Name: Date: Period:

Lens Lab

1. Measure the height of the object (the target): _____ mm
2. You will be using a lens that has a focal length of **75 mm**.
3. In a moment, we are going to set up the ray table so that the lens is **300 mm** away from the object.
   (a) Draw a picture of this situation.

   (b) Write down your knowns and unknowns.

   (c) Use the Fundamental Lens Equation to calculate what the distance to the image would be. (*This will be the* ***expected*** $\mathbf{d_i}$ *in the table below.*)

   (d) Use the Magnification Equation to determine what the image height will be. (*This will be the* ***expected*** $\mathbf{h_i}$ *in the table below.*)

4. Make the same calculations for each of the following situations:

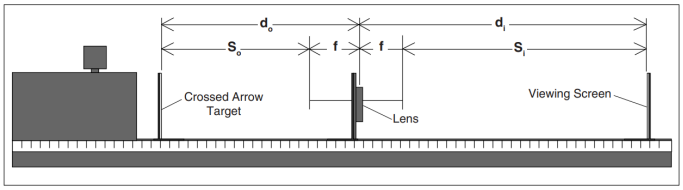
Lens is 225 mm from object	**Lens is 100 mm from object**	**Lens is 50 mm from object**

(a) Write down your knowns and unknowns.

(b) Use the Fundamental Lens Equation to calculate what the distance to the image would be. (*This will be the* ***expected*** $\mathbf{d_i}$ *in the table below.*)

(c) Use the Magnification Equation to determine what the image height will be. (*This will be the* ***expected*** $\mathbf{h_i}$ *in the table below.*)

5. Now we need to set up your experiment. Get the following items out of the box:
   (a) "Crossed Arrow Target"
   (b) "75mm focal length convex lens"
   (c) "Screen"
   (d) Three L-shaped lens holders
   (e) The track
   (f) The light source
6. Transfer all of your calculations from Questions #3 & 4 into the appropriate "expected" columns in the table below.
7. Set up the experiment as shown below:



8. Now, to find the measured values, do the following:
   (a) To get a d_o of 300 mm (which is equivalent to 30 cm), make the distance between the crossed-arrow target and the lens 30 cm. It does not matter how far the crossed-arrow target is from the light source.
   (b) Move the screen until the image comes into sharp focus. Notice that the image is inverted.
   (c) Measure the distance between the lens and the screen. This is your **measured** d_i.
   (d) Use a ruler to measure the height of the image on the screen. Yes, it will be tiny, but do your best. This is your **measured** h_i. Please note that this value should be **negative** since the image is inverted.
   (e) Repeat the same steps for the other d_o values.
   (f) If it is not possible to focus an image on the screen, simply mark an 'X' through that box.
9. Calculate your percent errors using this equation:

$$\% \text{ error} = \frac{|\text{measured} - \text{expected}|}{\text{expected}} \times 100$$

d_o **(mm)**	d_i **expected**	d_i **measured**	**% error**	h_i **expected**	h_i **measured**	**% error**
300						
225						
100						
50						

10. How good are your percent errors? What are some errors in the experiment that prevent this from being 0%?

11. Which image could not be focused on the screen? Why couldn't it be focused?

12. Looking at your answer to the previous question and the focal length of the lens (75 mm), how is focal length related to whether the image is real or virtual?

13. How do your numbers for d_i come out when the image is virtual?