① Consider an input signal

$$x = x_0 + \eta$$

(x: actual, x_0: ideal, η: noise)

Define $SNR_{fl} = \dfrac{\sigma_{x_0}^2}{\sigma_\eta^2}$ (floating-point SNR)

x is quantized to B_x bits to generate $x_q = x + q_x$. Assume x_0, q_x & η are uncorrelated.

$$SNR_{fx} = \frac{\sigma_{x_0}^2}{Var(x_0 - x_q)} \quad \ldots \text{ (fixed-point SNR)}$$

a) What is the minimum value of B_x such that SNR_{fx} is within 0.5 dB of SNR_{fl}?

b) Sketch a generic plot of SNR_{fx} vs. B_x.