# Physics 203 Ecampus
Group Quizbit | Ray Optics

Work with your lab group to produce a single handwritten solution to the question(s) in this Quizbit. Submit a single copy of your work to Gradescope. Writing everyone's name on the handwritten copy does not associate each student with the work, be sure to add the group member's names when submitting. The clarity of communicating your reasoning, along with providing multiple representations and clearly organizing your work will be weighed more heavily than the final answer in your grade.

1. A drawing of "Trogdor the Burninator" is placed **5.0 cm** from a converging lens of focal length **10 cm**. You do not need to draw Trogdor in detail. Instead, represent them as a single arrow pointed upwards from the optical axis.

   Hint: the width of a standard piece of 8.5" by 11" paper is about 20 cm.

   Hints:
   $v = f\lambda$
   $v = c / n$
   $n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$
   $1/f = 1/d_o + 1/d_i$
   $m = - d_i / d_o$

   (a) Carefully and precisely, draw a ray diagram for this scenario, identifying the image location.
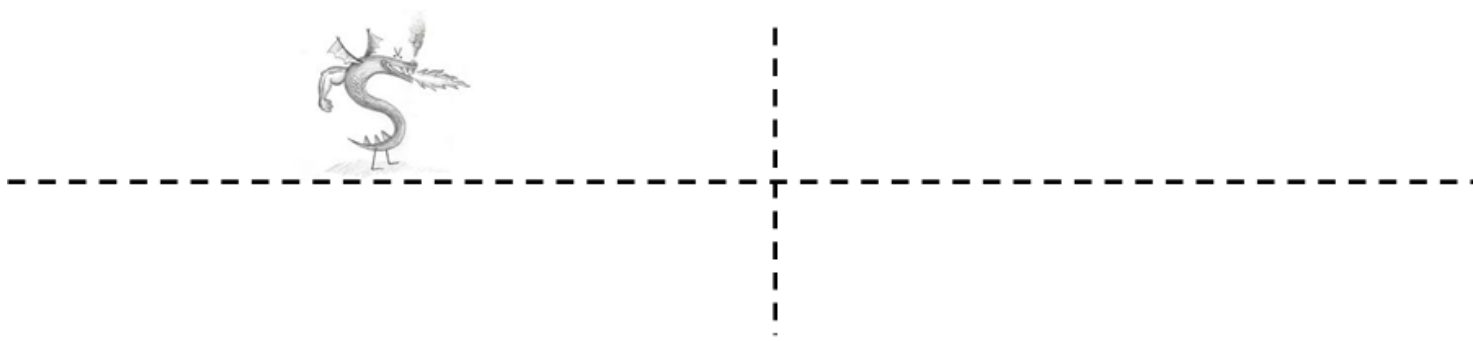
   (b) Using the mathematical model, show how to find the image distance for this scenario.
   (c) Use the concept of multiple representations and related quantities sensemaking to compare your answers in parts (a) and (b).

2. Four layers of transparent materials are placed next to each other. The first layer has an index of refraction of n_1 = **3.20**, the second n_2 = **3.55**, the third n_3 = **2.75**, and the last n_4 = **2.30**. Red light of wavelength 685 nm is incident from the first layer on the second layer at an angle of 43 degrees with respect to the surface (see image). At what angles of refraction does the light travel into each layer of material? Draw a representation of the light's path. Make sure to label each angle of refraction.