Afocal Glass Rod

An afocal system is to be fabricated by polishing convex surfaces onto both ends of a 150 mm long glass rod. The magnitude of the lateral magnification of the system is 0.5, and the glass has an index of refraction of 1.5.

What are the two required radii of curvature? \(|m| = 0.5\)

Solution:

Both surfaces are convex → \(\phi_1 > 0\) \(\phi_2 > 0\) \(f_1 > 0\) \(f_2 > 0\)

\[
m = -\frac{f_2}{f_1} = -0.5 \text{ (must be negative)}
\]

Afocal: \(L = f'_{R_1} - f_{F_2}\) \(f'_{R_1} = nf_1\) \(f_{F_2} = -nf_2\)

\(L = nf_1 + nf_2 = 150\text{mm}\)

\(n = 1.5\) \(f_1 = 2f_2\)

\(1.5 \times (2f_2 + f_2) = 150\)

\(f_2 = 33.33\text{mm}\)

\(f_1 = 66.67\text{mm}\)

\[
\phi_1 = \frac{1}{f_1} = (n-1) / R_1 \quad \phi_2 = \frac{1}{f_2} = (1-n) / R_2
\]

\(R_1 = 33.33\text{mm}\)

\(R_2 = -16.67\text{mm}\)