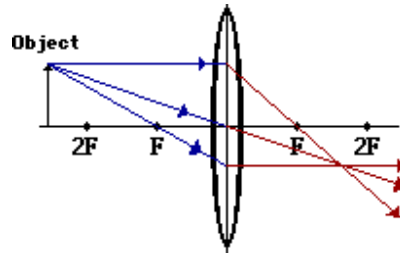


## *Optics Bench*

### A Virtual Applet Lab

<http://webphysics.davidson.edu/applets/Optics/intro.html>  
<http://ww2.unime.it/weblab>



### For the Study of Lens Images

#### General Applet Procedure:

1. Open the internet browser and select OPTICS BENCH from the **favorites** pull-down menu at the top of the browser. (See instructor if you are unable to accomplish this task.) or type in this website URL:  
[http://webphysics.davidson.edu/alumni/MiLee/java/Final\\_Optics/optics.htm](http://webphysics.davidson.edu/alumni/MiLee/java/Final_Optics/optics.htm)
2. Click on the FULL SCREEN command at the top of the browser control panel.
3. You should notice when the applet loads that the screen area is black with a yellow horizontal line dividing the dark area into two equal halves. This area is the optics bench active area. The yellow line is the principal axis for any lens or mirror in the active area.
4. Place the mouse cursor in the dark area of the applet. Notice the yellow-coordinate box that appears in the lower left-hand corner of the screen. The coordinate box indicates the position of the cursor position on the screen. This in turn can locate the position of any object or image placed on the optics bench.
5. Move the cursor on the screen and determine the maximum and minimum X and Y coordinate values.

	<u>X-Coordinate</u>	<u>Y-Coordinate</u>
Maximum Value	_____	_____
Minimum Value	_____	_____

6. Notice at the top of the applet screen are menu buttons to select "BEAM", "OBJECT", "SOURCE", or "CLEAR ALL". At the bottom of the applet screen are menu buttons for "LENS", "MIRROR", "APERATURE", or "CLEAR ACTIVE".
7. Begin by selecting "BEAM". To do this press the beam button and then move the cursor into the dark area of the screen and click where you want to place the beam. A beam is a source of parallel rays.
8. Place your cursor in the green circle of the beam to make this "ACTIVE". Notice the two white spots near the circle. Place the mouse on these two white circles and describe the control you have over the beam for these two points as you "drag" the mouse about.

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9. Press "CLEAR ALL". Now select "SOURCE" from the upper applet menu and click the mouse with the cursor in the dark area of the applet. Describe the emitted ray pattern from the source.

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10. Place the cursor on the white spot on the upper beam from the source. Drag the mouse and state how this changes the rays from the beam.

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Can the position of the "source" be moved on the screen? \_\_\_\_\_ How? \_\_\_\_\_

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11. Press "CLEAR ALL". Now Select "OBJECT" and click the mouse with the cursor in the dark area of the screen. Describe what is placed on the screen. \_\_\_\_\_

Can this "object" be moved on the screen? \_\_\_\_\_ Can you change the height of the Object? \_\_\_\_\_. Where do you have to click on the object to move it or change its size? \_\_\_\_\_. How would you measure the vertical height of the "object" you created on the optics bench? \_\_\_\_\_

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12. Press "CLEAR ALL". Now select from the bottom applet menu the lens by clicking on the LENS button. Now move the mouse cursor into the applet dark active area and click the left mouse button once. What type of lens is seen on the screen? \_\_\_\_\_. How are you able to move the lens horizontally on the screen? \_\_\_\_\_

Does the applet show a vertical axis for the lens? \_\_\_\_\_ What color is it? \_\_\_\_\_ Does the applet show the real and virtual focal points for the lens. \_\_\_\_\_. How would you measure the focal length of the lens? \_\_\_\_\_

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Are you able to make the focal length greater or smaller? \_\_\_\_\_ How? \_\_\_\_\_

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Describe what happens when your mouse drags the left focal point to the far right side of the lens.

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Does the applet allow you to change the lens type from convex to concave? \_\_\_\_\_

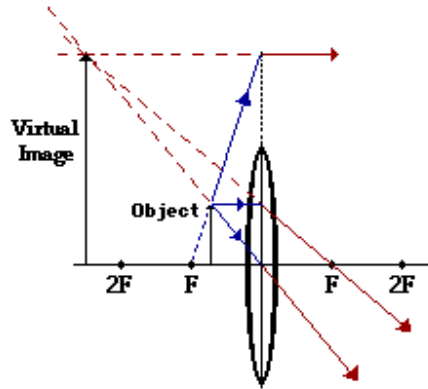
## Experimental Procedure using the Optics Bench Applet:

### Convex Lens:

1. Press "CLEAR ALL".
2. Press "Lens" and activate a convex lens on the optical bench (applet screen). Position the center of the lens at coordinates (3.4, 0).
3. Press "BEAM" and position it at the coordinates (0.5, 0) on the screen. Draw the lens and beam path to and through the lens in the space below.

\_\_\_\_\_

4. What is the position of the focal point on the screen? Coordinates = (\_\_\_\_\_, \_\_\_\_\_)
5. What is the focal length of this lens? \_\_\_\_\_
6. Click on the lens and make the focal length of the lens shorter. What happens to the shape of the lens? \_\_\_\_\_
7. In general, the thicker the lens the \_\_\_\_\_ the focal length and the thinner the lens the \_\_\_\_\_ focal length.
8. Click on the BEAM (in the green circle) to make it ACTIVE and move the beam closer to the lens. Does the position of the focal point change? \_\_\_\_\_ Focal length change? \_\_\_\_\_
9. Click on the BEAM to make it ACTIVE and then press the "CLEAR ACTIVE" button at the bottom of the applet screen. What is left visible on the screen? \_\_\_\_\_ and what is removed from the screen.
10. Now measure the focal length of your convex lens. Focal Length = \_\_\_\_\_
11. Now click on "OBJECT" from the top applet menu. Place the object at a distance less than the focal length from the center of the lens and give it a height of 25% that of the lens.



Ray Diagram for Object Located in Front of F

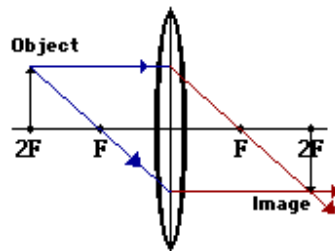
Record the focal length of the lens = \_\_\_\_\_. Measure the height of the object = \_\_\_\_\_. Measure the height of the image = \_\_\_\_\_. What is the magnification ( $S_i/S_o$ ) of the image? \_\_\_\_\_. Describe the image by its observed characteristics (real or virtual, upright or inverted, etc.) \_\_\_\_\_

12. Move the object to the focal point. Describe the image characteristics, position, etc.

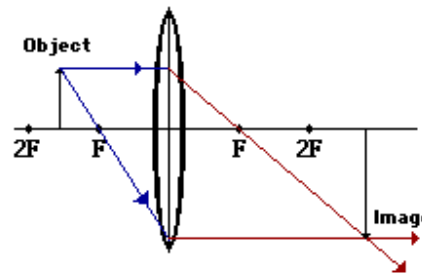
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Ray Diagram for Object Located at 2F



Ray Diagram for Object Located Between F and 2F

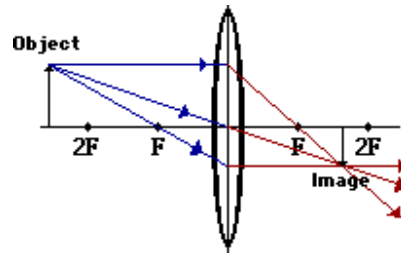
13. Make the object smaller and located it between F and 2F.

Measure the size of the image = \_\_\_\_\_, size of the object = \_\_\_\_\_, position of the image (x,y) = \_\_\_\_\_, \_\_\_\_\_, position of the object (x,y) = \_\_\_\_\_, \_\_\_\_\_. Describe the characteristics of the image \_\_\_\_\_

14. Make the object 25% of the height of the lens and position it at 2F from the lens.

Measure the size of the image = \_\_\_\_\_, size of the object = \_\_\_\_\_, position of the image (x,y) = \_\_\_\_\_, \_\_\_\_\_, position of the object (x,y) = \_\_\_\_\_, \_\_\_\_\_. Describe the characteristics of the image \_\_\_\_\_

15. Move the object to a point beyond 2F on the Principal axis.



Measure the size of the image = \_\_\_\_\_, size of the object = \_\_\_\_\_, position of the image (x,y) = \_\_\_\_\_, \_\_\_\_\_, position of the object (x,y) = \_\_\_\_\_, \_\_\_\_\_.

Describe the characteristics of the image \_\_\_\_\_

16. Make the image small. Describe the location where the image is magnified the greatest.

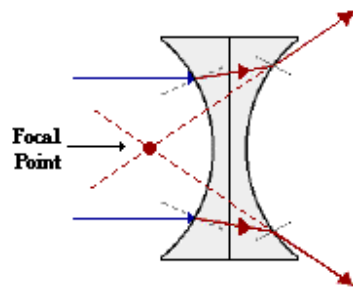
17. Where is the object located to produce a "same-size" image? \_\_\_\_\_

18. A real image is always \_\_\_\_\_ and a virtual is always \_\_\_\_\_.

Can you invert the object so it points below the principal axis? \_\_\_\_\_ How is this done?

What is the vertical position of the image? \_\_\_\_\_

### Concave Lens:



**A diverging lens is said to have a negative focal length since rays which enter the lens traveling parallel to the principal axis diverge.**

Change the convex lens to a concave lens.

Position the object at various locations relative to the lens. Describe the images made by a concave lens. \_\_\_\_\_

Where is the object located to produce the greatest vertical image? \_\_\_\_\_

What do concave lenses do to a beam of parallel light rays shiny through it? \_\_\_\_\_