Then the final image is at infinity

⇒ Spherical aberration →

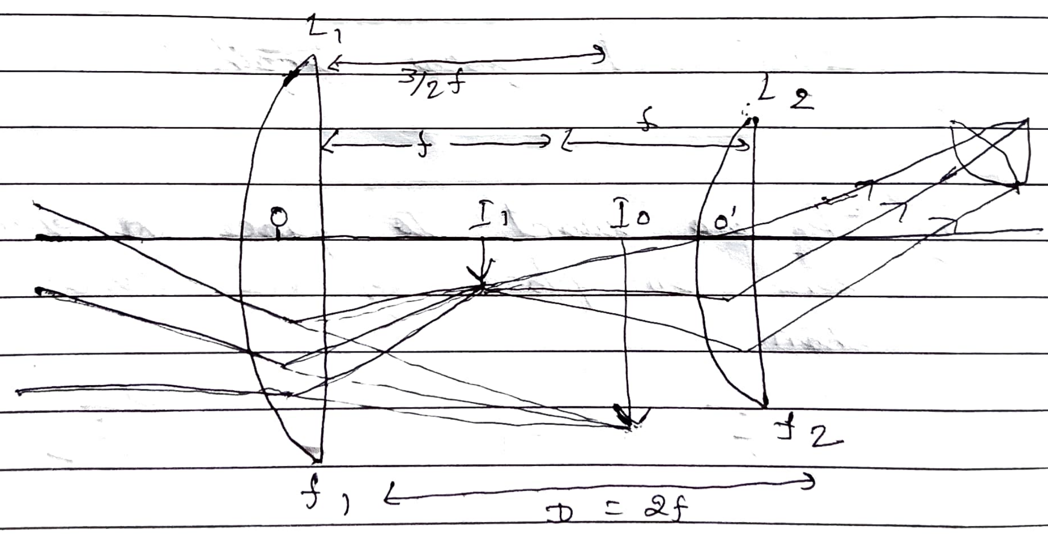
The condition of spherical aberration is that In lens combination the distance between two lenses is equal to the difference of focal lengths of two lenses.

$$d = f_1 - f_2 \qquad f_1 = 2f$$
$$f_2 = f$$

chromatic aberration →

For achromatism the distance between two lenses is equal to the mean focal length

$$d = \frac{f_1 + f_2}{2}$$



working → For lens L_1

Image of lens L_1 is at I_1

$$v = f$$

object of lens L_1 is at I_0 (u)

Focal length $f_1 = 3f$

By using lens formula

$$\frac{1}{f_1} = -\frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{3f} = -\frac{1}{u} + \frac{1}{f}$$

$$-\frac{1}{u} = \frac{1}{3f} - \frac{1}{f}$$

$$= \frac{f - 3f}{3f^2} = \frac{-2f}{3f/2}$$

$$-\frac{1}{u} = -\frac{2\cancel{f}}{3f^{\cancel{2}}}$$

$$\boxed{u = \frac{3}{2}f}$$

Equivalent focal length

If we want to place a equivalent lens in place of this combination than

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$

$$\frac{1}{f} = \frac{1}{3f} + \frac{1}{f} - \frac{2f}{3f \times f}$$

$$\frac{1}{f} = \frac{f + 3f - 2f}{3f^2}$$

$$\frac{1}{f} = \frac{2f}{3f^2}$$

$$f = \frac{3f^2}{2f} = \frac{3}{2}f$$