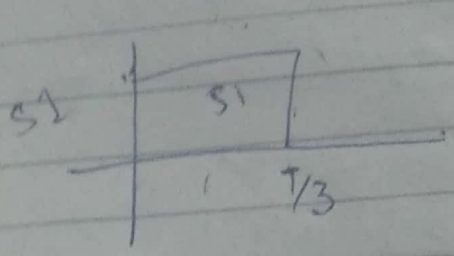
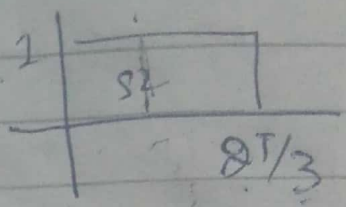
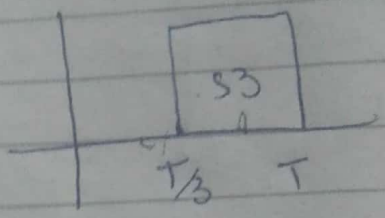
Paper

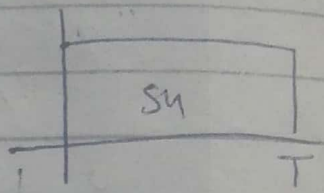
S_1 [illegible]

S_2 =



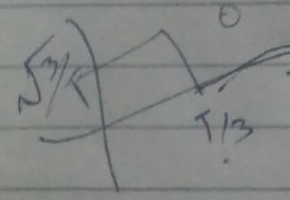






$$\mathcal{E}_1 = \int_0^{T/3} s_1^2 \, dt$$

$$\mathcal{E}_1 = T \Big|_0^{T/3} = \frac{T}{3}$$



$$\phi_1 = \frac{s_1}{\sqrt{\mathcal{E}}} = \frac{1}{\sqrt{T/3}} = \sqrt{\frac{3}{T}}$$

$$q_{21} = S_{21} - S_{21}\phi_1$$

$$q_{21} = S_{21}$$

$$S_{21} = \int_0^{2T/3} S_2 \, \phi_1 \, dt$$

$$= \int_0^{T/3} 1 \sqrt{\frac{3}{T}} \, dt + \int_{T/3}^{2T/3} 0$$

$$2\sqrt{\frac{3}{T}} \frac{T^{1-\frac{1}{2}}}{3^{1-\frac{1}{2}}} = \sqrt{\frac{3}{T}} \times \frac{T}{3}$$

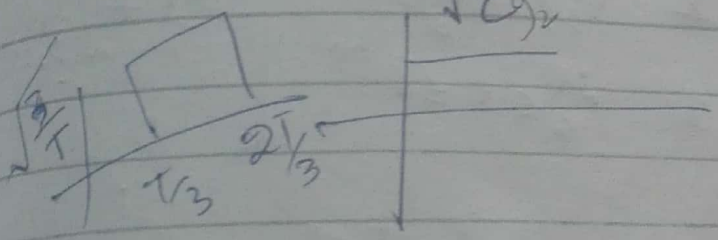
$$g_2 = \sqrt{\frac{1}{3}} \times \sqrt{\frac{3}{T}}$$

$$= \int_0^{T/3} \sqrt{\frac{1}{3}} \times \sqrt{\frac{3}{T}}$$

$$\sqrt{1} = 1 - 0 \qquad 1 - 0$$

$$1 - 1 \Big|_0^{T/3} \quad 1 - 0 \Big|_{T/3}^{2T/3}$$

$$\phi_2 = \frac{g_2}{\sqrt{\varepsilon_{g_2}}}$$



$$\varepsilon_2 = \int_0^T g_2^2 \, dt$$

$$= \int_{T/3}^{2T/3} 1^2$$

$$g_3 = S_3 - (S_{31}\phi_1 + S_{32}\phi_2)$$

$$S_{31} = S_3 \phi_1 = 0$$

$$S_3 \int S_3 \phi_2 = \int_{T/3}^{2T/3} 1 \sqrt{\frac{3}{T}} = \sqrt{\frac{3}{T}}$$

$$\varepsilon_2 = \frac{2T}{3} - T/3 = \frac{2T - T}{3} = \frac{T}{3}$$

$$\phi_2 = \frac{g_2}{\sqrt{\varepsilon_2}} = \frac{1}{\sqrt{T/3}} = \sqrt{\frac{3}{T}}$$

$$S_1 = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{..} \end{bmatrix}$$

$$S_{32} = \int_{T/3}^{2T/3} \sqrt{\frac{3}{T}}\, dt$$

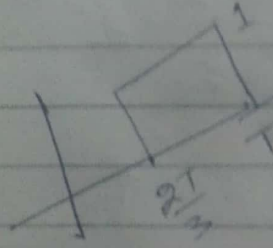
$$= \sqrt{\frac{3}{T}} \Big|_{T/3}^{2T/3} t$$

$$= \frac{2T}{3} - \frac{T}{3} = \frac{T}{3} \cdot \sqrt{\frac{3}{T}}$$

$$S_{32} = \sqrt{\frac{T}{3}}$$

$$g_3 = S_3 - (S_{31}\phi_1 + S_{32}\phi_2)$$

$$= \begin{cases} 1 & T/3 \le t \le \frac{2T}{3} \\ 1 & \frac{2T}{3} \le t \le T \end{cases} - \begin{cases} 0 + \sqrt{\frac{T}{3}} \times \sqrt{\frac{3}{T}} \cdot 1 \\ 0 \cdot 0 \end{cases}$$



$$= 1 - \sqrt{\frac{T}{3}} \times \sqrt{\frac{3}{T}} = \begin{cases} 0 \\ 1 - 0 \end{cases} \quad 1 \ \frac{2T}{3}$$

$$\varepsilon_3 = \int_0^T g_3^2\, dt$$

$$= \int_{2T/3}^{T} dt.$$

$$\varepsilon_2 = T - \frac{2T}{3} = \frac{3T - 2T}{3}$$

$$= \frac{T}{3}$$

$$\phi_3 = \frac{g_3}{\sqrt{T/3}} = \sqrt{\frac{3}{T}}$$

Q. 5.4

$$S_0(t) = 0$$

$$S_{01} = 0$$

$$E = \int_0^T S_0 \, dt$$

$$\therefore \quad E = 0$$

$$=$$

$$E\,\overline{S_1(t)} = \int_0^T A^2 \, dt$$

$$\overline{\phi_1(t)} = \frac{A\sqrt{T}}{\sqrt{}}$$

$$= A^2 T$$

$$\phi_1 = \frac{A}{A\sqrt{T}} = \frac{1}{\sqrt{T}}$$

$$S_{11} = \int_0^T \phi_1 \, S_1(t)$$

$$= 2 \int_0^T A \cdot \frac{1}{\sqrt{T}}$$

$$\boxed{P_e = \frac{N_0}{2}}$$

$$= A \cdot \frac{1}{T} \cdot T$$

$$\boxed{S_{11} = A\sqrt{T}}$$

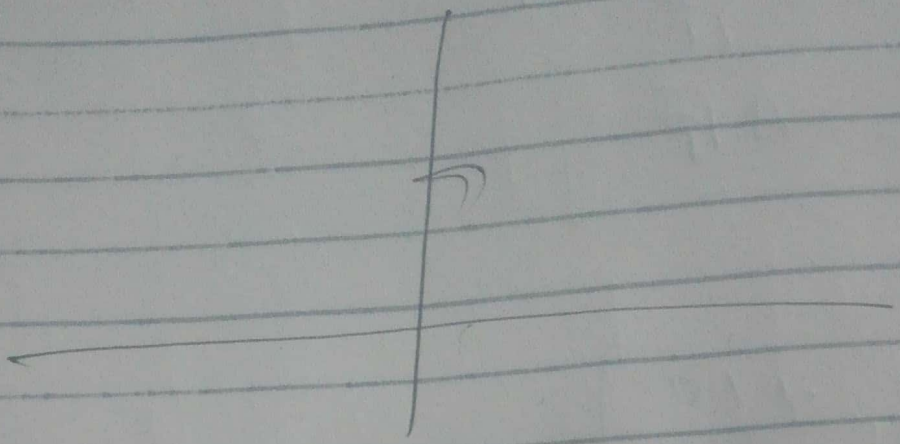
$$r = S_{11} + w$$

$$r = S_0 + w$$

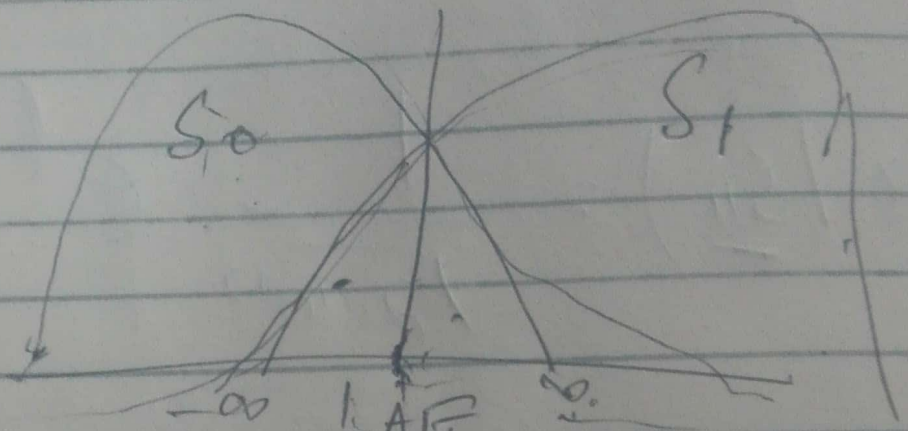
$$P(r/S_{11}) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(\frac{r - S_{11}}{2\sigma^2}\right)^2}$$

$$P(r/S_{01}) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(\frac{r - 0}{2\sigma^2}\right)^2}$$

$$\frac{P(r/S_0)}{P(r/S_1)} = \frac{e^{\left(\frac{r-0}{2\sigma^2}\right)}}{e^{\frac{(r - S_{11})^2}{2\sigma}}} \gtrless 1$$



optimal threshold



So

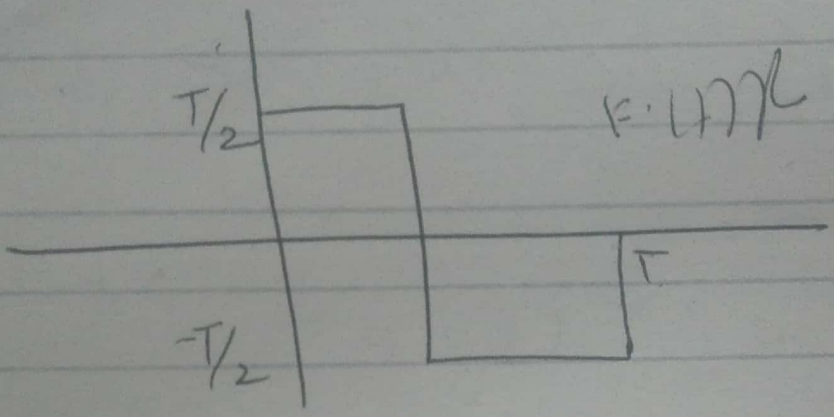
$$= \int_{\frac{1}{2}AT}^{\infty} \frac{1}{\sqrt{2\pi N_0}} e^{\left(\frac{-\gamma}{N_0}\right)} dt$$

Q3 of paper

Match filter for the graph

$h(t) = x(T - t)$

shift, flip

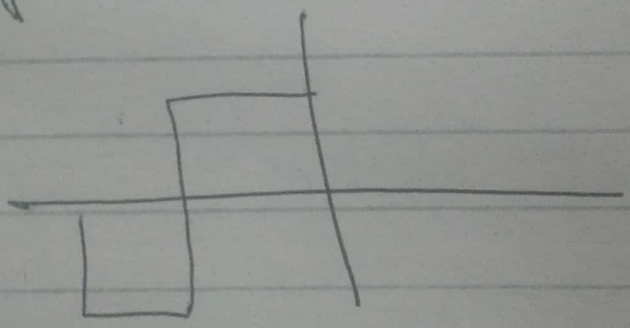


$x(t - T)$

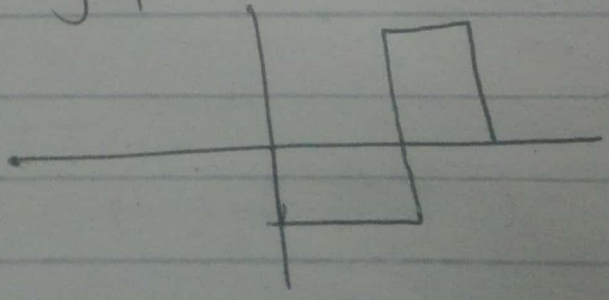
$x(t)$

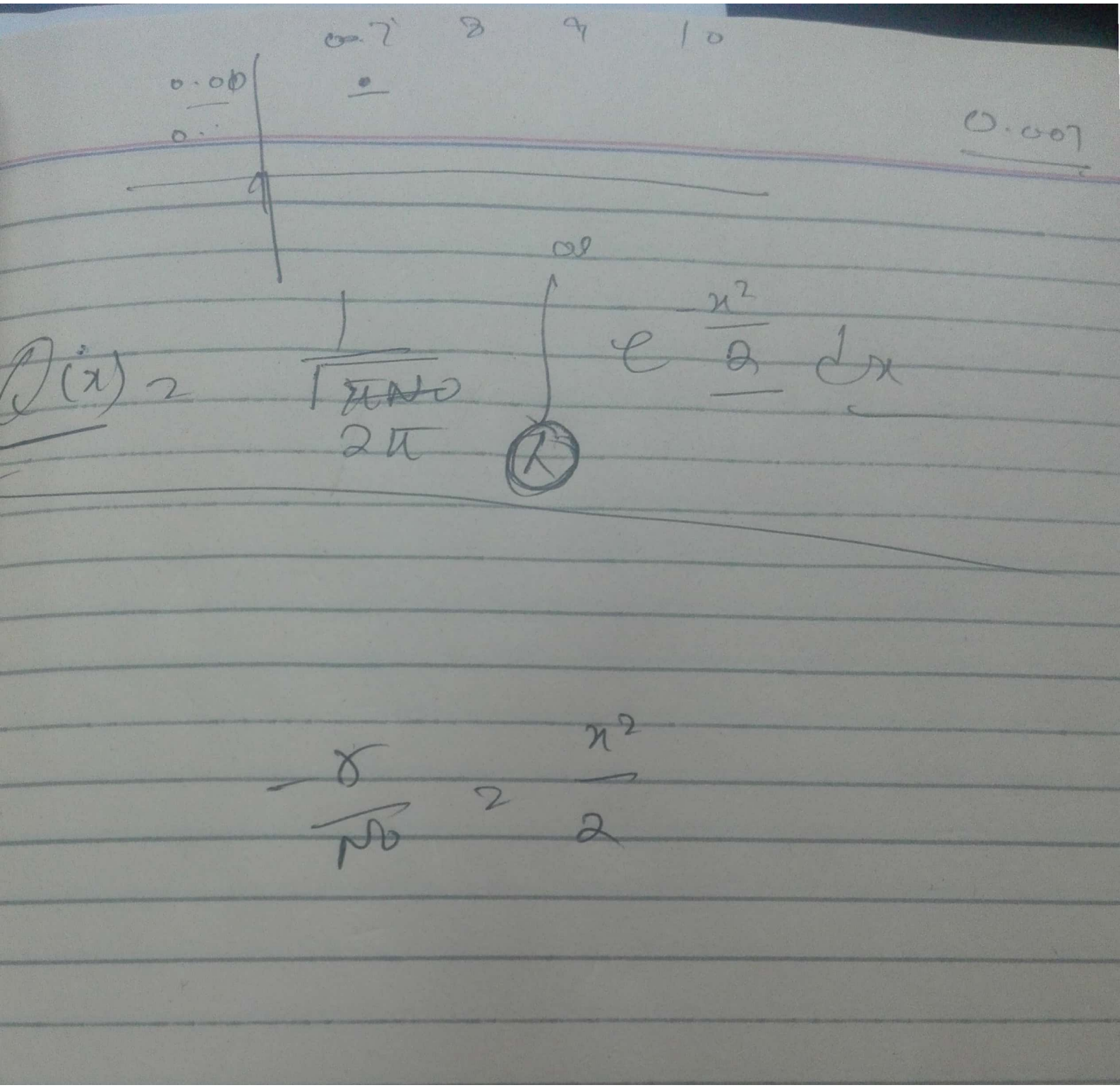
flip

$x(T - t)$



shift by T




7 8 9 10
0.008
0.007
$\phi(x) = \frac{1}{\sqrt{2\pi}} \int_{x}^{\infty} e^{-\frac{x^2}{2}} dx$
$\frac{\gamma}{\sqrt{N}} = \frac{x^2}{2}$

function:

Tables made on error function:

	1	2	3	4	5	6
0.0						
0.1						
0.2						
0.3						⊙ → value of 0.36
0.4						
0.5						