

# $E_b/N_0$ vs. BER

Signal energy per information bit:

$$E_b = E_s/R$$

Noise power:

$$N_0/2 = \sigma^2$$

$$\text{SNR} = E_s/\sigma^2 = RE_b/(N_0/2)$$

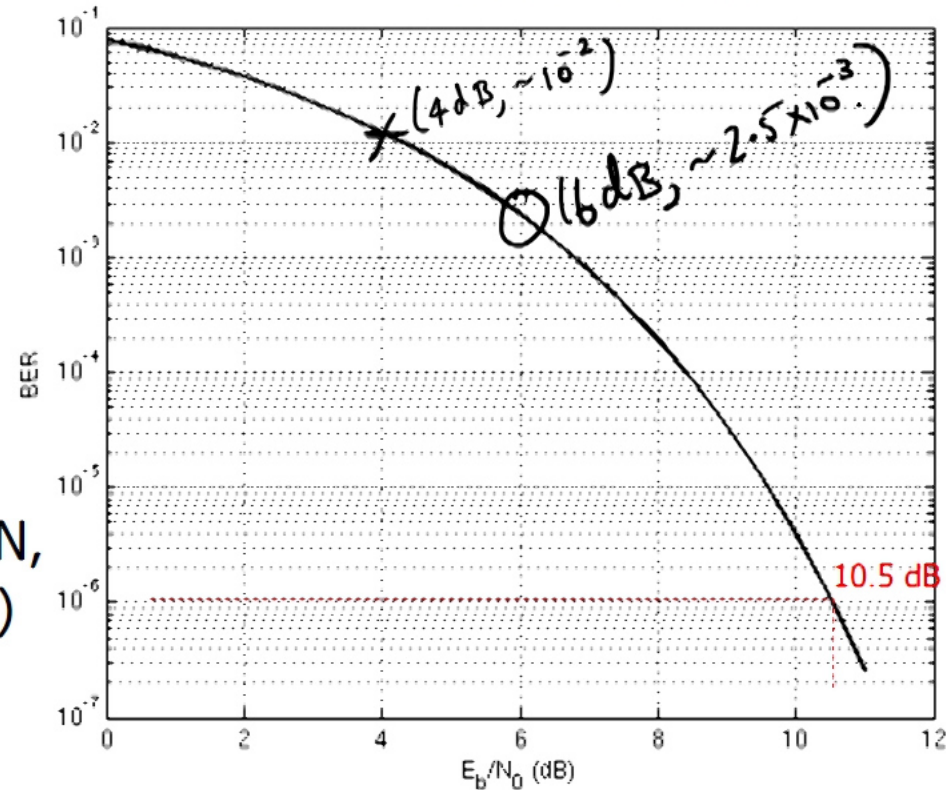
Or

$$\text{SNR} = 2R (E_b/N_0)$$

For uncoded BPSK over AWGN,

$$\begin{aligned} \text{BER} &= Q(1/\sigma) = Q(\sqrt{\text{SNR}}) \\ &= \underline{Q(\sqrt{2(E_b/N_0)})} \end{aligned}$$

Plot of BER vs.  $E_b/N_0$  (dB) for uncoded BPSK



Coding enables same BER at lower  $E_b/N_0$ 's!