

The thin lens formula is

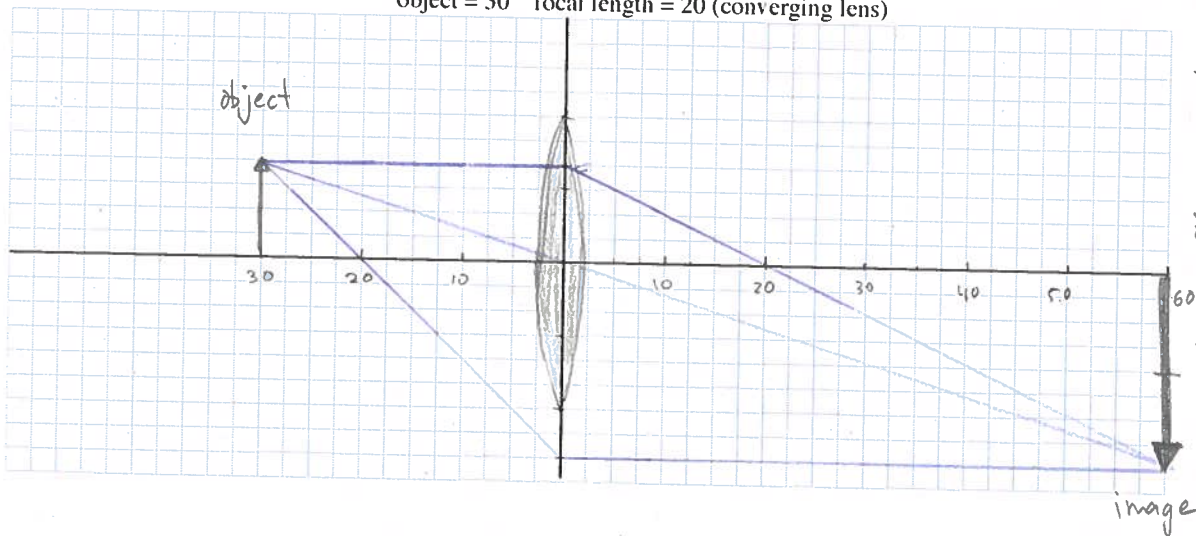
$$\frac{1}{p} + \frac{1}{i} = \frac{1}{f} \quad (1.1)$$

where p is the object distance, i is the image distance, and f the focal length of the lens.

Show that for the two scenarios, we can use simple rays and geometry to arrive at the image distances as predicted by the equation.

Diagram 1

object = 30 focal length = 20 (converging lens)



$$\frac{1}{p} + \frac{1}{i} = \frac{1}{f}$$

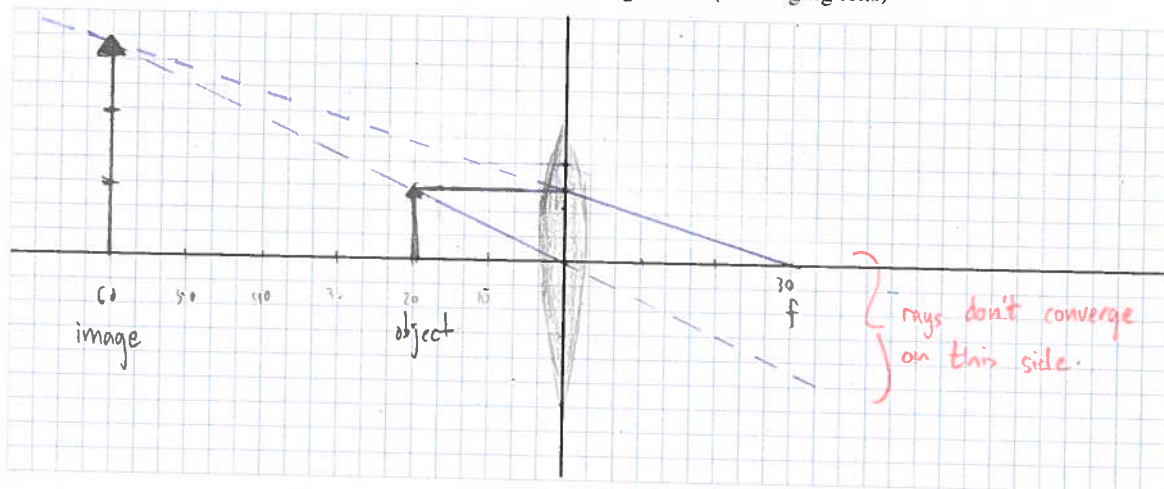
$$\downarrow$$

$$i = \frac{fp}{p-f} = \frac{20 \times 30}{30-20} = 60$$

$$m = -\frac{i}{p} = -\frac{60}{30} = -2$$

Diagram 2

object = 20 focal length = 30 (converging lens)



$$i = \frac{30 \times 20}{20-30} = -60$$

$$m = -\frac{(-60)}{20} = +3$$

↑
virtual image