

19. We use the lens maker's equation, Eq. 35-10:

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

where f is the focal length, n is the index of refraction, r_1 is the radius of curvature of the first surface encountered by the light and r_2 is the radius of curvature of the second surface. Since one surface has twice the radius of the other and since one surface is convex to the incoming light while the other is concave, set $r_2 = -2r_1$ to obtain

$$\frac{1}{f} = (n - 1) \left(\frac{1}{r_1} + \frac{1}{2r_1} \right) = \frac{3(n - 1)}{2r_1} .$$

We solve for r_1 :

$$r_1 = \frac{3(n - 1)f}{2} = \frac{3(1.5 - 1)(60 \text{ mm})}{2} = 45 \text{ mm} .$$

The radii are 45 mm and 90 mm.