613.

Problem 44.12 (RHK)

A double-convex lens is to be made of glass with an index of refraction of 1.5. *One surface is to have twice the radius of curvature of the other and the focal length is to be* 60 mm. *We have to find the radii*.

Solution:

The focal length *f* of lens is given by the relation

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

where r_1 and r_2 are the radius of curvature of the first and the second curved surfaces of the lens. In a convex lens the centre of curvature of the first curved face, C_1, lies in the *R*-side and therefore the radius of curvature $r_1 = R$ is positive. The centre of curvature of the second face of the double-convex lens, C_2, lies in the *V*-side and therefore the radius of curvature $r_2 = -2R$ is negative. We can solve for from the equation

$$\frac{1}{f} = (1.5-1)\left(\frac{1}{R} + \frac{1}{2R}\right)$$

$$= \frac{0.5 \times 3}{2R}.$$

$\therefore\ R = 0.75 \times 60 \text{ mm} = 45 \text{ mm}.$

Therefore, the radii of the double-convex lens are 45 mm and 90 mm.