Thin Lens Quiz Version A

① $f = -4.9$ cm (diverging lens → negative f)

$s_1 = 5.8$ cm (use cm throughout)

$s_2 = ?$

From equation sheet $\frac{1}{s_1} + \frac{1}{s_2} = \frac{1}{f}$

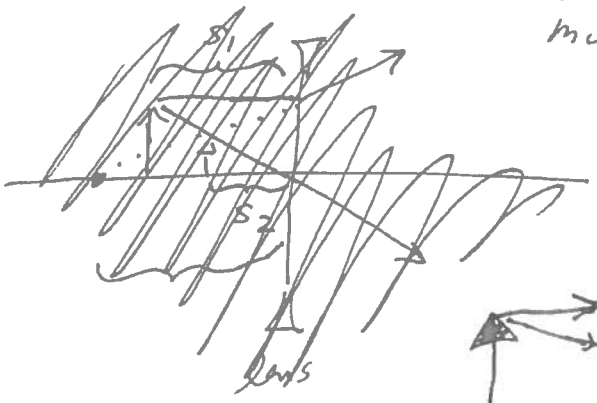
Solve for s_2: $\frac{1}{s_2} = \frac{1}{f} - \frac{1}{s_1} = \frac{s_1 - f}{f s_1} \Rightarrow \boxed{s_2 = \frac{f s_1}{s_1 - f}}$

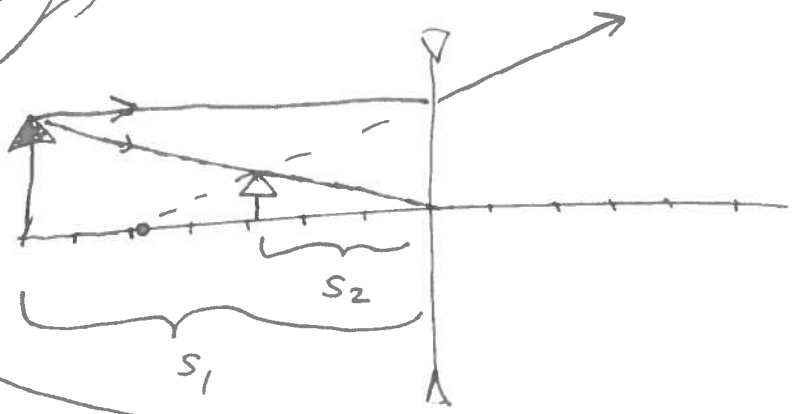
↳ $f < 0$ if diverging.

$s_2 = \frac{(-4.9)(5.8)}{5.8 - -4.9} = \boxed{-2.66 \text{ cm}}$

$5.8 + 4.9$

↳ All answers on wikiquizes must be positive → $\boxed{2.66 \text{ cm} = s_2}$



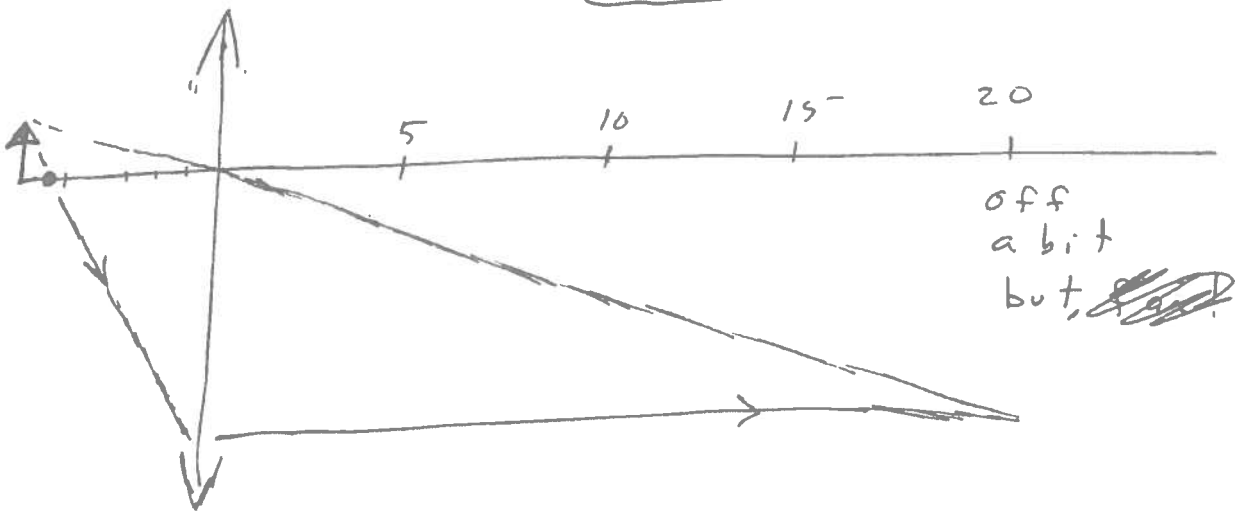


② $s_1 = 6.05$ cm

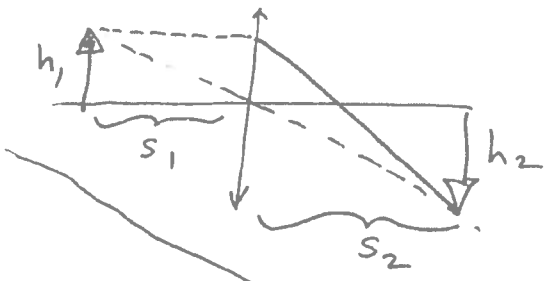
$f = 5.4$ cm

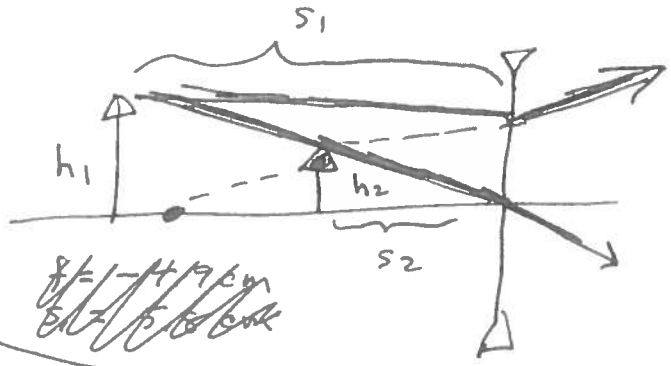
$s_2 = ?$

$s_2 = \frac{f s_1}{s_1 - f} = \frac{(6.05)(5.4)}{6.05 - 5.4} = \boxed{50.3 \text{ cm} = s_2}$



(3) Use similar triangles. $\boxed{\frac{h_1}{s_1} = \frac{h_2}{s_2}}$ – not on formula sheet. Draw + derive!





$h_1 = .59$ cm

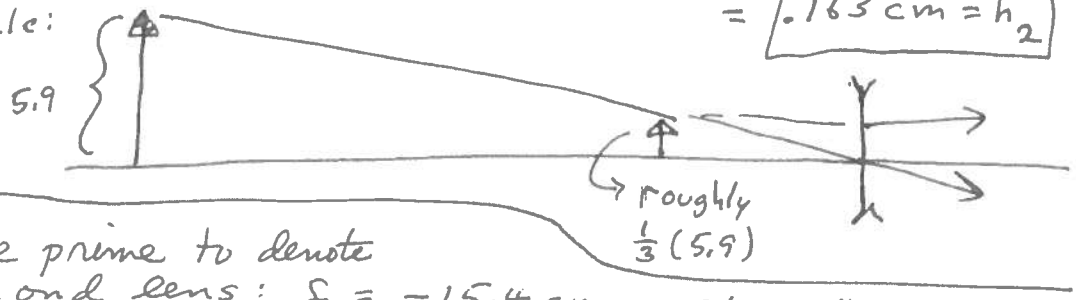
$f = -57$ cm

$s_1 = 149$ cm

$$s_2 = \frac{f s_1}{s_1 - f} = \frac{(-57)(149)}{149 - -57} = 41.228 \text{ cm.}$$

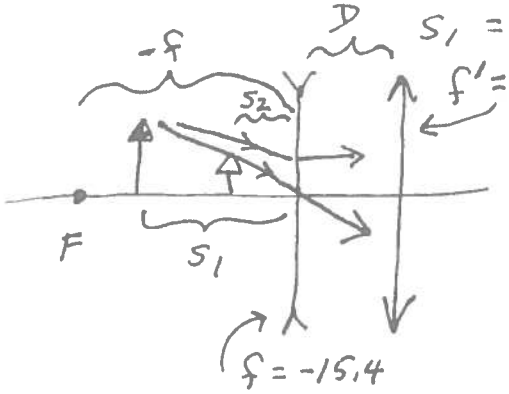
$$h_2 = \frac{s_2}{s_1} h_1 = \frac{41.228}{149}(.59) = \boxed{.163 \text{ cm} = h_2}$$

To scale:



(4) Use prime to denote second lens: $f = -15.4$ cm $\quad f' = +4$ cm

$s_1 = 12.1$ cm $\quad D = 6.5$ cm



second lens "sees" object at $|D| + |s_2| = D - s_2$ since $s_2 < 0$.

$$s_2 = \frac{f s_1}{s - f} = \frac{(-15.4)(12.1)}{12.1 - -15.4} = -6.776 \text{ cm}$$

Now do converging lens: $s_1' = D - s_2 = 6.5 + 6.776 = 13.276$ cm

$$s_2' = \frac{f' s_1'}{s_1' - f'} = \frac{(4)(13.276)}{13.276 - 4} = \boxed{5.72 \text{ cm}}$$