626.

<u>Problem 44.37 (RHK)</u>

Parallel rays entering a relaxed eye gazing at infinity produce a real, inverted image on the retina. The eye thus acts as a converging lens. Assume a focal length f *for the eye of* 2.50 cm. *An object is moved to a distance* $o = 36.0 \text{ cm}$ *from the eye. To form an image on the retina the effective focal length of the eye must be reduced to* f'. *This is done by the action of the ciliary muscles that change the shape of the lens and thus the effective focal length of the eye.* (a) *We have to find* f' *from the above data.* (b) *We have answer in the process whether the radii of curvature of the lens become larger or smaller in the transition from observing infinity to a finite distance.*

<u>Solution:</u>

We find f' using the thin lens equation with values

$o = 36.0 \text{ cm}$ and $i = 2.5 \text{ cm}$.

We have

$$\frac{1}{36.0\text{ cm}}+\frac{1}{2.5\text{ cm}}=\frac{1}{f'},$$

or

$$f'=\frac{36.0\times 2.5}{38.5}\text{ cm}=2.34\text{ cm}.$$

We answer next the second part of the problem. For a converging lens, the focal length *f* is determined in terms of the radii of curvature r_1 and r_2 by the lens maker's formula:

$$\frac{1}{f}=(n-1)\left(\frac{1}{r_1}+\left|\frac{1}{r_2}\right|\right).$$

As the focal length of the eye lens gets reduced from 2.5 cm to 2.34 cm in shifting eye from seeing a far object to seeing a near object, the radii of curvature of the eye lens will become smaller.