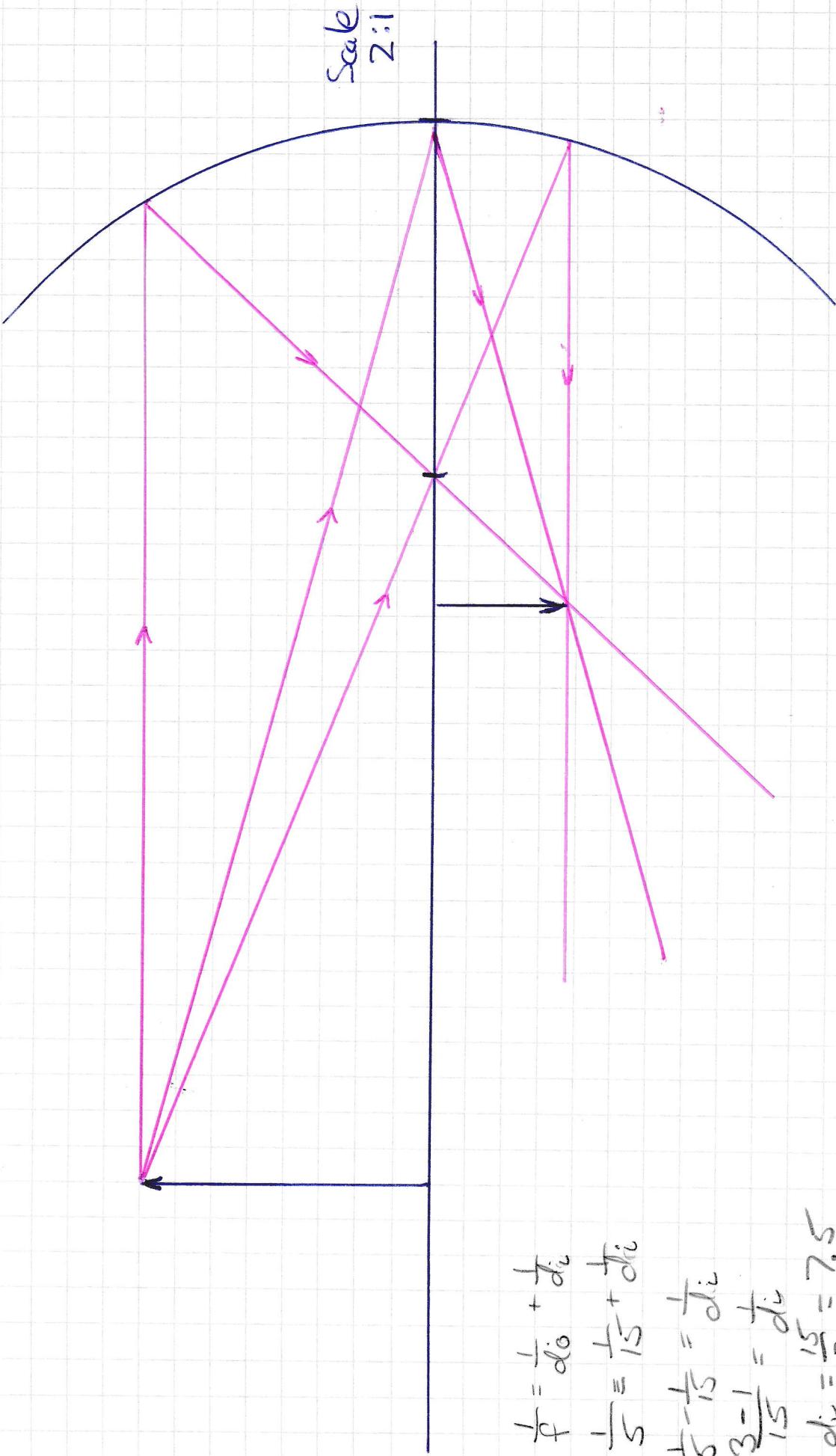


Lens / Mirror Practice (2020)

Draw a ray diagram and calculate the image characteristics for the following situations (find d_i , h_i , m and identify LOST characteristics):

1. An object of height 4 cm is placed 15cm in front of a concave mirror with focal length of 5.0 cm.
2. An object of height 4cm is placed 12cm in front of a diverging lens with focal length 3cm.
3. An object of height 2.0cm is place 3.0cm in front of a converging lens with a focal length of 5.0cm.

$$f = 5.0\text{cm}, d_o = 15\text{cm}, h_o = 4\text{cm}$$



Scale 2:1

$$\frac{1}{t} = \frac{1}{d_0} + \frac{d_0}{c}$$

$$\frac{1}{5} = \frac{1}{15} + \frac{1}{15}$$

$$\frac{1}{5} - \frac{1}{15} = \frac{1}{15}$$

$$\frac{3-1}{15} = \frac{1}{15}$$

$$dh = \frac{15}{2} = 7.5$$

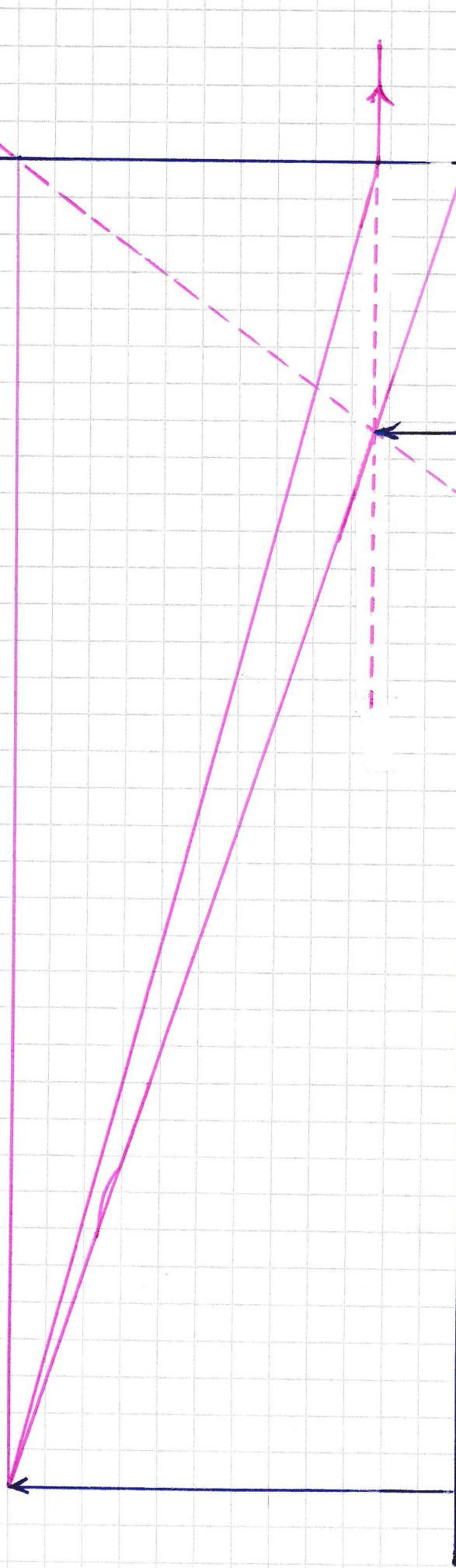
$$m = \frac{h_2}{h_1} = \frac{-2}{4} = -0.5$$

$$m = -\frac{d\dot{x}}{dt} = \frac{-7.5}{15} = -0.5$$

Same side
 inverted
 Smaller
 real

$$\frac{h''}{h_0} = \frac{-\frac{d^2}{ds^2}}{\frac{h''}{4}} = -\frac{7.5}{15} = -2$$

#2. $f = -3 \text{ cm}$, $h_o = 4 \text{ cm}$, $d_o = 12 \text{ cm}$ (lens)



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

$$-\frac{1}{3} = \frac{1}{12} + \frac{1}{d_i}$$

$$-\frac{1}{3} - \frac{1}{12} = \frac{1}{d_i}$$

$$d_i = -\frac{12}{5} = -2.4 \text{ cm}$$

$$m = \frac{h_i}{h_o} = \frac{0.8}{4} = 0.2$$

$$m = -\frac{d_i}{d_o} = -\frac{(-2.4)}{12} = 0.2$$

Scale
3:1

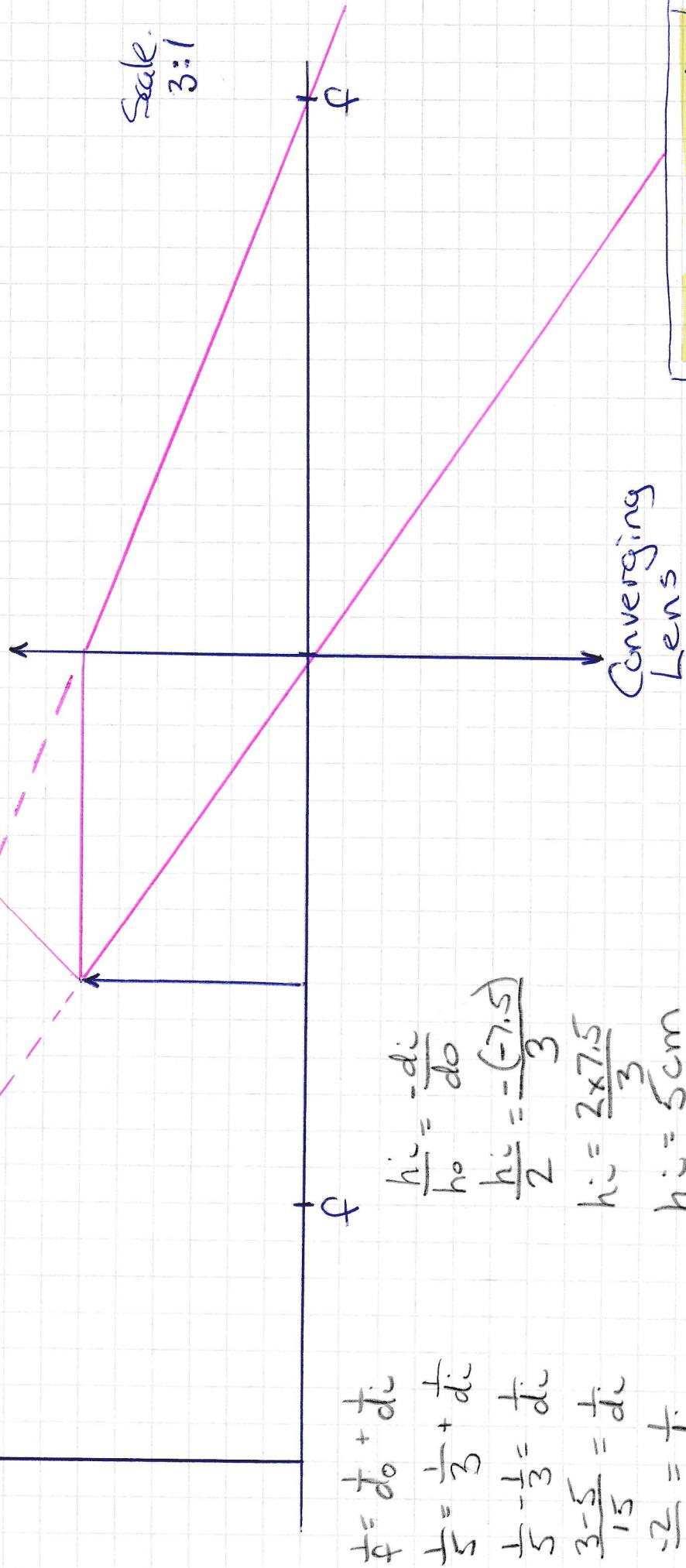
L - same side
O - upright
S - smaller
T - virtual

Diverging Lens

$$f = +5\text{ cm}, d_o = 3\text{ cm}, h_o = 2\text{ cm}$$

(lens)

Scale:
3:1



L - same side
O - upright
S - larger
T - virtual

$$m = \frac{h_i}{h_o} = \frac{5}{2} = 2.5$$

$$m = \frac{-d_i}{d_o} = \frac{(-7.5)}{3} = 2.5$$

#3

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

$$\frac{1}{5} - \frac{1}{3} = \frac{1}{d_i}$$

$$\frac{3-5}{15} = \frac{1}{d_i}$$

$$\frac{-2}{15} = \frac{1}{d_i}$$

$$d_i = -\frac{15}{2} = -7.5\text{ cm}$$

$$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

$$\frac{h_i}{2} = \frac{(-7.5)}{3}$$

$$h_i = \frac{2 \times 7.5}{3}$$

$$h_i = 5\text{ cm}$$