3.1

Side 316 "

a) $D_0 = 4N\left(\frac{d}{\lambda}\right)$ $D_0 = 20 dB = 10^2 = 100$

$d = \frac{\lambda}{4}$

$100 = 4N\left(\frac{\frac{\lambda}{4}}{\lambda}\right) \Leftrightarrow N = \underline{\underline{100}}$

b) $L = 99 \cdot d = 99 \cdot \frac{\lambda}{4} = 24.75 \cdot \lambda$

c) $HPBW = 2 \cdot \cos^{-1}\left(1 - \frac{1.391 \cdot \lambda}{\pi N d}\right) = 2 \cdot \cos^{-1}\left(1 - \frac{1.391 \cdot \lambda}{\pi N \cdot \lambda/4}\right) = 2 \cdot \cos^{-1}\left(1 - \frac{5.564}{\pi \cdot 100}\right)$

$= 0.377 \ rad = 21.6°$

d) $-13 dB$ since it is almost a sinc function

e) $\beta = \pm k d = \pm \frac{2\pi}{\lambda} \cdot \frac{\lambda}{4} = \pm \frac{\pi}{2} = \pm 90°$