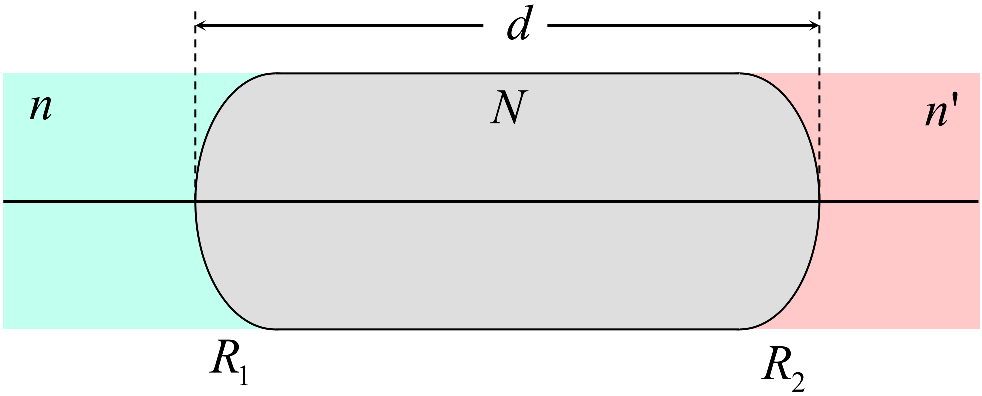
Thick Lens



General Thin Lens Equations

Power: $C = -\frac{n}{f} = \frac{n'}{f'}$

Shape Factor: $\gamma = \frac{1}{2}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

Focal Lengths: $f' = -f$

Lens Maker's Equation: $C = -\frac{n}{f} = \frac{n'}{f'} = \frac{N-n}{R_1} + \frac{n'-N}{R_2} - \frac{d(N-n)(n'-N)}{R_1 R_2 N}$

$$C = (N-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) + \frac{d(N-1)^2}{R_1 R_2 N}$$ Thick lens in air with glass index N

Distance for Magnification: $x = f'\left(\frac{1}{m_y}\frac{n}{n'} - 1\right)$

At the conjugate points A and A'

Imaging Equation: $\frac{n'}{x'} = \frac{n}{x} + \frac{n'}{f'}$

Optical Invariance: $ny\alpha = n'y'\alpha'$

Newton's Equation: $m_y = \frac{y'}{y} = -\frac{f}{\overline{FA}} = -\frac{\overline{F'A'}}{f'}$

Transverse Magnification: $m_y = \frac{y'}{y} = \frac{x'}{x}\frac{n}{n'} = -\frac{1}{m_\alpha}\frac{n}{n'} = \frac{1}{m_x}\frac{x}{x'} = -\frac{m_\alpha}{m_x}$

Angular Magnification: $m_\alpha = \frac{\alpha'}{\alpha} = -\frac{x}{x'} = -\frac{1}{m_y}\frac{n}{n'} = -m_x\frac{x'}{x}\frac{n}{n'} = -m_x m_y$

Axial Magnification: $m_x = \frac{dx}{dx'} = \frac{n}{n'}\left(\frac{x}{x'}\right)^2 = \frac{1}{m_y}\frac{x}{x'} = -m_\alpha\frac{x}{x'}\frac{n'}{n} = -\frac{m_\alpha}{m_y}$