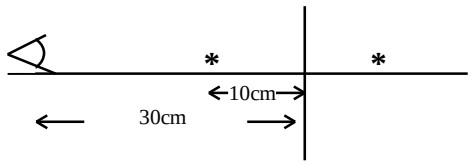
2.



Must focus @ 40cm away

7.

$$\mathbf{m = 2.5 = \frac{-S'}{S}}$$

$$\mathbf{\frac{1}{S} + \frac{1}{S'} = \frac{2}{35}}$$

Subsitute $S' = -2.5S$

$$\mathbf{\frac{1}{S} - \frac{1}{2.5S} = \frac{2}{35}}$$

$$\mathbf{2.5 - 1 = \frac{2}{35}(2.5S)}$$

$$\mathbf{1.5 = 0.143S}$$

$$\mathbf{S = 10.4cm}$$

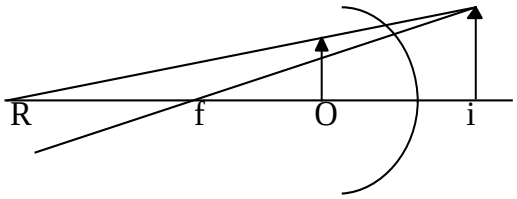
17.

$$\mathbf{\frac{1}{10} + \frac{1}{i} = \frac{1}{20}}$$

$$\mathbf{\frac{1}{i} = \frac{1}{20} - \frac{2}{20} = \frac{-1}{20}}$$

$$\therefore \mathbf{i = -20}$$

$$\mathbf{m = \frac{-(-20)}{10} = +2}$$



18.

$$\frac{1}{24}+\frac{1}{S'}=\frac{2}{R}$$

$$.5=\frac{-S'}{24}\therefore S'=-12$$

$$\frac{1}{24}-\frac{1}{12}=\frac{2}{R}$$

$$\frac{-1}{24}=\frac{2}{R}\therefore R=-48\text{cm}$$

$$\text{but know m}=\frac{-(-12)}{24}=+.5$$

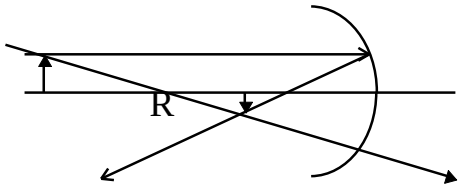
means image is erect

So choose other sign

$$-.5=\frac{S'}{24}\Rightarrow S'=+12$$

$$\frac{1}{24}+\frac{1}{12}=\frac{2}{R}$$

$$\frac{3}{24}=\frac{2}{R}\therefore R=16\text{cm}$$



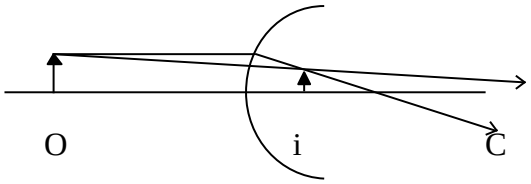
19.

$$r=-40\therefore f=-20$$

$$\frac{1}{O}-\frac{1}{10}=\frac{1}{-20}$$

$$\frac{1}{O}=\frac{-1}{20}+\frac{2}{20}=\frac{1}{20}$$

$$\therefore O=20\text{cm}$$



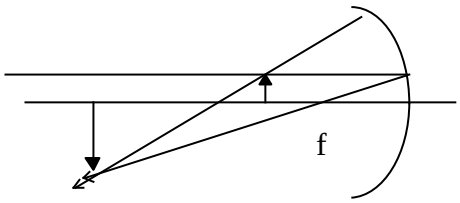
21.

$$\frac{1}{30}+\frac{1}{i}=\frac{1}{20}$$

$$\frac{1}{i}=\frac{3}{60}-\frac{2}{60}=\frac{1}{60}$$

$$\therefore i=60\text{cm}$$

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



22.

$$\frac{1}{S}+\frac{1}{S'}=\frac{-1}{20}$$

$$0.1=\frac{-S'}{S}\Rightarrow .1S=-S'$$

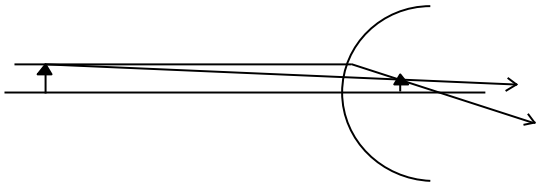
$$S=-10S'$$

$$\frac{-1}{10S'}+\frac{1}{S'}=\frac{-1}{20}$$

$$1-10=\frac{S'}{2}\therefore S'=-18$$

$$S=180$$

If we choose f neg S



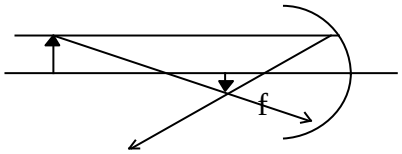
24.

$$m=\frac{-1}{2}=\frac{-i}{60}$$

$$\therefore i=30$$

$$\frac{1}{60}+\frac{1}{30}=\frac{1}{f}$$

$$f=20cm$$



28.

$$m=+1.0=\frac{-i}{20}$$

$$i=-10$$

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

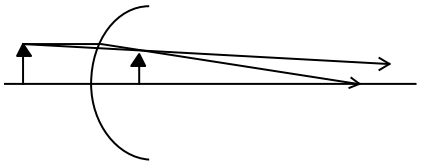
Plane Mirror

29.

$r = 40 \therefore f = 20$

$\frac{1}{S} + \frac{1}{4} = \frac{1}{20} \Rightarrow \frac{1}{S} = \frac{1}{20} - \frac{5}{20} = \frac{-4}{20}$

$\therefore S = -5$



not possible for a convex mirror so reverse signs

$r = -40 \therefore f = -20$

$\frac{1}{S} - \frac{1}{4} = \frac{-1}{20} \Rightarrow \frac{1}{S} = \frac{-1}{20} + \frac{5}{20} = \frac{4}{20}$

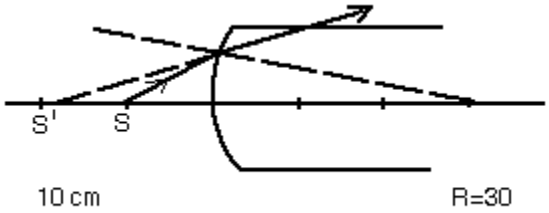
$S = +5$

32.

$\frac{1.0}{10} + \frac{1.5}{S'} = \frac{1.5 - 1.0}{30}$

$\frac{1.5}{S'} = \frac{.5}{30} - \frac{1}{10}$

$\therefore S' = -18\text{cm}$ **Virtual Im age**

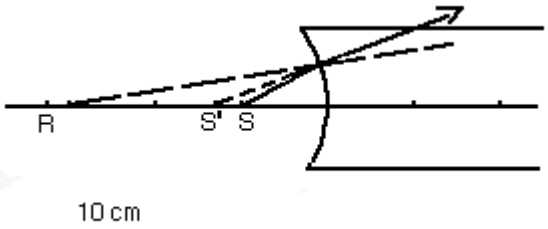


33.

$\frac{1}{10} + \frac{1.5}{-13} = \frac{.5}{R}$

$.100 - .115 = \frac{.5}{R}$

$R = \frac{.5}{-.0154} = -32.5$



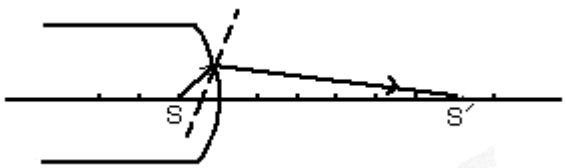
34.

$\frac{1.5}{100} + \frac{1}{600} = \frac{n_2 - 1.5}{-30}$

$.0116 = \frac{n_2 - 1.5}{-30}$

$-.35 = n_2 - 1.5$

$\therefore n_2 = 1.15$

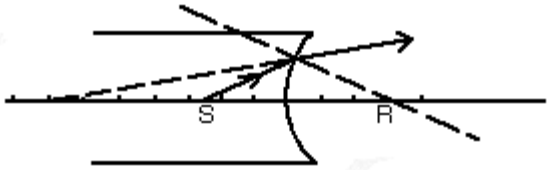


35.

$$\frac{1.5}{70}+\frac{1}{S'}=\frac{-.5}{30}$$

$$\frac{1}{S'}=-.0166-.0214$$

$$S'=-26.3\text{cm}$$

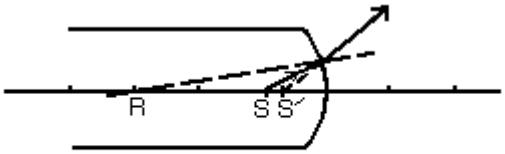


36.

$$\frac{1.5}{S}-\frac{1}{7.5}=\frac{-.5}{-30}$$

$$\frac{1.5}{S}=.0166+.133=.1499$$

$$\therefore S=10$$



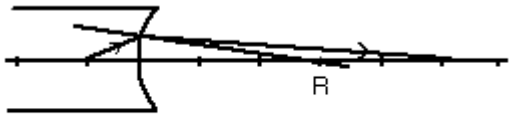
10 cm

37.

$$\frac{1.5}{10}-\frac{1}{6}=\frac{-.5}{R}$$

$$.15-.166=-.016=\frac{-.5}{R}$$

$$R=+31.2$$



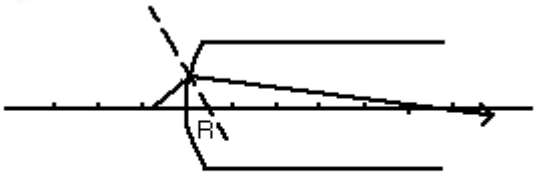
10 cm

38.

$$\frac{1}{S}+\frac{1.5}{600}=\frac{.5}{30}$$

$$\frac{1}{S}=.0167-.0025$$

$$S=70.4\text{cm}$$



100 cm

43.

a) $\frac{1}{f} = (1.5-1)(0-\frac{-1}{20})$

$f = +40cm$

b) $\frac{1}{S} + \frac{1}{S'} = \frac{1}{40}$

$\frac{1}{40} + \frac{1}{S'} = \frac{1}{40}$

$S' = \infty$ **because object is @ focal point of a thin lense**

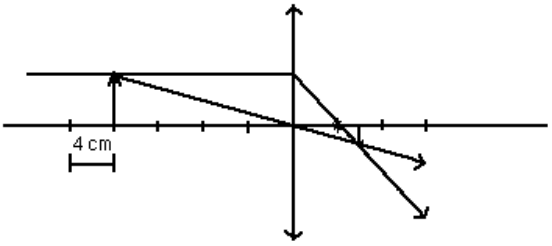
50.

$\frac{1}{16} + \frac{1}{S'} = \frac{1}{4}$

$\frac{1}{S'} = \frac{4}{16} - \frac{1}{16} = \frac{3}{16}$

$S' = 5.33$

$m = \frac{-5.33}{16} = -.33$



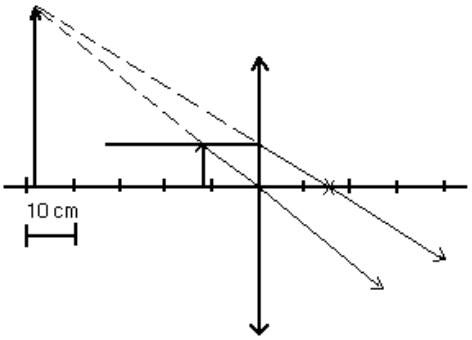
51.

$\frac{1}{12} + \frac{1}{S'} = \frac{1}{16}$

$\frac{1}{S'} = \frac{1}{16} - \frac{1}{12} = \frac{-1}{48}$

$S' = 48$

$m = \frac{-(-48)}{12} = 4x$



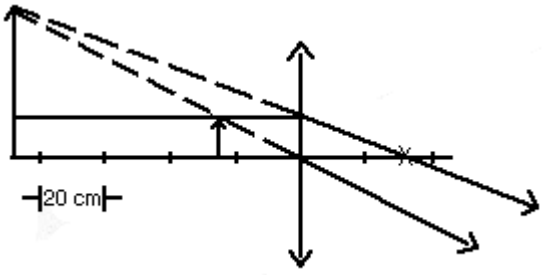
52.

$\frac{1}{25} + \frac{1}{S'} = \frac{1}{35}$

$\frac{1}{S'} = \frac{1}{35} - \frac{1}{25} = \frac{-10}{875}$

$S' = -87.5$

$m = -\frac{-87.5}{25}$



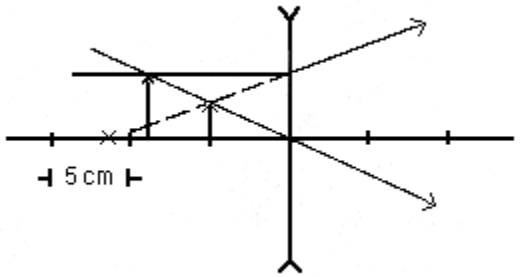
53.

$$\frac{1}{8}+\frac{1}{S'}=\frac{1}{-12}$$

$$S'=\frac{1}{-12}-\frac{1}{8}=\frac{-10}{48}$$

$$S'=-4.8$$

$$m=-\frac{-4.8}{8}=.4$$



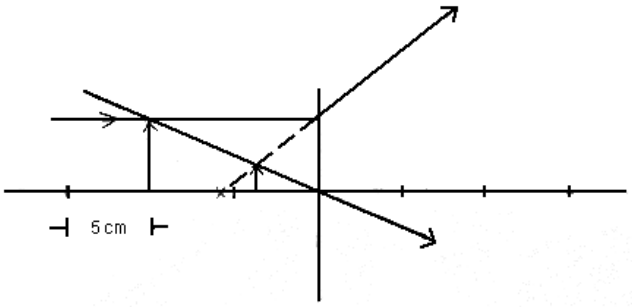
54.

$$\frac{1}{10}+\frac{1}{S'}=\frac{1}{-6}$$

$$\frac{1}{S'}=\frac{-10}{60}-\frac{6}{60}=\frac{-16}{60}$$

$$S'=-3.75$$

$$m=-\frac{-3.75}{10}=.375$$



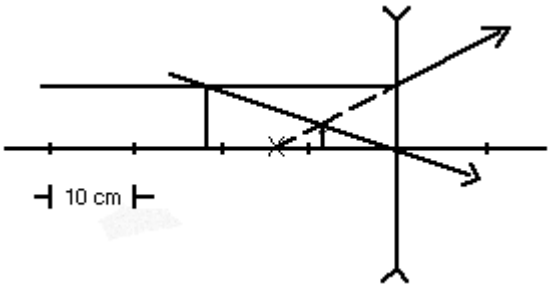
55.

$$\frac{1}{22}+\frac{1}{S'}=\frac{1}{-14}$$

$$\frac{1}{S'}=\frac{1}{-14}-\frac{1}{22}=\frac{-36}{308}$$

$$S'=-8.6$$

$$m=-\frac{-8.6}{22}$$



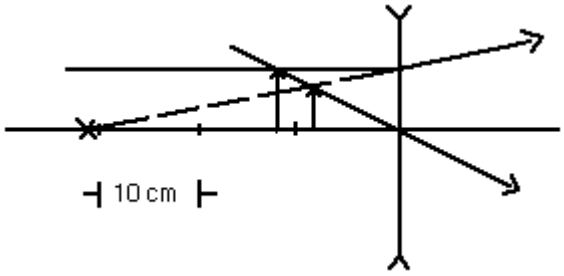
56.

$$\frac{1}{12}+\frac{1}{S'}=\frac{1}{-31}$$

$$\frac{1}{S'}=\frac{1}{-31}-\frac{1}{12}=-\frac{43}{372}$$

$$S'=-8.65$$

$$m=\frac{8.65}{12}$$



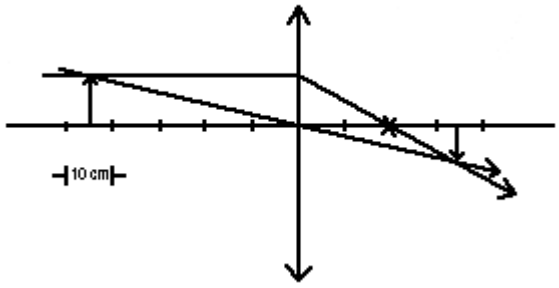
57.

$$\frac{1}{45}+\frac{1}{S'}=\frac{1}{20}$$

$$\frac{1}{S'}=\frac{1}{20}-\frac{1}{45}=\frac{25}{900}$$

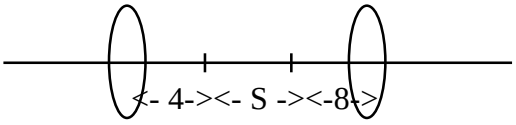
$$S'=36$$

$$m=-\frac{36}{45}$$



89.

a) S is chosen so that the image falls at the focal length of the eyepeice



$$\therefore S = 25 - 12 = 13\text{cm}$$

b) From the figure it looks like magnification of objective is ≈ 3

$$\text{Actually } m=\frac{-S}{F_{ob}}=-3.25$$

$$\frac{1}{S}+\frac{1}{S'}=\frac{1}{f}$$

$$\frac{1}{S}+\frac{1}{17}=\frac{1}{4}\therefore\frac{1}{S}=\frac{17}{68}-\frac{4}{68}\Rightarrow S=5.23\text{cm}$$

$$\text{d)}m_\theta=\frac{25}{f}=\frac{25}{8}=3.125$$

$$\text{e)}M=m*m_\theta=(-3.25)(3.125)=-10.1$$

92.

$\mathbf{M = m_1 m_2}$

$\mathbf{m_1 = \frac{-S'}{S} = \frac{-250}{10} = -25}$

assume object of eyepeice is at focal point

$\mathbf{m_2 = \frac{25cm}{50mm} = 5}$

overall

$\mathbf{M = -25(5) = -125}$

106.

a) $\mathbf{\frac{1}{S_1} + \frac{1}{S_1'} = \frac{1}{f_1}}$

$\mathbf{S_1 = 2f_1}$ **(Given)**

$\mathbf{\frac{1}{2f_1} + \frac{1}{S_1'} = \frac{1}{f_1}}$

$\mathbf{\frac{1}{S_1'} = \frac{1}{f_1} - \frac{1}{2f_1} = \frac{1}{2f_1}}$

$\mathbf{\therefore S_1' = 2f_1}$ **note this is** $\mathbf{2f_2}$ **from the mirror so** $\mathbf{S_2 = 2f_2}$

$\mathbf{\frac{1}{2f_2} + \frac{1}{S_2'} = \frac{1}{f_2}}$

so object is back where object was looking through the lens this means that final image is back at object

b)