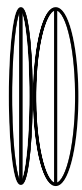
ARBOR SCIENTIFIC

Name(s) > ______________________________

Mathematical Model of Images from Lenses

Part 1: In the previous activity, you discovered that placing Lens A and Lens B together created a shorter focal length.

$f_A = 20$ cm $\qquad$ $f_B = 10$ cm



The equation to predict the combined focal length is:

$$\frac{1}{f_{combined}} = \frac{1}{f_A} + \frac{1}{f_B}$$

Substitute your focal lengths into this equation to predict the combined focal length.

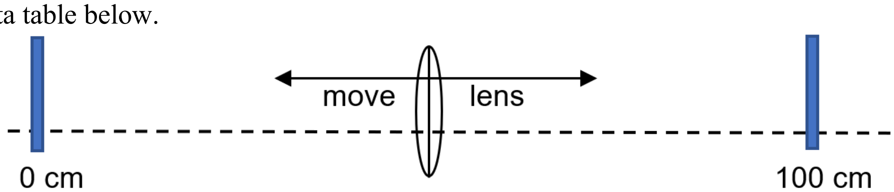
Now use the equipment to measure the combined focal length. Show your results.

f = _____ cm

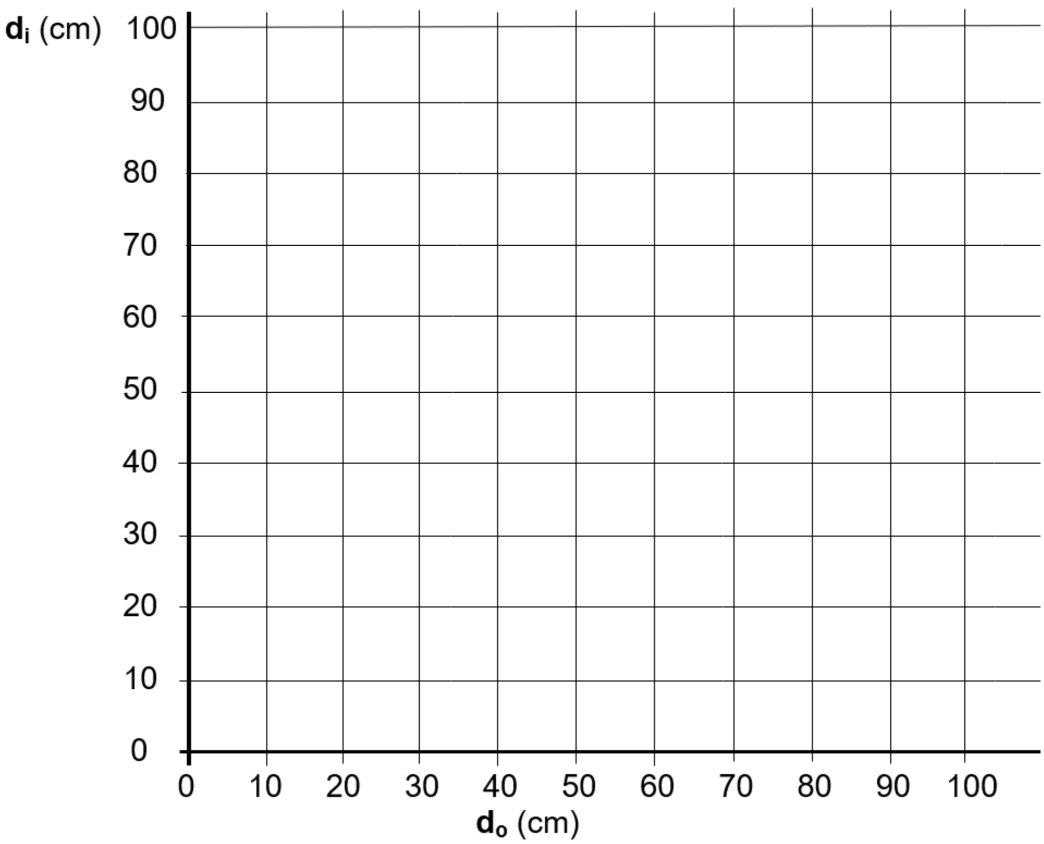
The equation that describes the relation between focal length (**f**), the object distance (**d_o**), and the image distance (**d_i**) is:

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

Place the “F” object at 0 cm and the screen at the 100 cm position. Adjust the position of your lens so that a sharp image appears on the screen. Record the values into the data table below. Keep the “F” object and screen in the same positions and **move the lens** to find another position for a sharp image. Record the new values into the data table. Keep the object at 0 cm and move the screen to the 80 cm position. Repeat this process to complete the data table below.



	d_o (cm)	d_i (cm)
$d_o + d_i = 100$ cm		
$d_o + d_i = 100$ cm		
$d_o + d_i = 80$ cm		
$d_o + d_i = 80$ cm		
$d_o + d_i = 60$ cm		
$d_o + d_i = 60$ cm		
$d_o + d_i = 40$ cm		
$d_o + d_i = 40$ cm		



Plot your data points on the graph above.
Draw a smooth curve to connect the points.

Look closely at the curve. Does the increasing value of $\mathbf{d_i}$ seem to be approaching a limit as the value of $\mathbf{d_o}$ keeps increasing? Estimate the value of $\mathbf{d_i}$ Draw this horizontal line (called an asymptote).

Predicted minimum: $\mathbf{d_i}$ = _____ cm

Now use the equation above to calculate $\mathbf{d_i}$ when $\mathbf{d_o}$ = 5000 cm.

$\mathbf{d_i}$ = _____ cm

Look closely at the curve above. Do you see a line of reflection symmetry? Draw it!

Draw this straight line on the curve.

Conclusions

Suppose that a different lab team had a different focal length for their experiment. How would their graph be similar to your graph? How would it be different?