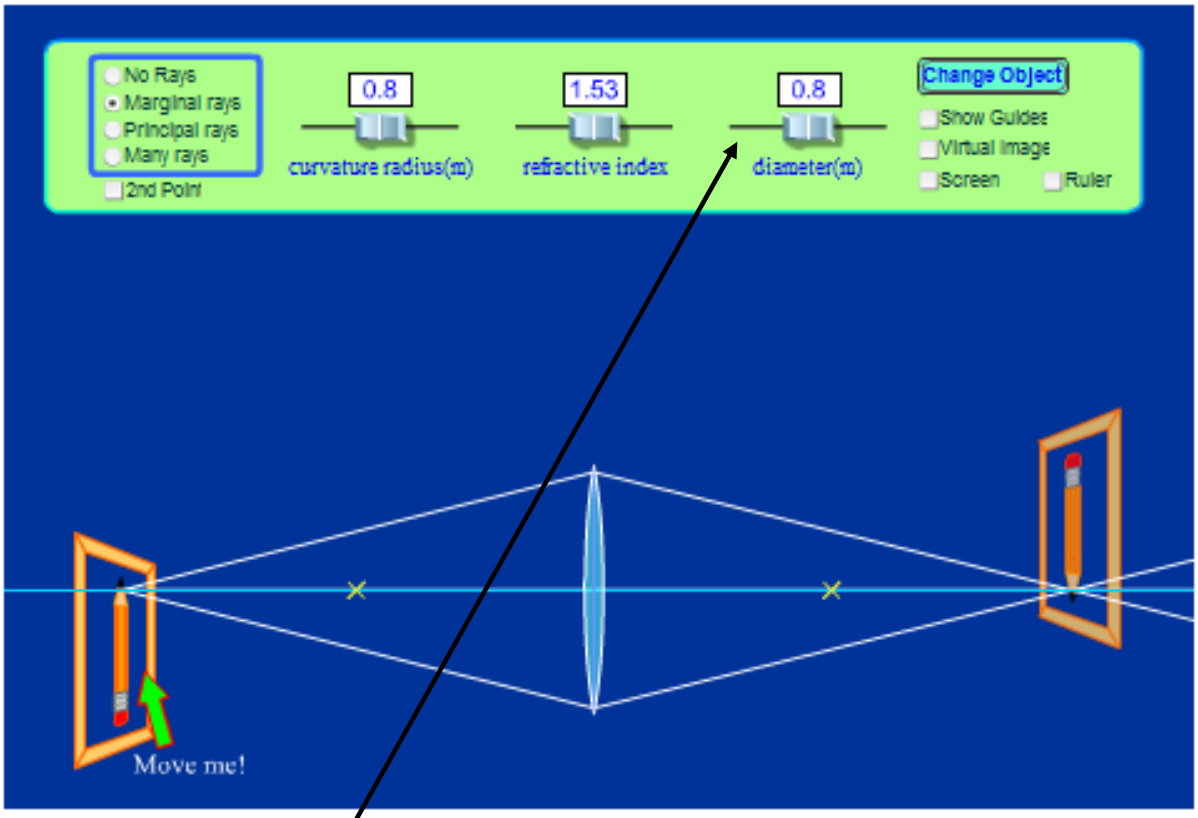
Physics 112: Geometric Optics Virtual Lab

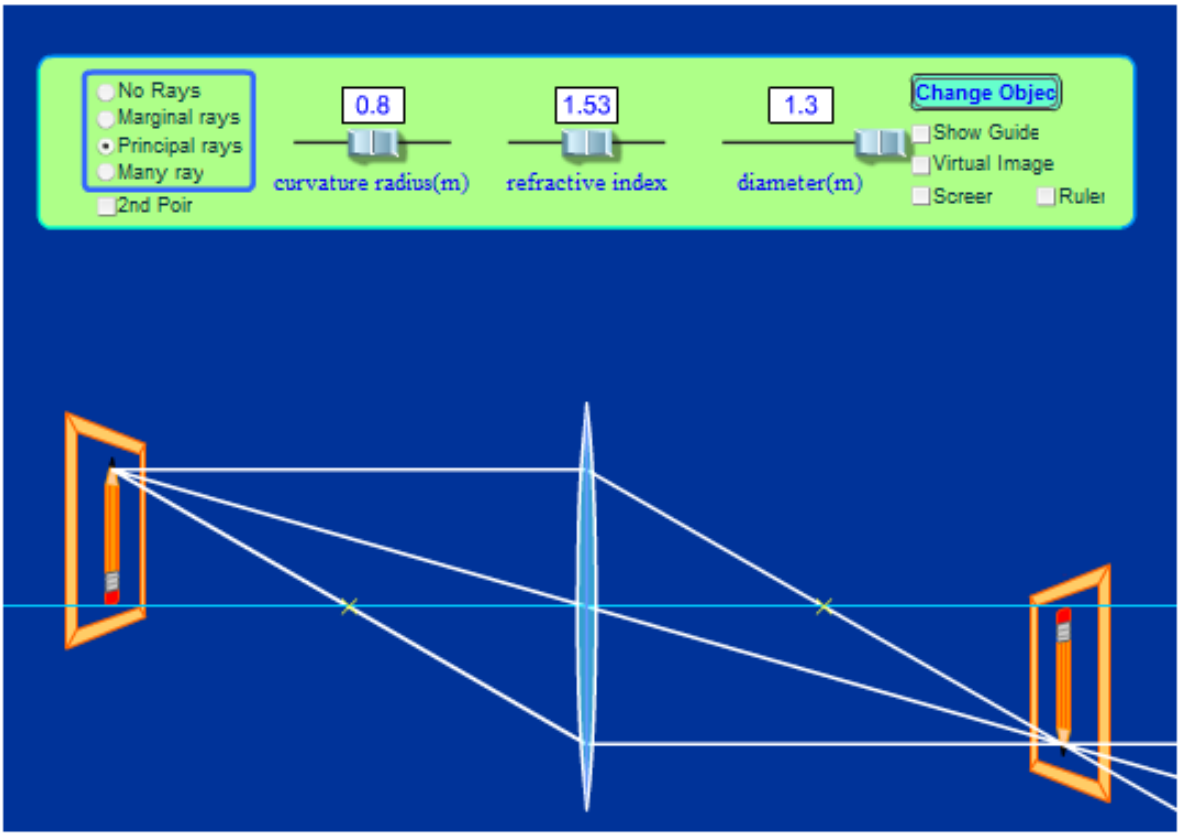
This is a program that simulates were an image forms depending on the structure of a lens. This worksheet will guide you through the different properties of refractive lenses.

1. When the program starts you should see:



2. The object is on the left and the image is on the right. First, change the diameter by sliding the button left and right. How does the diameter of a lens affect the image?

3. Move the object so that the bottom of the pencil is on the blue line. Click the principle rays button and increase the diameter to the maximum size. It should look like the image on the next page.



4. Images form where the refracted light rays meet. We will always consider light coming from the top of the object – that enables us to locate the top of the image and get an idea of its size. The lens inverts the object to make it appear upside down – our eyes do this as well. Now is a good time to introduce the terminology associated with lenses:
    - The centre of gravity (geometric centre) of the lens is called the vertex, V.
    - The horizontal line that cuts through V is called the principle axis.
    - The x's on either side of the lens is the principle focus, F (the lens is symmetric so there is a principle focus on either side).

5. There are a few options for viewing how light leaves the pencil, refracts, and then forms an image. What you are viewing is called the principle rays – these are the rays we will use in our course to sketch where an image will form and how big (or small) it is. There are three principle rays:
    - A ray that leaves the pencil (object) parallel to the principle axis ←This ray will refract and pass through the principle focus on the other side.
    - A ray that is directed through V will not change direction.

- A ray that leave the pencil and passes through (or appears to have come from) the principle focus ←This ray emerges from the lens parallel to the principle axis.
- Since all three light rays came from top of the pencil the emerging light rays all pass meet at the top of the image.
- Each lens is unique. Depending on its shape and material each lens has its own principle focus (focal point).

6. How does moving the object left change the size of the image? Right? What happens to the image if the pencil is between the principle focus and the lens?

7. Change the curvature of the lens. What affect does it have?

8. Change the refractive index. What affect does it have?

9. Make the lens to your choosing. What happens to the image as you move the object farther away from the principle focus? Towards the principle focus?

10. Near the top right select the "virtual Image" box. Move your object around in the space between F and V, where is the image?
    - When an image forms on the same side of a lens as the object that image is called virtual (like a magnifying glass) because our eyes are fooled into thinking that is where the image is.
    - Images that form on the opposite side of a lens are called real images because we could put a piece of paper there and see the image.

11. Place the object at F, what do you notice about the lines on the other side of the lens? Could an image form?

12. Where can an image never form?