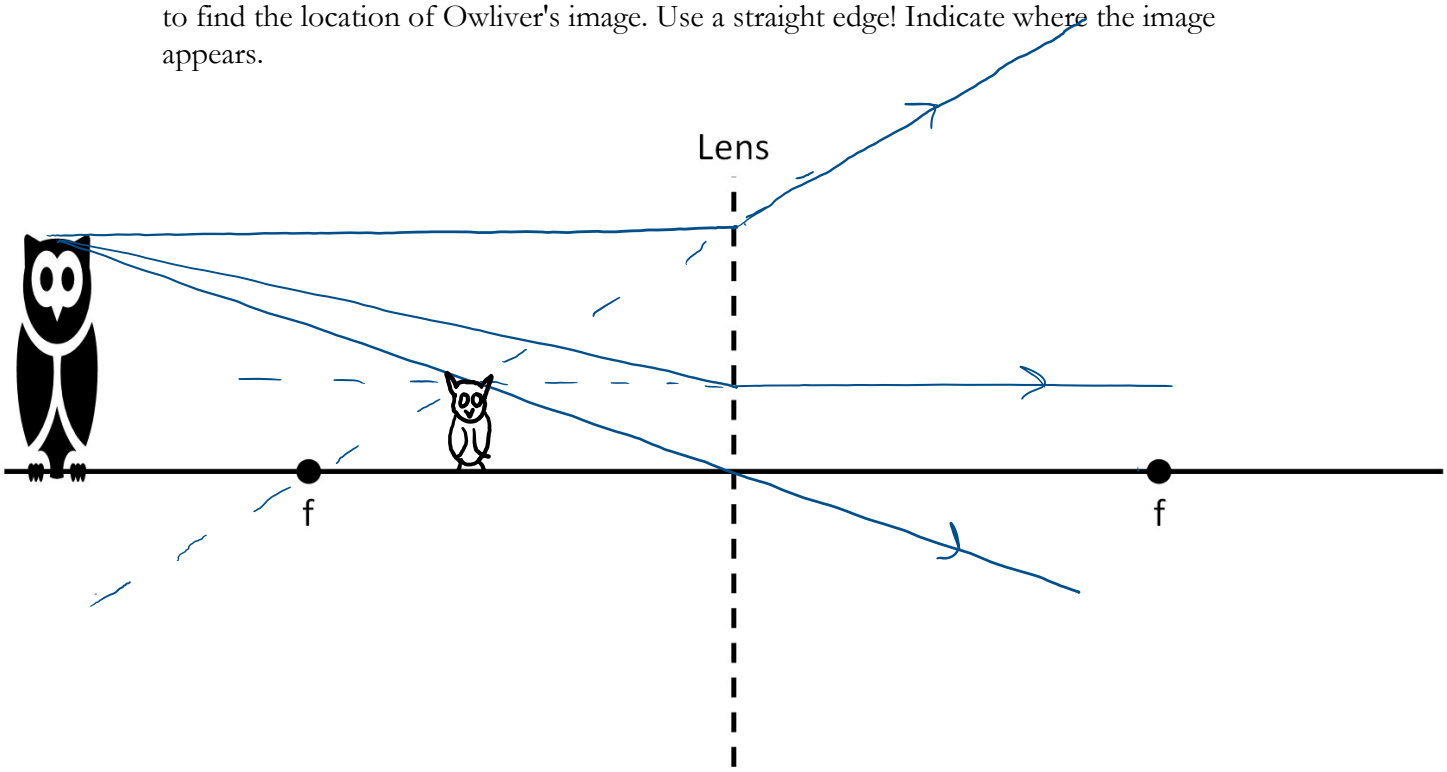
Week 3 Challenge Homework Solutions

Question 1

Owliver the barn owl is sitting, as shown, in front of a diverging lens with the pictured focal points.

(a) Using the provided optical axis (or a good copy), carefully and precisely draw a ray diagram to find the location of Owliver's image. Use a straight edge! Indicate where the image appears.



(b) Is the image real, or virtual? Explain how you determined this.

Virtual, light does not converge to a point (image) the observer on the right would trace rays back to the virtual image of Owliver shown above.

(c) Estimate the magnification of the image.

$m \approx +\frac{2}{5}$

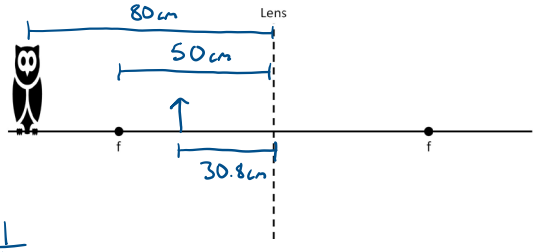
the image has same orientation as the object (both upright) $\Rightarrow$ + magnification

it looks a little less than $\frac{1}{2}$ the size of the object $\Rightarrow \frac{2}{5}$

Question 2

Owliver the barn owl is sitting, as shown, in front of a diverging lens with the pictured focal points.

(a) Owliver is sitting 80 cm from the lens, which has a focal length of 50 cm. Using the math representation, find the location of the image.



f for a diverging lens is negative

$$\Rightarrow \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \Rightarrow \frac{1}{-50\,cm} = \frac{1}{+80\,cm} + \frac{1}{d_i}$$

$$\frac{1}{d_i} = \frac{1}{-50\,cm} - \frac{1}{80\,cm} = -\frac{8}{400\,cm} - \frac{5}{400\,cm} = -\frac{13}{400\,cm}$$

$$d_i = -\frac{400}{13}\,cm = -30.8\,cm$$

(b) Using the math representation find the magnification of his image.

$$m = -\frac{d_i}{d_o} = -\frac{-400/13\,cm}{80\,cm} = +\frac{5}{13} = +0.38$$

(c) Use the *Related Quantities* and *Order of Magnitude* Sense-making techniques to compare your answers to part (a) and (b) with those found when studying the same problem with ray tracing in RO.L2.4-01

(a) I found virtual image between the lens & the left focal point in both RO.L2.4-01 & RO.L3.4-01

(b) In both solutions I found a magnification that was positive and just less than $\frac{1}{2}$.