Telephoto - Gaussian Reduction

The following combination of thin lenses in air is in a telephoto configuration:

\[ f_1 = 75 \text{ mm} \]
\[ f_2 = -60 \text{ mm} \]
\[ \text{Spacing} = 35 \text{ mm} \]

Use Gaussian reduction to determine the focal length of the system, and the locations of the rear principal plane and the rear focal point.

Solution

\[ f_1 = 75 \text{mm} \quad \phi_1 = 0.01333/\text{mm} \]
\[ f_2 = -60 \text{mm} \quad \phi_2 = -0.01666/\text{mm} \]
\[ t = 35 \text{mm} \quad \tau = t = 35 \text{mm} \]

\[ \phi = \phi_1 + \phi_2 - \phi_1 \phi_2 \tau \]
\[ \phi = 0.00444/\text{mm} \]
\[ f = 225 \text{mm} \quad f'_R = 225 \text{mm} \]
\[ d' = \delta' = -\frac{\phi_1}{\phi} \tau \]
\[ d' = -105 \text{mm} \]
\[ BFD = f'_R + d' \]
\[ BFD = 120 \text{mm} \]

![Diagram of telephoto lens system]