Task 3:

a) The corresponding distribution is: $f(x) = \frac{1}{2a} \exp\left(\frac{-|x-\mu|}{a}\right)$

$$= \int \frac{1}{2a} \exp\left(\frac{-|x-\mu|}{a}\right) dx = \begin{cases} \frac{1}{2} e^{(x-\mu)/a} (|\mu - x| + 1) & \text{if } x \leq \mu \\ 1 - \frac{1}{2} \exp\left(-\frac{x-\mu}{a}\right) & \text{if } x \geq \mu \end{cases}$$

b) The differential entropy is: $h(x) = E\left[-\log\left(\frac{1}{2a} \exp\left(\frac{-|x-\mu|}{a}\right)\right)\right]$
which is equal to: $\ln(2ae^1)$.

Thus the differential entropy does not depend on the expected value of μ.

And the variance $= E(x - E(x)^2)$
$= 2a^2$.

c) The formula $SQNR_0 = 20 \log_{10}(\sqrt{12\sigma_x^2}\, 2^{-h(x)})$
$= 20 \log_{10}(\sqrt{24} \times a \times 2^{-\ln(2ae^1)})$

d) Using $H(I) = 4$ bits and $a = 2$.

$\Delta = 2^{h(\lambda) - H(I)}$

$\Delta = 2^{20 \log_{10}(3.75) - 4} = 2^{7.48} \simeq 178.08$

Task 4: