

**Problem 9.28** A uniformly illuminated rectangular aperture situated in the  $x$ - $y$  plane is 2 m high (along  $x$ ) and 1 m wide (along  $y$ ). If  $f = 10$  GHz, determine the following:

- (a) The beamwidths of the radiation pattern in the elevation plane ( $x$ - $z$  plane) and the azimuth plane ( $y$ - $z$  plane).
- (b) The antenna directivity  $D$  in decibels.

**Solution:** From Eqs. (9.94a), (9.94b), and (9.96),

$$\beta_{xz} = 0.88 \frac{\lambda}{l_x} = \frac{0.88 \times 3 \times 10^{-2}}{2} = 1.32 \times 10^{-2} \text{ rad} = 0.75^\circ,$$

$$\beta_{yz} = 0.88 \frac{\lambda}{l_y} = \frac{0.88 \times 3 \times 10^{-2}}{1} = 2.64 \times 10^{-2} \text{ rad} = 1.51^\circ,$$

$$D = \frac{4\pi}{\beta_{xz}\beta_{yz}} = \frac{4\pi}{(1.32 \times 10^{-2})(2.64 \times 10^{-2})} = 3.61 \times 10^4 = 45.6 \text{ dB}.$$

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