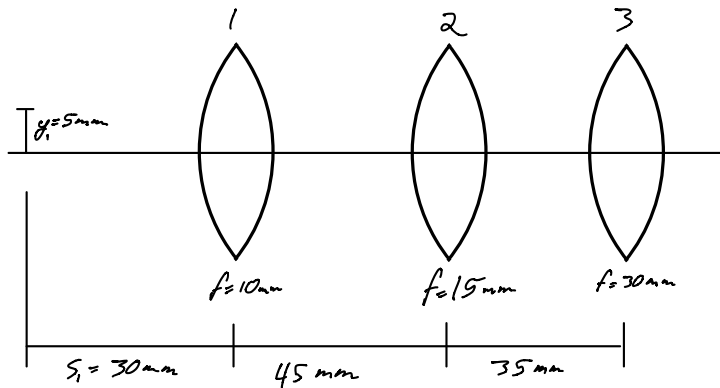


NAME: Ethan Bolton

### Geometric Optics – Take Home Portion

Instructions: For the following problem, show all work including all equations used, numbers entered into the equations, and then circle your final answer complete with units. **You are expected to do your own work!**

A microscope is made of 3 lenses in a row. A 5 mm object is placed 30 mm in front of lens 1 which is a converging lens with a focal length of 10 mm. Lens 1 and 2 are separated by 45 mm. Lens 2 is a 15 mm focal length converging lens. The distance between lens 2 and lens 3, a 30 mm focal length converging lens, is 35 mm. What is the location of the final image with respect to the 3<sup>rd</sup> lens, its size, and orientation?



$$S_1' = \frac{1}{\frac{1}{f_1} - \frac{1}{S_1}}$$

$$= \frac{1}{\frac{1}{10} - \frac{1}{30}}$$

$S_1' = 15\text{ mm}$   
right of lens 1

$$S_2 = 45\text{ mm} - S_1'$$

$$S_2 = 30\text{ mm}$$

$$S_2' = \frac{1}{\frac{1}{f_2} - \frac{1}{S_2}}$$

$$= \frac{1}{\frac{1}{15} - \frac{1}{30}}$$

$$S_2' = 30\text{ mm right of lens 2}$$

$$S_3 = 35 - S_2'$$

$$= 35 - 70$$

$$S_3 = -5$$

$$S_3' = \frac{1}{\frac{1}{f_3} - \frac{1}{S_3}}$$

$$= \frac{1}{\frac{1}{30} - \frac{1}{-5}}$$

$$S_3' = -6\text{ mm}$$

(6 mm left of lens 3)

(Virtual)

$$y_1' = -\frac{S_1'}{S_1} y_1$$

$$= -\frac{15}{30} 5$$

$$y_1' = -2.5\text{ mm}$$

$$y_2 = y_1'$$

$$y_2' = -\frac{S_2'}{S_2} y_2$$

$$= -\frac{30}{30} (-2.5)$$

$$y_2' = 2.5\text{ mm}$$

$$y_3 = y_2'$$

$$y_3' = -\frac{S_3'}{S_3} y_3$$

$$= -\frac{-6}{5} (2.5)$$

$$y_3' = 3\text{ mm}$$

(upright)