Problem 9.9 The radiation pattern of a circular parabolic-reflector antenna consists of a circular major lobe with a half-power beamwidth of 3° and a few minor lobes. Ignoring the minor lobes, obtain an estimate for the antenna directivity in dB.

Solution: A circular lobe means that $\beta_{xz} = \beta_{yz} = 3^\circ = 0.052$ rad. Using Eq. (9.26), we have

$$D = \frac{4\pi}{\beta_{xz}\beta_{yz}} = \frac{4\pi}{(0.052)^2} = 4.58 \times 10^3.$$

In dB,

$$D(\text{dB}) = 10\log D = 10\log(4.58 \times 10^3) = 36.61 \text{ dB}.$$