2.8A: Power of a Lens

I have drawn two rays emanating from the tip of the object. One is parallel to the axis; after refraction it passes through the focus. The other goes through the centre (“pole”) of the lens; since the lens is “thin”, this ray is neither deviated not displaced. The two rays cross at the tip of the image.

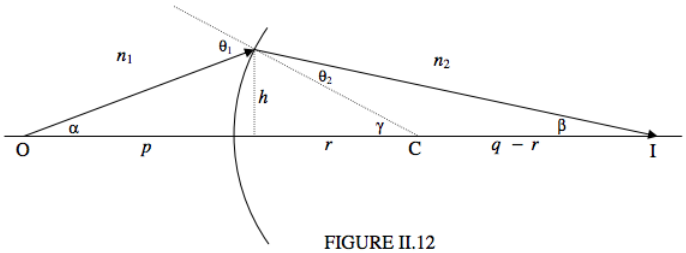

FIGURE II.12

From two obvious pair of similar triangles, we see that

$$\frac{h'}{h} = \frac{q}{p} = \frac{q-f}{f}. \tag{2.8A.1}$$

From this we immediately obtain

$$\frac{1}{q} = -\frac{1}{p} + \frac{1}{f}. \tag{2.8A.2}$$

Since the initial and final convergences are $-1/p$ and $1/q$, it follows that the power is $1/f$. You might want to draw the cases where the real object is at a distance less than $2f$ from the lens (and hence forms a virtual image) or for a virtual object, or the corresponding situations for a diverging lens. You will reach the same conclusion in each case.