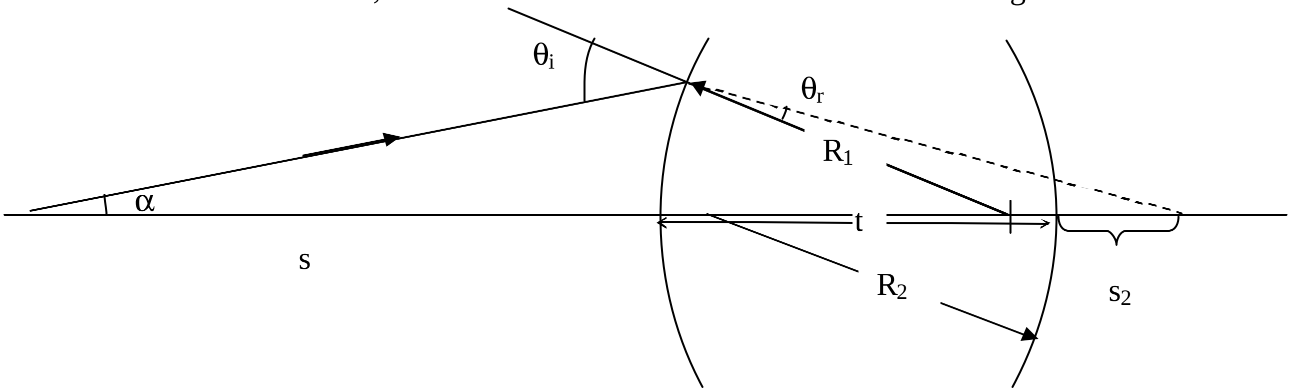
Double surface refraction

Since a lens has two surfaces, we will add a second surface as shown in the diagram.



Using previous results, s_2 is negative (sign convention). The image of the point source on the left is formed a distance s' from the first surface. The distance of the second surface from the first is t. The image of the point source formed by the first surface will act as the object for the second surface.

(1) Using the relation found previously for a single surface, write an expression for the location of the image (s_2') formed by the second surface. Be careful regarding the sign of s_2 and explain why you chose the sign you used.

(2) Determine the object distance for the second surface (s_2) in terms of the thickness of the lens (t) and the image distance from the first lens.

Replace s_2 in (1) using the expression in (2), then make the thin lens approximation that the lens thickness is MUCH smaller than the object or image distance (I know that is not the case in the drawing, but that's ok).

Solve for $n_r \frac{h}{s'}$ and find s_2' in terms of the radii of curvature of the second surface and the object distance.

Replace $n_r \frac{h}{s'}$ with an expression involving this term determined previously.

Move the terms involving the radii of the surfaces to one side of the equation and combine. On the other side, you want a relationship involving s and s_2'.

Does this equation look familiar?

If s becomes ∞ then where would the image be of the point source be?

With s being large, you should determine a relationship for the ________________ ____________________ of a lens that depends upon the ________________ of ________________ for the surroundings and for the lens material. This expression is:

Using this expression you can get a second relation for when s is not large that relates the object location, image location and the ________________ _________________ of the lens.