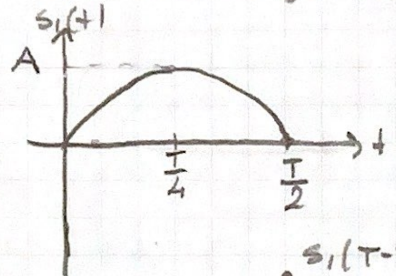
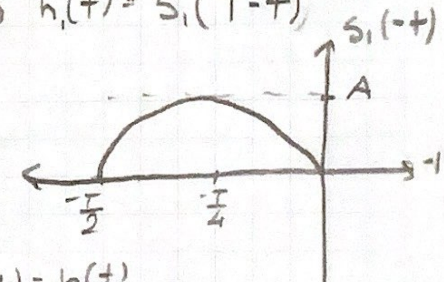
$$s_1(t) = \begin{cases} A \cdot \sin\left(\frac{2\pi t}{T}\right), & 0 \leq t \leq T/2 \\ 0, & \text{else} \end{cases} \qquad s_2(t) = -s_1(t - T/2)$$

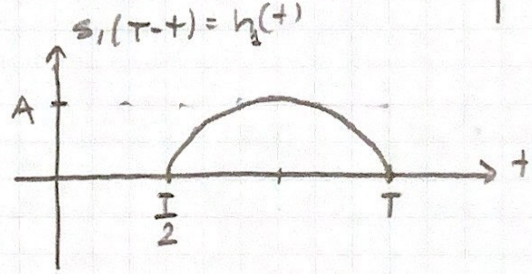
a) $P(1) = P(0) = 1/2$

$$P_b = Q\left(\frac{a_1 - a_2}{2 N_0}\right)$$

$s(t)$ reel olduğundan $h_1(t) = s_1(T - t)$

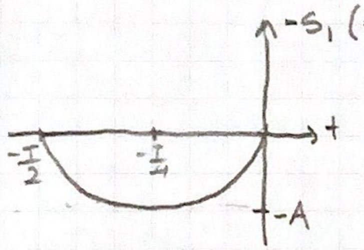




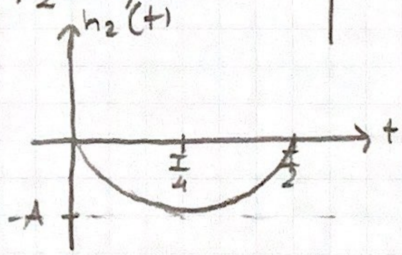


$s_2(t)$ reel olduğundan

$$h_2(t) = s_2(T-t) = -s_1(T - t - T/2)$$
$$s_2(T-t) = -s_1(T/2 - t)$$



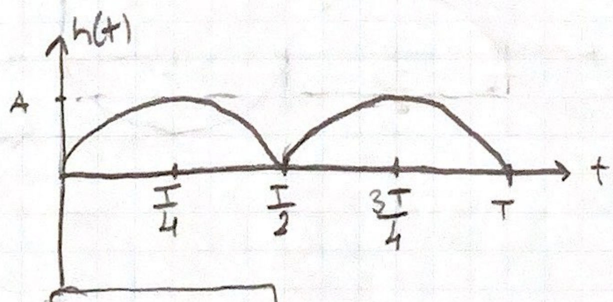
$\Rightarrow$



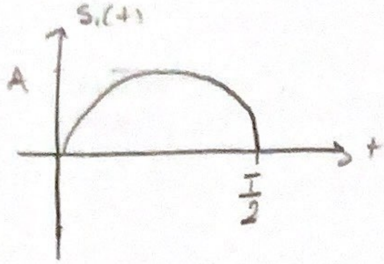
$h(t) = h_1(t) - h_2(t)$ (üst üste binme olmadığından toplanabilir.)

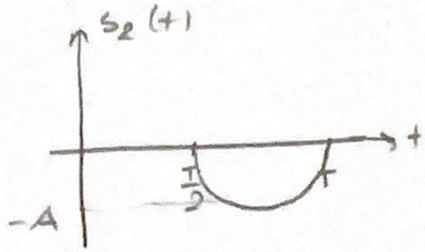
$h(t) = s_1(T-t) - s_2(T-t)$

$$\boxed{\gamma_0 = \frac{a_1 + a_2}{2} = 0}$$



$$\boxed{E_h = \frac{A^2}{2} T}$$

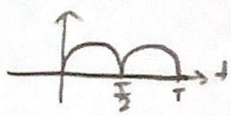




$$P_{s_1} = \frac{A^2}{2}\cdot\frac{T}{2} = \frac{A^2 \cdot T}{4} \qquad P_{s_2} = \frac{A^2}{2}\cdot\frac{T}{2} = \frac{A^2 T}{4}$$

$$E_b = \underbrace{E_{s_1}}_{\frac{A^2T}{4}} \cdot \underbrace{P(s_1)}_{\frac{1}{2}} + \underbrace{E_{s_2}}_{\frac{A^2T}{4}} \cdot \underbrace{P(s_2)}_{\frac{1}{2}} = \boxed{\frac{A^2T}{4} = E_b}$$

$$a_1 = \int_0^T s_1(t)\underbrace{\left[s_1(t) - \cancel{s_2(t)}\right]}\,dt = \int_0^{T/2} s_1^2(t)\,dt = \int_0^{T/2} A^2 \underbrace{\sin^2\left(\frac{2\pi t}{T}\right)}_{\frac{1}{2}\left[1-\cos\left(\frac{2\cdot 2\pi t}{T}\right)\right]} dt$$



$$= \frac{A^2 t}{2} - \frac{A^2}{2}\sin\left(\frac{4\pi t}{T}\right)\Bigg|_0^{T/2}$$

$$= \frac{A^2}{2}\left(t - \sin\left(\frac{4\pi t}{T}\right)\right)\Bigg|_0^{T/2} = \frac{A^2}{2}\left(\left[\frac{T}{2} - \underbrace{\cancel{\sin}(2\pi)}_{0}\right] - \left[0 - \underbrace{\cancel{\sin}(0)}_{0}\right]\right)$$

$$\boxed{a_1 = \frac{A^2T}{4}}$$

$$a_2 = \int_0^T s_2(t)\left[s_1(t) - s_2(t)\right]dt = -\int_{T/2}^{T} \underbrace{s_2^2(t)}\,dt = -\int_0^{T/2} +A^2 \cdot \sin^2\left(\frac{2\pi t}{T}\right)dt$$

$s_1^2(t)$'nin aynısı olur. (eksilisi)

$$\boxed{a_2 = \frac{-A^2T}{4}}$$

$E_b = \frac{A^2T}{4} = 1$ ise

$a_1 = \frac{A2T}{4}$ ve $a_2 = -\frac{A^2T}{4}$ de "1" olur.

$$\sigma_0^{\,2} = \frac{N_0}{2} \cdot E_h = \frac{N_0}{2} \cdot \frac{A^2T}{2} = \boxed{\frac{N_0A^2T}{4}}$$

E_h'yi bulmuştuk

$$\boxed{\sigma_0 = \frac{A}{2}\sqrt{N_0 . T}}$$

$$P_b = Q\left(\frac{a_1 - a_2}{2\sigma_0}\right) = Q\left(\frac{\frac{A^2T}{4} - \left(-\frac{A^2T}{4}\right)}{2 . \frac{A}{2}\sqrt{N_0T}}\right) = Q\left(\sqrt{\frac{A^2T}{4N_0}}\right)$$

$$\boxed{P_b = Q\left(\sqrt{\frac{E_b}{N_0}}\right)}$$

$E_b = 1$ için $P_b = Q\left(\sqrt{\frac{1}{N_0}}\right)$

b) $P(1) = \frac{1}{4}$, $P(0) = \frac{3}{4}$

sinüzoidal işaretin gücü

zamanla çarpılırsa enerjiyi verir

$$\sigma_0^2 = \frac{N_0}{2} \cdot E_h \qquad E_h = \int_0^T \left| -A\sin\left(\frac{2\pi t}{T}\right)\right|^2 dt = \frac{A^2 \cdot T}{2}$$

$$\sigma_0^2 = \frac{N_0 \cdot A^2 \cdot T}{4}$$

$$\gamma_0 = \frac{\frac{N_0 \cdot A^2 \cdot T}{4}}{\underbrace{\frac{A^2T}{4} - -\frac{A^2T}{4}}_{\frac{A^2T}{2}}} \cdot \underbrace{\ln\frac{\left(\frac{3}{4}\right)}{\left(\frac{1}{4}\right)}}_{\ln(3)} + \frac{\overbrace{\frac{A^2T}{4} + -\frac{A^2T}{4}}^{0}}{2}$$

$$\boxed{\gamma_0 = \frac{N_0}{2} \cdot (1.09) \cong \frac{N_0}{2}}$$

$$P_b = \left[1 - Q\left(\frac{\gamma_0 - a_1}{\sigma_0}\right)\right] P(s_1) + Q\left(\frac{\gamma_0 - a_2}{\sigma_0}\right) P(s_2)$$

$$\boxed{P_b = \left[Q\left(\frac{\frac{A^2T}{4} - \frac{N_0}{2}}{\frac{A}{2}\sqrt{N_0 T}}\right)\right] \cdot \frac{1}{4} + Q\left(\frac{\frac{N_0}{2} - -\frac{A^2T}{4}}{\frac{A}{2}\sqrt{N_0 T}}\right) \cdot \frac{3}{4}}$$