Brady Kondek **5.06 Lens and Mirror Lab**

Data Collection

Table 1: Convex Lens

d_o **Object Distance (cm)**	d_i **Image Distance (cm)**	**Image characteristics** Upright or Inverted? (if no image, write "no image") Real or Virtual? Smaller, Larger, or Same size as object?
10.0	-20	*Upright* (rays intersect above the principal axis) *Virtual* (image forms on the same side as object) Image is *larger* than the object
20.0	None	*No image* (rays do not intersect)
30.0 (f) 60.0 (2f)	60	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the opposite side) Image is *larger* than the object
40.0	40	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the opposite side) Image is the *same size* as the object
50.0	33.3	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the opposite side) Image is *smaller* than the object

Table 2: Concave Mirror

d_o **Object Distance (cm)**	d_i **Image Distance (cm)**	**Image characteristics** Upright or Inverted? (if no image, write "no image") Real or Virtual? Smaller, Larger, or Same size as object?
20.0	-60	*Upright* (rays intersect above the principal axis) *Virtual* (image forms on the opposite side) Image is *larger* than the object
30.0	None	*No image* (rays do not intersect)
50.0 (f) 100.0 (2f)	75	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the same side as object) Image is *larger* than the object
60.0	60	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the same side as object) Image is the *same size* as the object
75.0	50	*Inverted* (rays intersect below the principal axis) *Real* (image forms on the same side as object) Image is *smaller* than the object

Brady Kondek **5.06 Lens and Mirror Lab**

Analysis (Refer to the Part D analysis questions. Place all answers below.)

1. **Use any data of your choice and the lens/mirror equation to calculate the focal lengths for both the convex lens and the concave mirror.**

   Convex lens chosen data: $d_o = 30.0\ cm$, $d_i = 60$ cm

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

   $\frac{1}{f} = \frac{1}{30.0} + \frac{1}{60} = 20\ cm$

   Focal length = 20 cm

   Concave mirror chosen data: $d_o = 50.0\ cm$, $d_i = 75\ cm$

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

   $\frac{1}{f} = \frac{1}{50.0} + \frac{1}{75} = 30\ cm$

   Focal length = 30 cm

2. **Once you have calculated the focal length for each, place an "f" next to that d_o value in your table. Multiply that value by two, and write a "2f" next to the new value in the table.**

   Convex: $30.0 * 2 = \mathbf{60.0\ cm}$

   Concave: $50.0 * 2 = \mathbf{100.0\ cm}$

3. **In one or two sentences, compare the data you collected in Table 1 and Table 2. Do you see any patterns or similarities? Describe them.**

   I noticed a couple patterns between the data in tables 1 and 2. First off, as the object distances increased, the images on both fronts followed the pattern of being larger than the object, to then being the same size, and eventually smaller. As well, the images were upright, then no image, and inverted from thereon out; this was the case for both tables.

4. **What range of d_o values will result in a real image? Infer this information for both the lens and mirror based on the data collected. Report these ranges in terms of f and/or 2f. For example, "When d_o is less than 2f."**

   When the d_o values are greater than f, then the values will result in a real image.

5. **What range of d_o values will result in a virtual image? Infer this information for both the lens and mirror based on the data collected. Report these ranges in terms of f and/or 2f. For example, "When d_o is less than 2f."**

   When the d_o values are less than f, then the values will result in a virtual image.

6. **What range of d_o values will result in a smaller image? Infer this information for both the lens and mirror based on the data collected. Report these ranges in terms of f and/or 2f. For example, "When d_o is less than 2f."**

   When the d_o values are greater than 2f, then the values will result in a smaller image. In short, as the d_o values increase, the image continues to get smaller.

7. **Describe what it means for the image when d_i is negative.**

   When d_i is negative, the image will turn out to be virtual.

8. **Describe what is observed when d_o = f for both the lens and the mirror.**

   When $d_o = f$, no image is formed, resulting in d_i having no value.

Conclusion (Refer to the Part E write conclusion section for guidance. Place conclusion below.)

The purpose of this lab was to provide a first-hand look in understanding how images are formed, and the formations at different object distances for convex lenses and concave mirrors. I was able to use any data to calculate the focal lengths for both the lens and mirror because in the end they all pretty much equaled out to the same focal length (separately for the lens and mirror). Through the analysis of the data, I was able to learn how specific changes in the values can have effects on how the image is formed, such as how adjusting the object distance does this.