HW 12-5 Soln)

Assume that the intensities add, since the sounds of each machine are *incoherent*, that is, we assume that five machines produce five times the energy as one machine, and that eight machines produce eight times the energy as one machine. We'll discuss later cases when this is not exactly so.

$\beta_5 = 87\text{dB}$

In general, $\beta = 10 \log_{10}[I/I_o]$ where $I_o = 10^{-12}$ wts/m^2

$\beta_5 = 10 \log_{10}[I_5/I_o]$
$\beta_8 = 10 \log_{10}[I_8/I_o]$

Subtract to obtain:

$$\begin{aligned}\beta_8 - \beta_5 &= 10 \log_{10}[I_8/I_o] - 10 \log_{10}[I_5/I_o] \\ &= 10\{[\log_{10}I_8 - \log_{10}I_o] - [\log_{10}I_5 - \log_{10}I_o]\} \\ &= 10\{\log_{10}I_8 - \log_{10}I_5\} \\ &= 10\log_{10}[I_8/I_5] \\ &= 10\log_{10}[8/5] \\ &= 10 \log_{10}[1.6]\end{aligned}$$

$\beta_8 - \beta_5 = 2$

$\beta_8 = \beta_5 + 2 = 87 + 2 =$ 89 dB