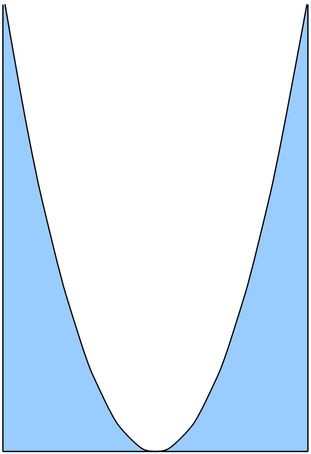
# How to Make a Fresnel Lens



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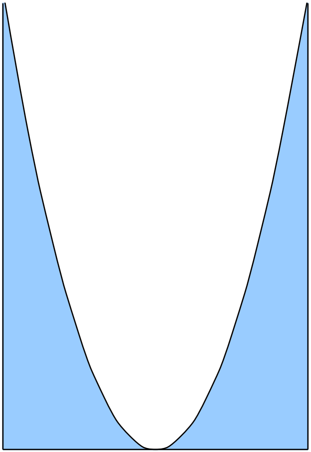

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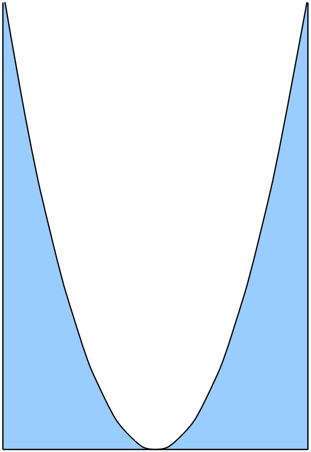

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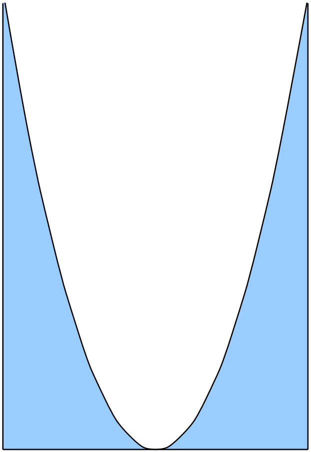

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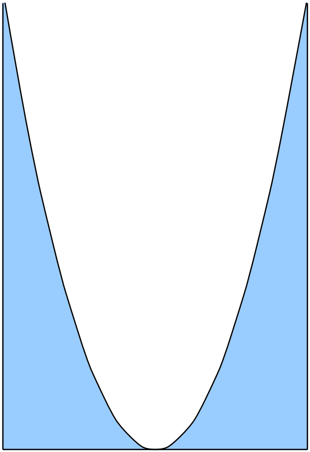

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aspect ratio too large for a stable structure and absorption would be too large!

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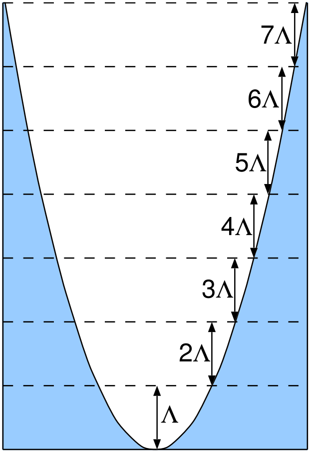


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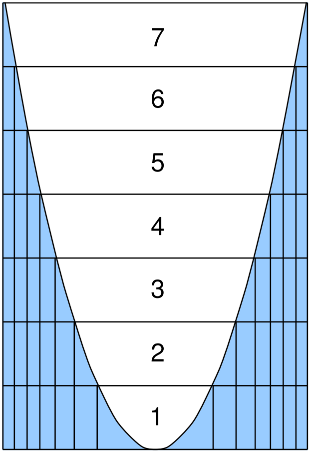


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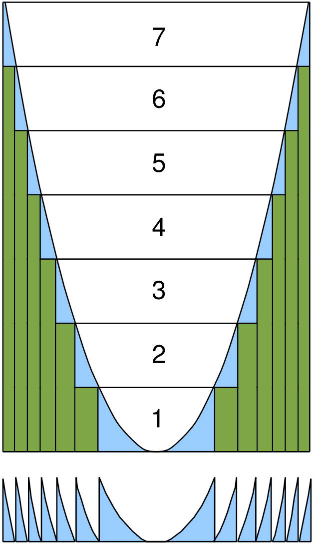


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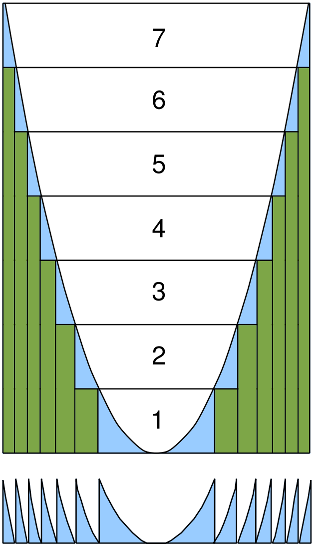
Each block of thickness $\Lambda$ serves no purpose for refraction but only attenuates the wave.

This material can be removed and the remaining material collapsed to produce a Fresnel lens which has the same optical properties as the parabolic lens as long as $f \gg N\Lambda$ where $N$ is the number of zones.

# Fresnel Lens Dimensions

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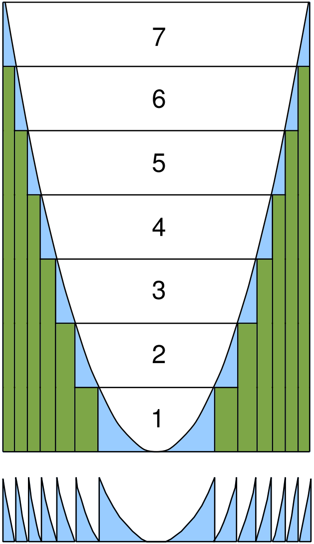


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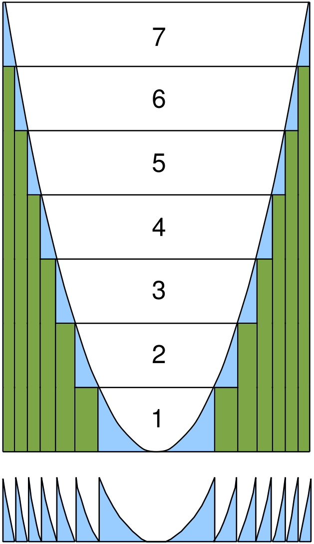


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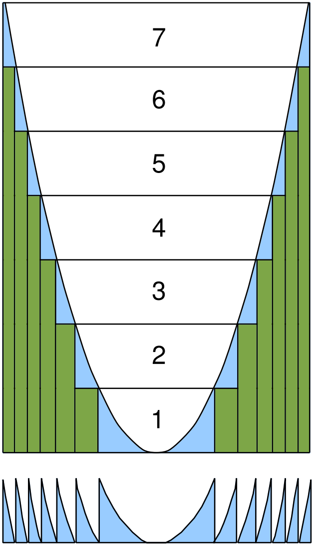


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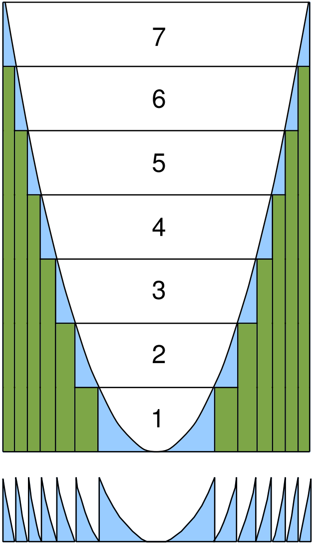


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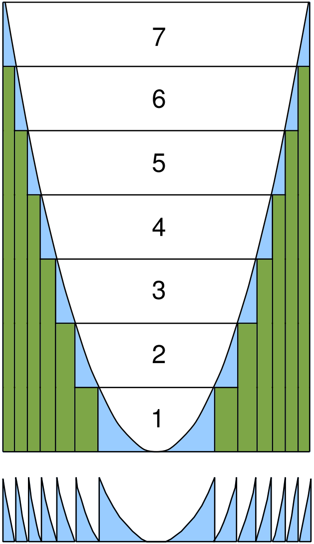


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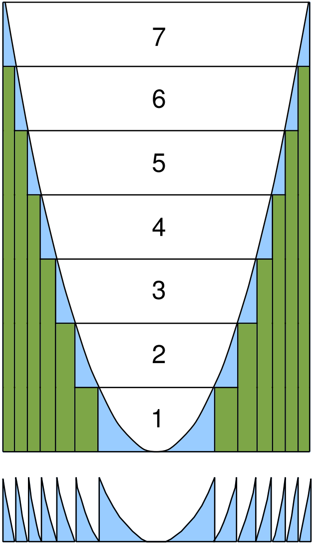


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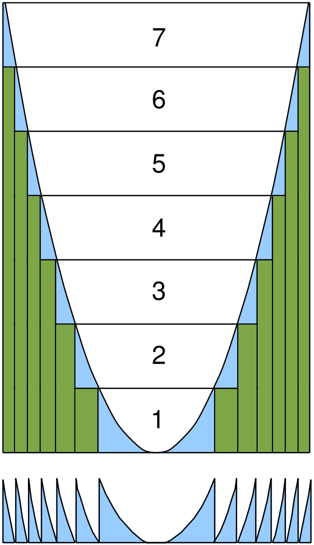


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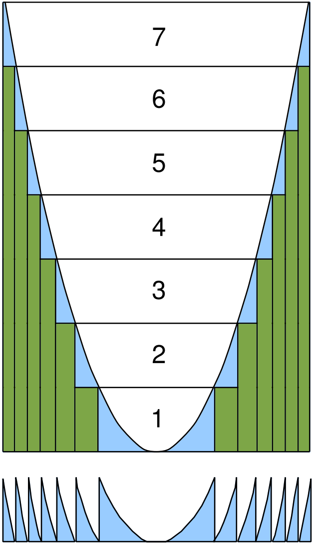


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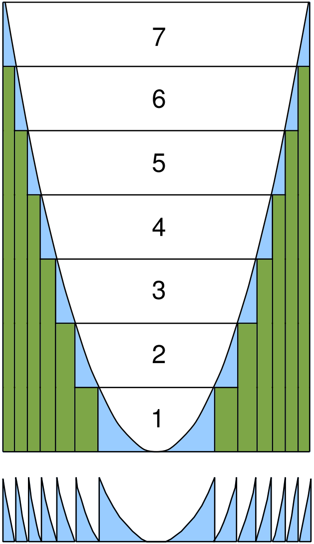


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The diameter of the entire lens is thus

$$2\xi_N = 2\sqrt{N} = \frac{1}{\Delta\xi_N}$$

# Fresnel Lens Example

In terms of the unscaled variables

$$\Delta x_N = \Delta \xi_N \sqrt{2\lambda_o f}$$

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If we take

$$\lambda_o = 1\text{Å} = 1\times 10^{-10}\text{m}$$
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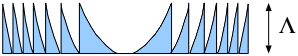
# Making a Fresnel Zone Plate




The specific shape required for a zone plate is difficult to fabricate, consequently, it is convenient to approximate the nearly triangular zones with a rectangular profile.

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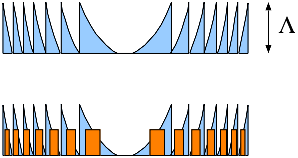


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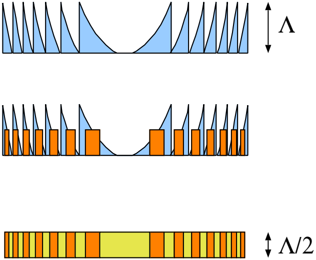


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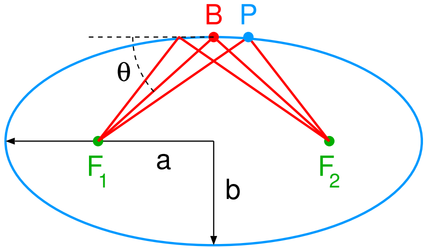
This kind of zone plate is not as efficient as a true Fresnel lens would be in the x-ray regime. Nevertheless, efficiencies up to 35% have been achieved.

# Tangential Focusing Mirror

The shape of an ideal mirror is an ellipse, where any ray coming from one focus will be projected to the second focus.



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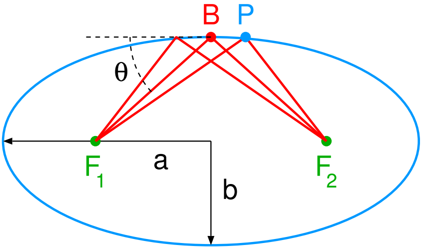
The shape of an ideal mirror is an ellipse, where any ray coming from one focus will be projected to the second focus. Consider a 1:1 focusing mirror. For an ellipse the sum of the distances from any point on the ellipse to the foci is a constant.

$$F_1P + F_2P = 2a$$



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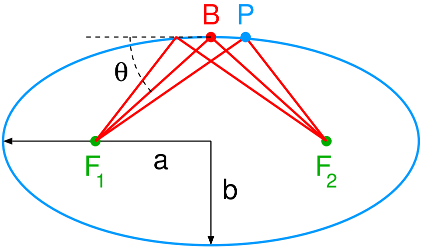

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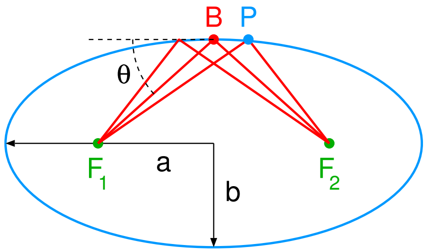

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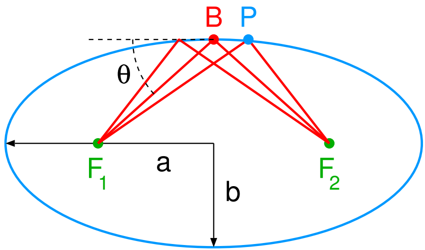


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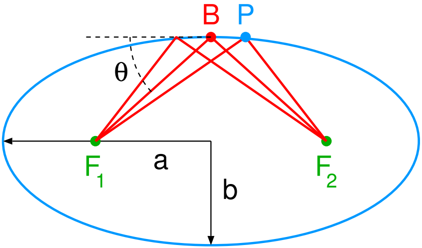


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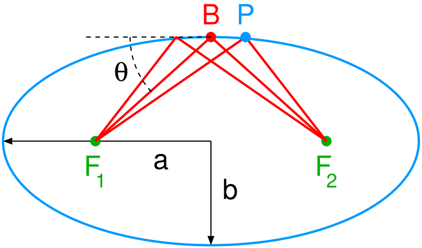


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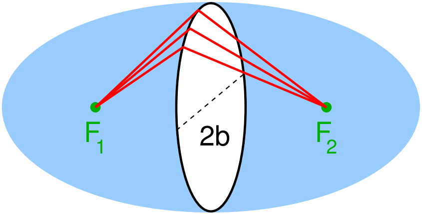
Ellipses are hard figures to make, so usually, they are approximated by circles. In the case of saggital focusing, an ellipsoid of revolution with diameter $2b$, is used for focusing.



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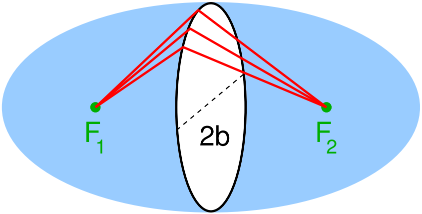

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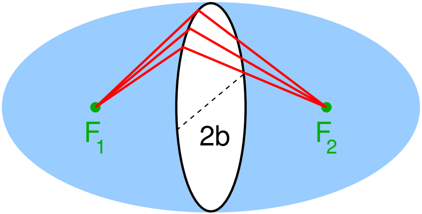

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