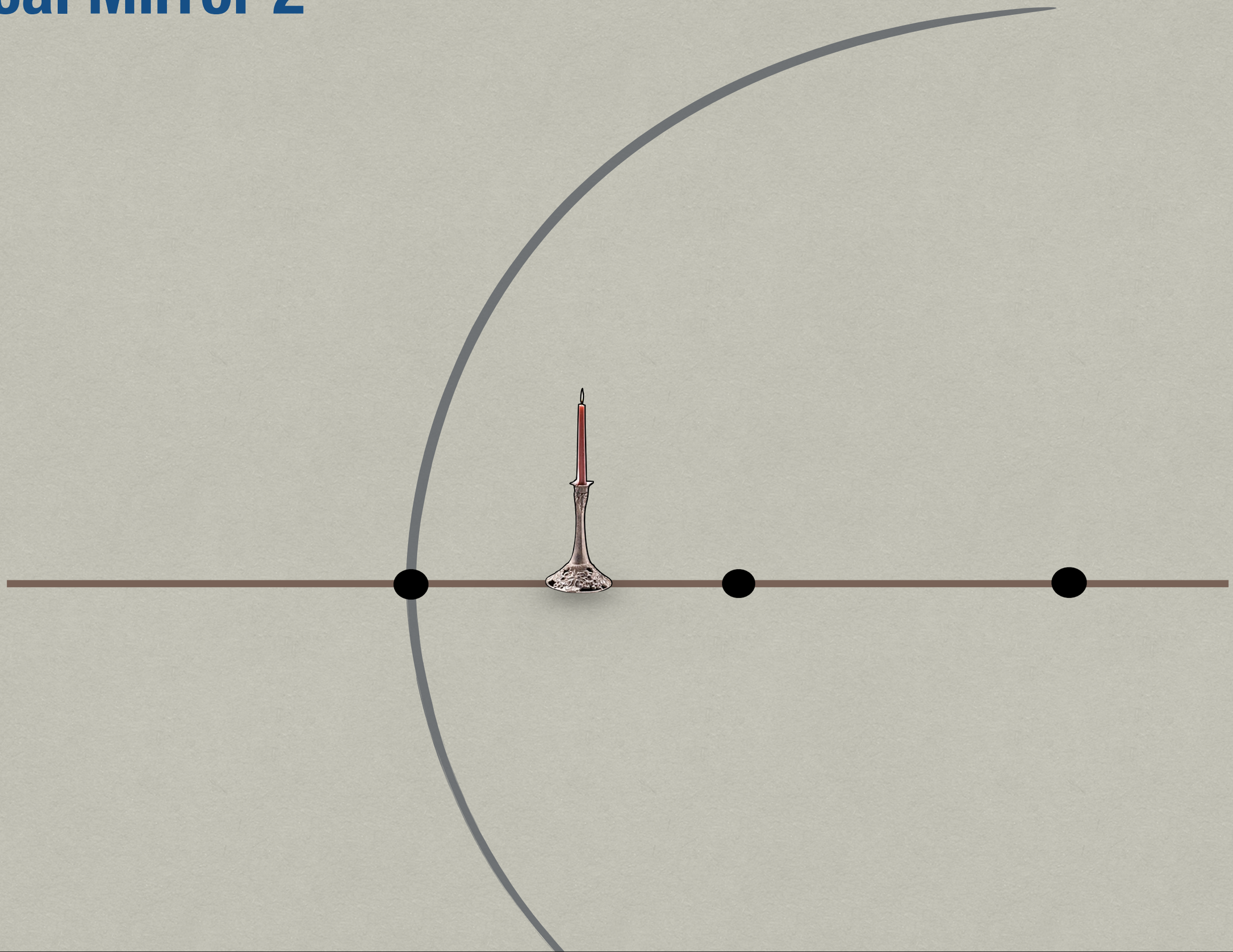
Parallel to Focal
Focal to Parallel
Center

There is only one focal point, halfway between the mirror and the center.

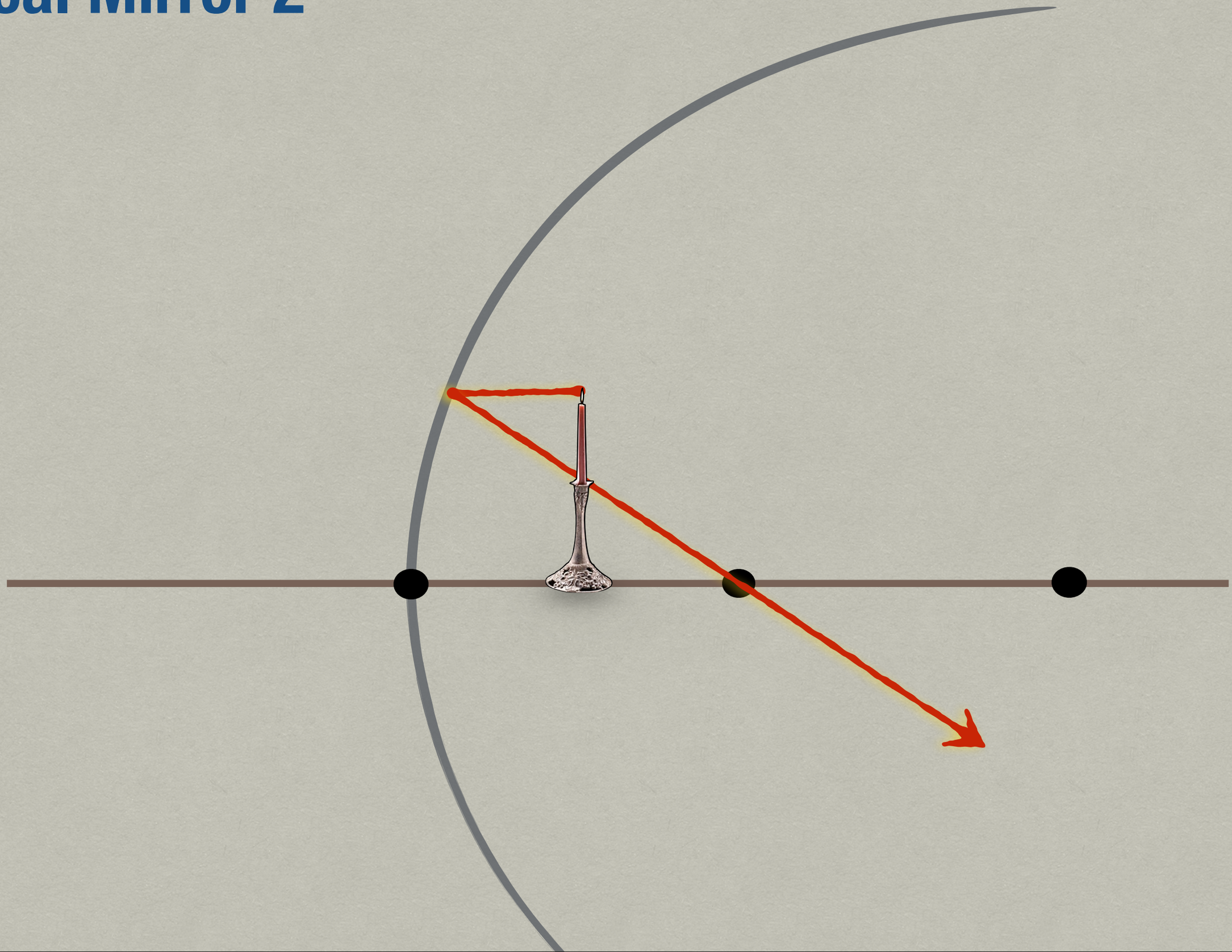
Measurements:
Spherical Mirror



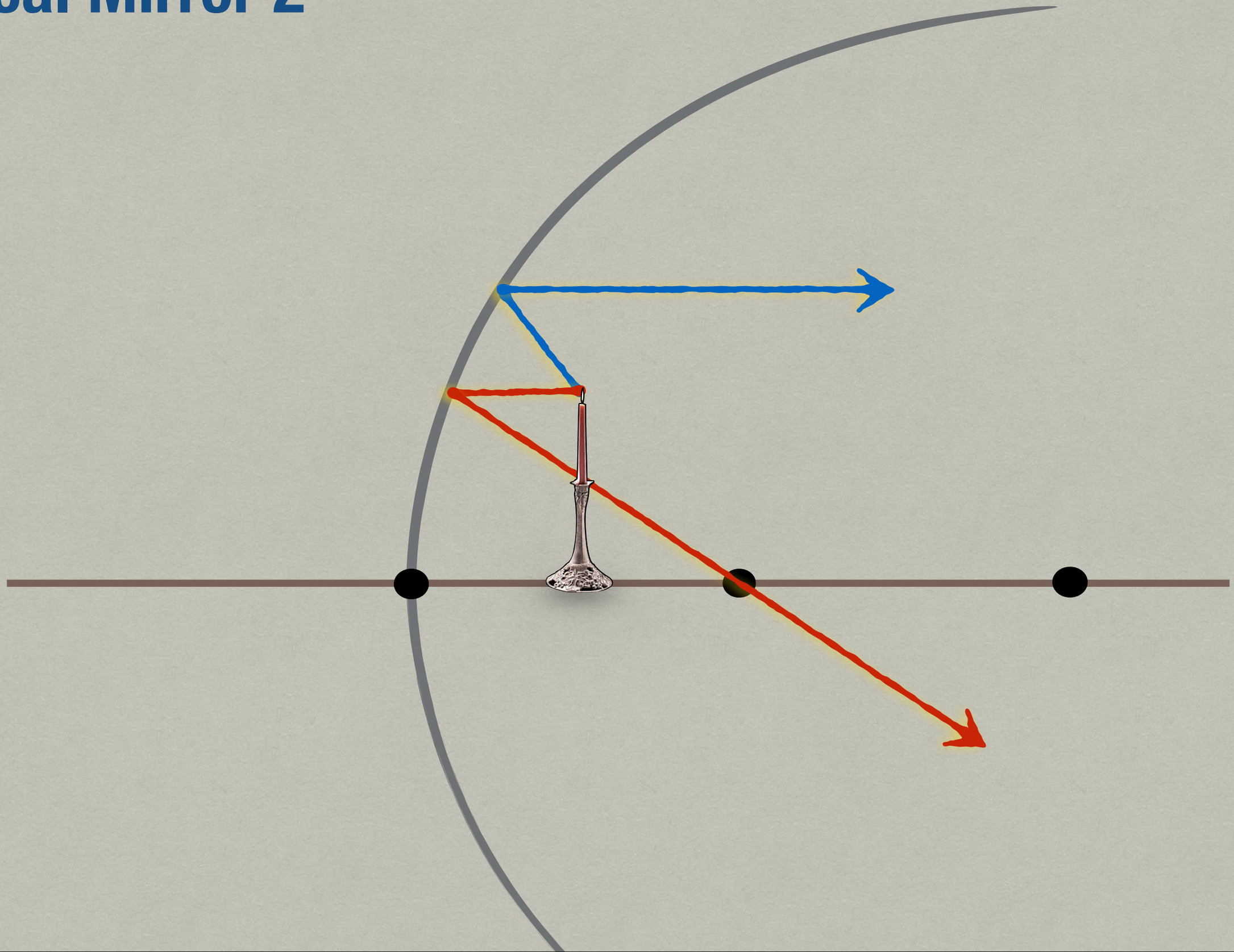
Ray Diagram: Spherical Mirror 2



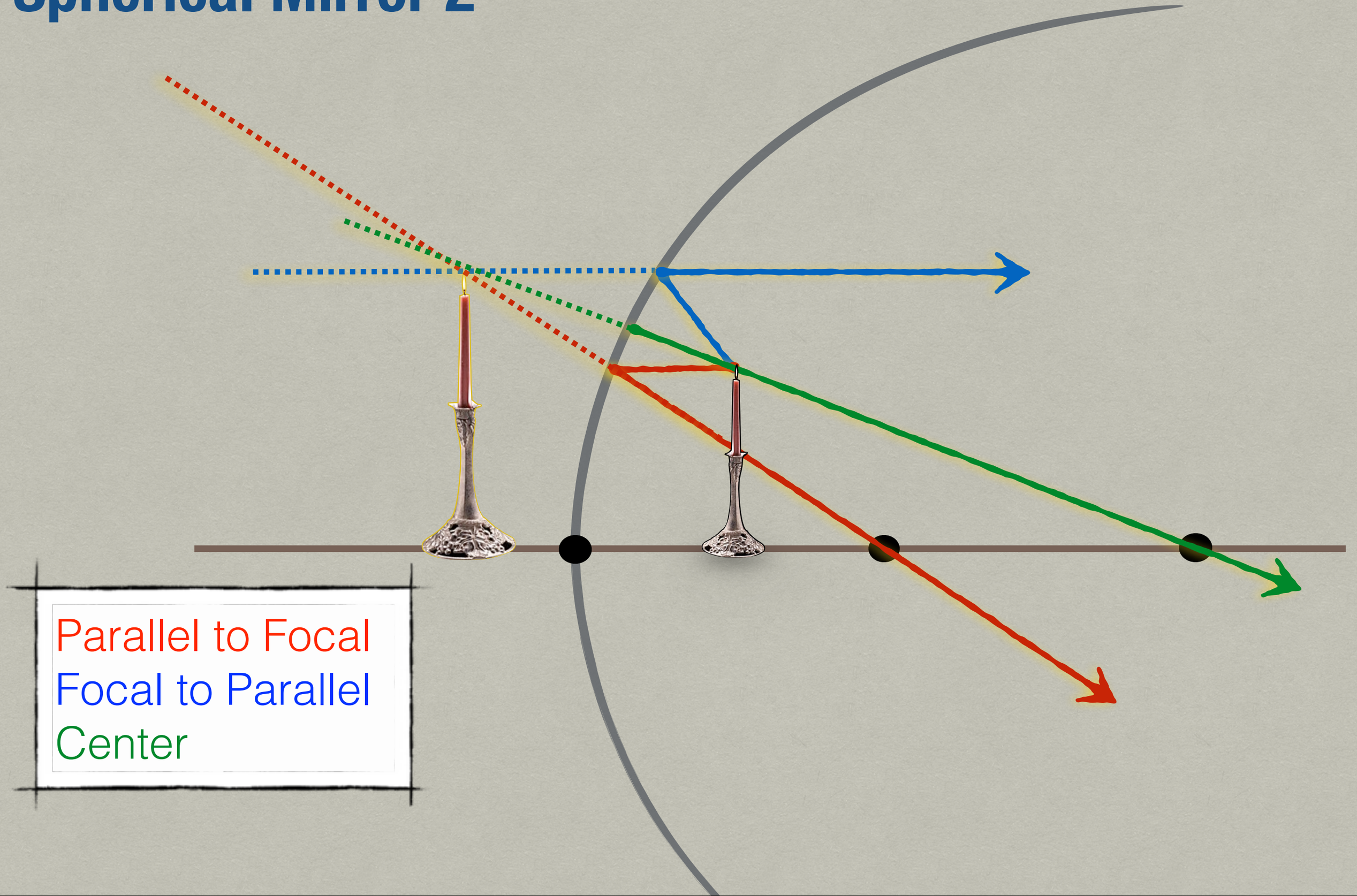
Ray Diagram: Spherical Mirror 2



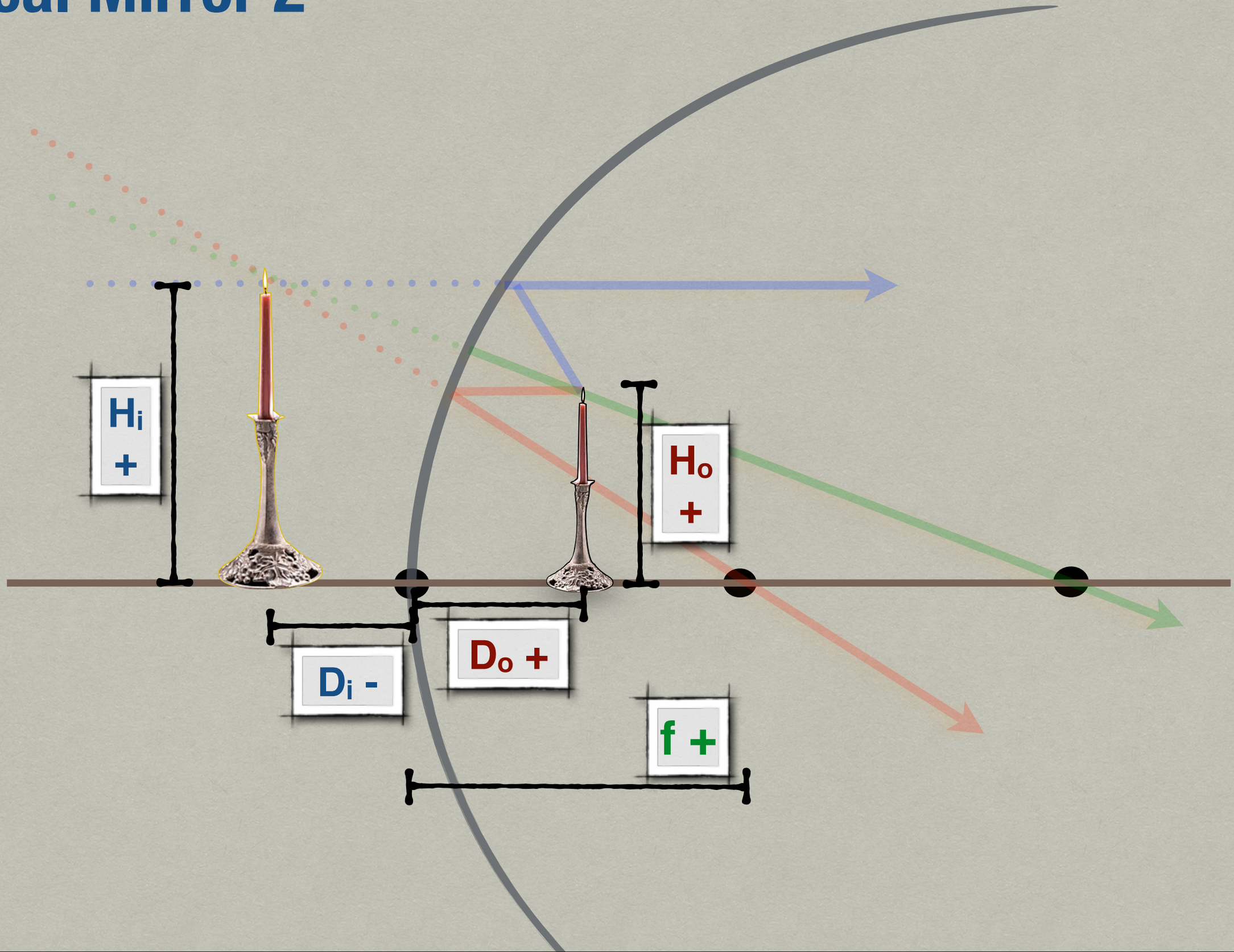
Ray Diagram: Spherical Mirror 2



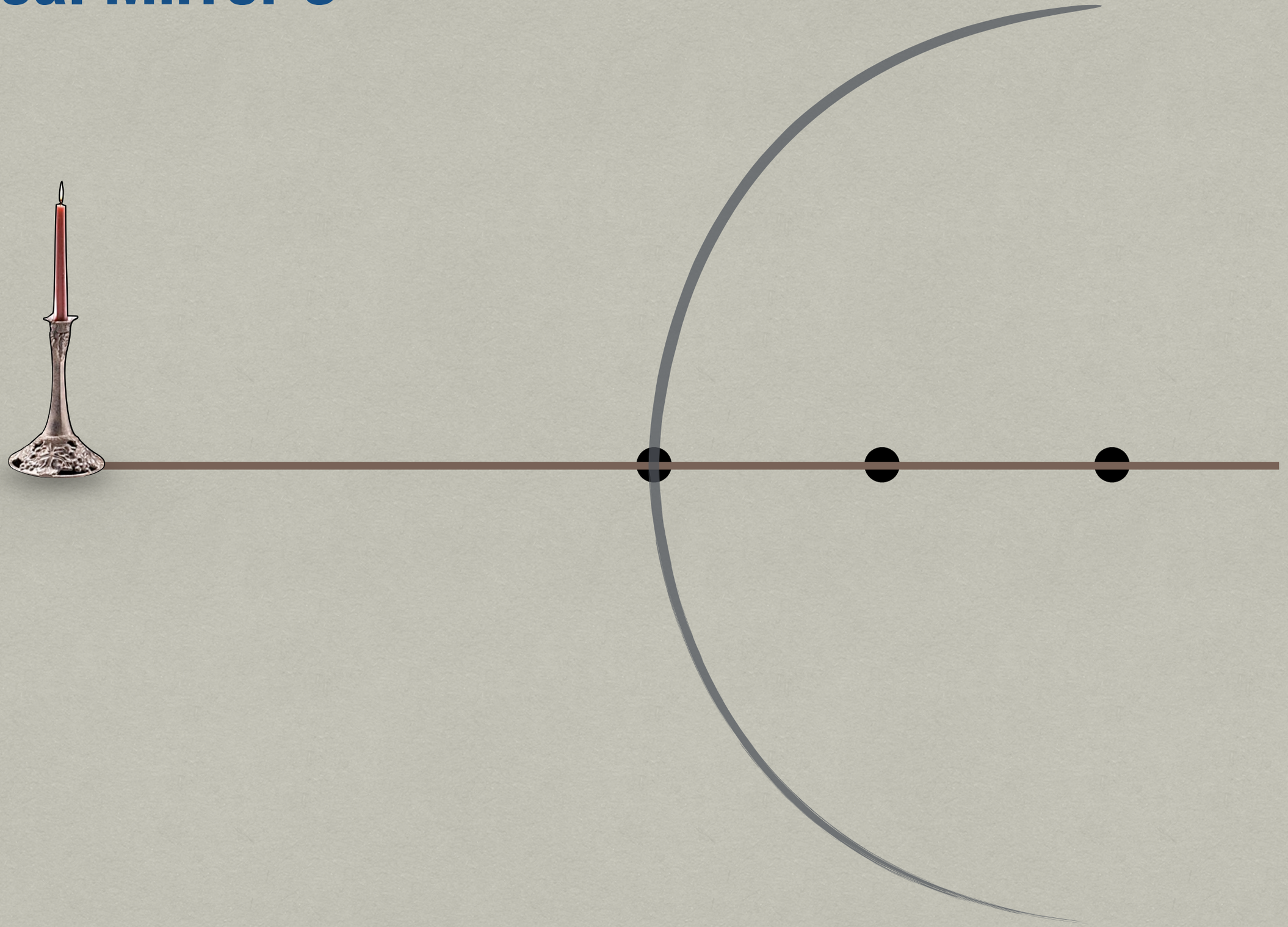
Ray Diagram: Spherical Mirror 2



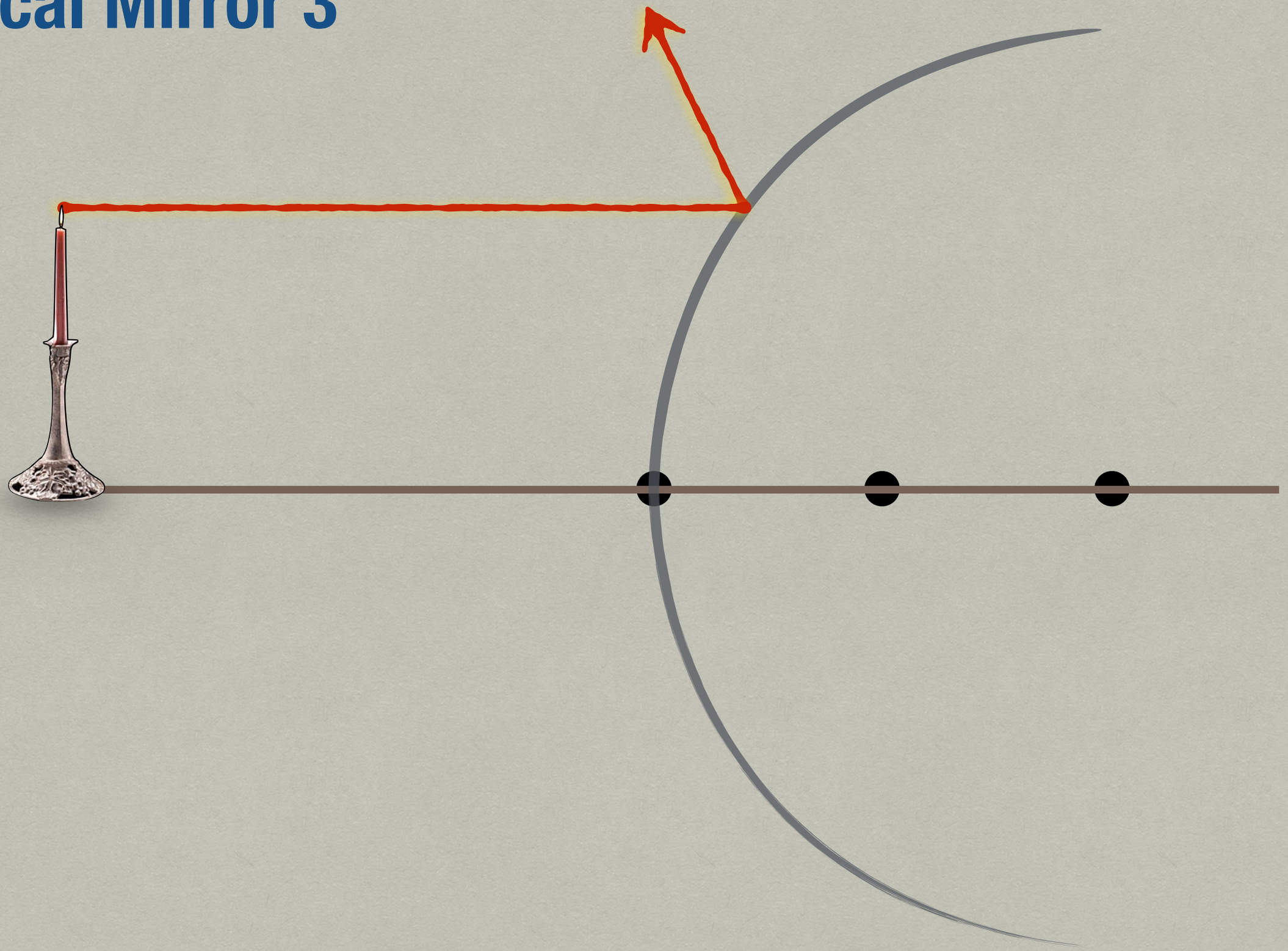
Measurement: Spherical Mirror 2



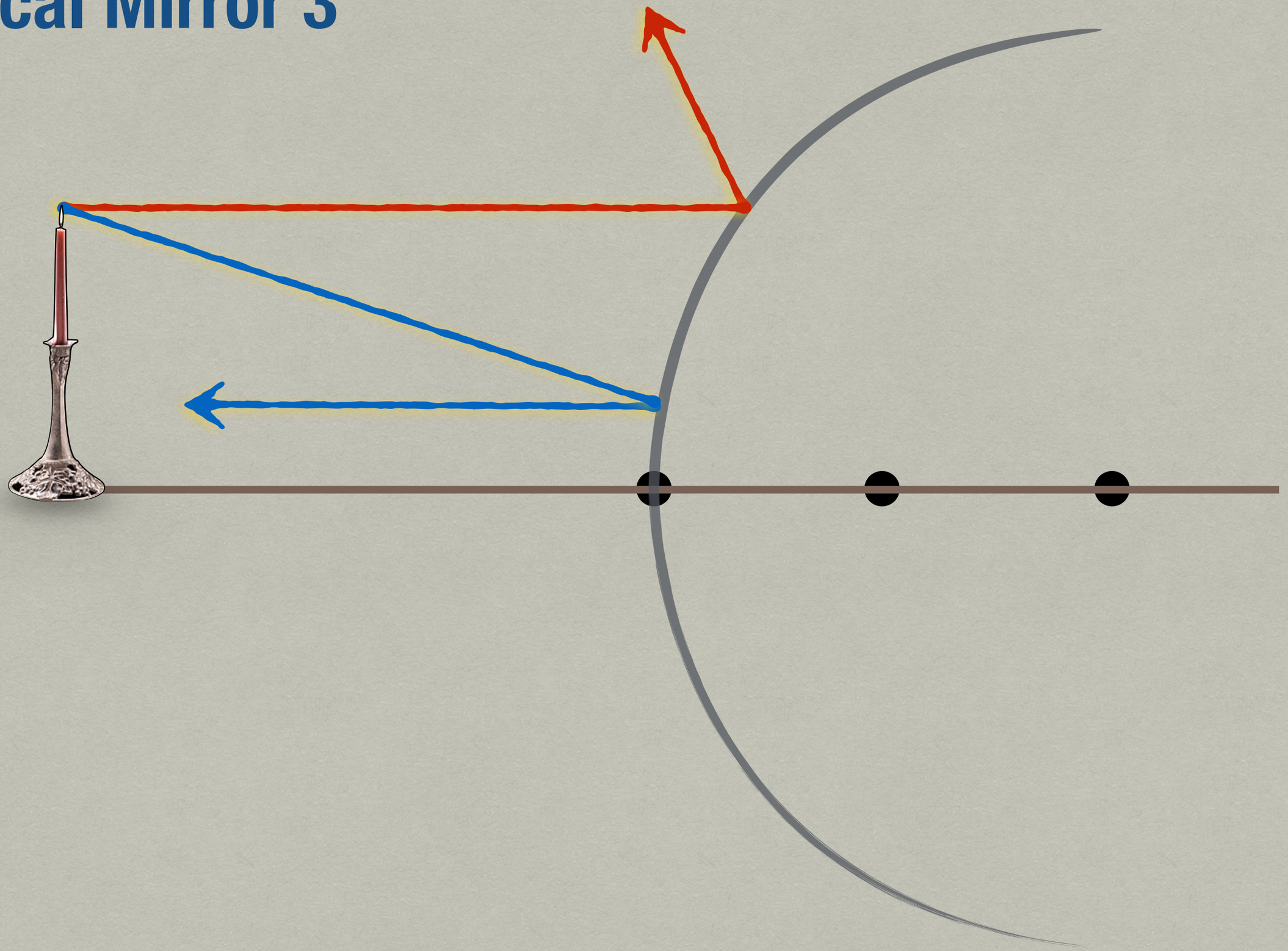
Ray Diagram:
Spherical Mirror 3



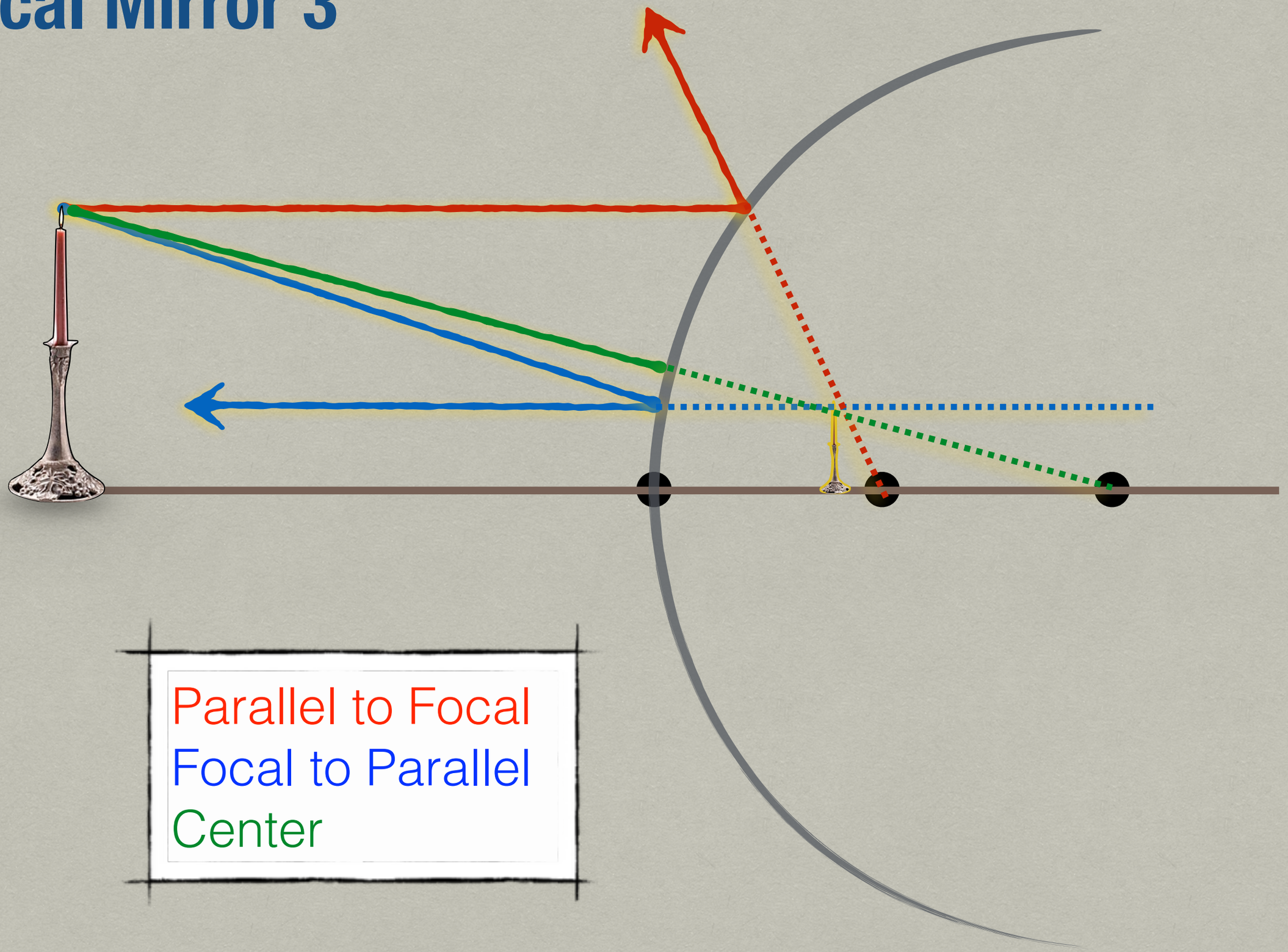
Ray Diagram: Spherical Mirror 3



Ray Diagram:
Spherical Mirror 3

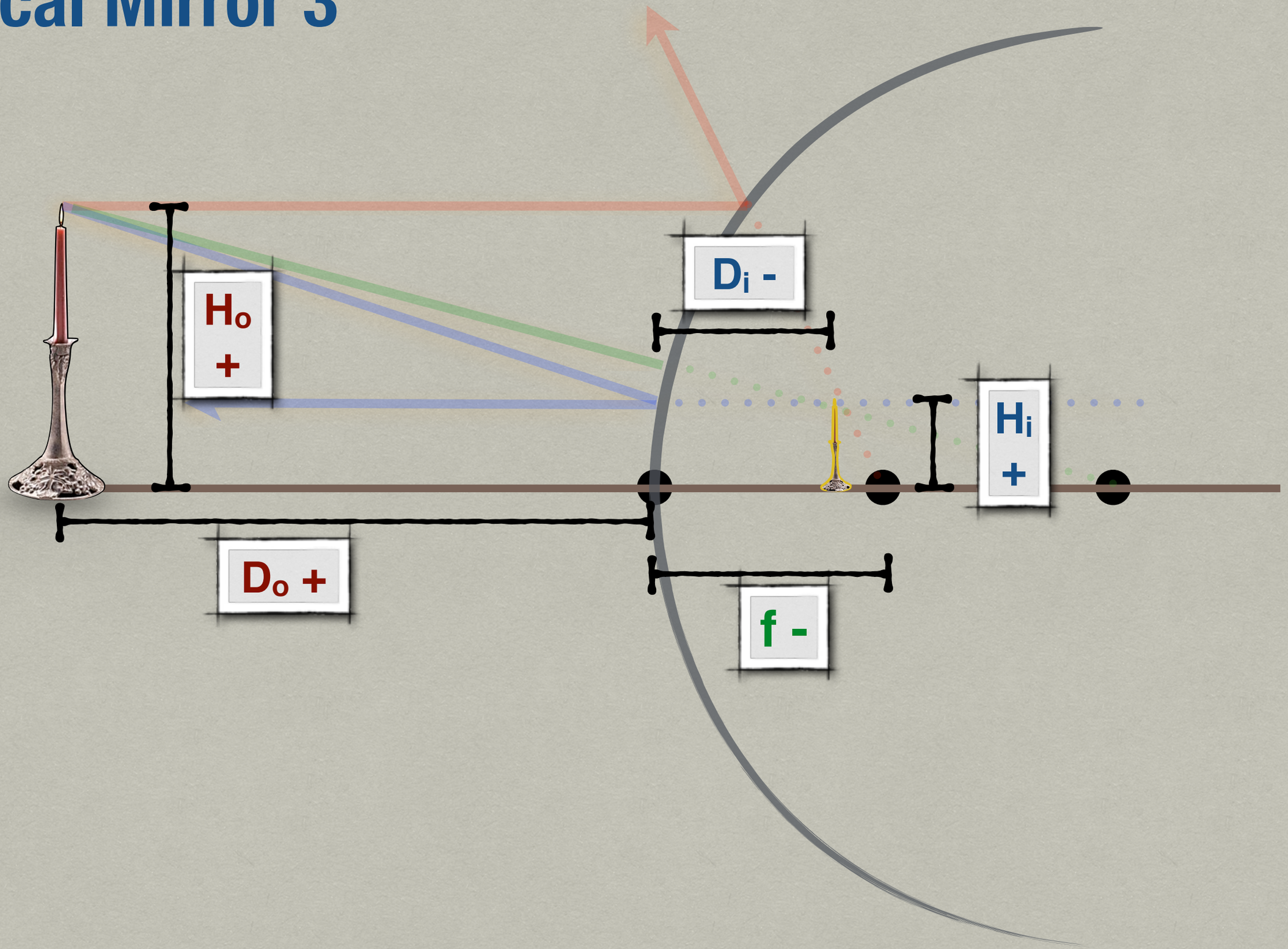


Ray Diagram:
Spherical Mirror 3



Parallel to Focal
Focal to Parallel
Center

Measurement:
Spherical Mirror 3



Equations

Mirror

f = r/2

$$f = \frac{r}{2}$$

Lens/Mirror

1/f = 1/Di + 1/Do

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

Magnification

M = Hi/Ho = -Di/Do

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