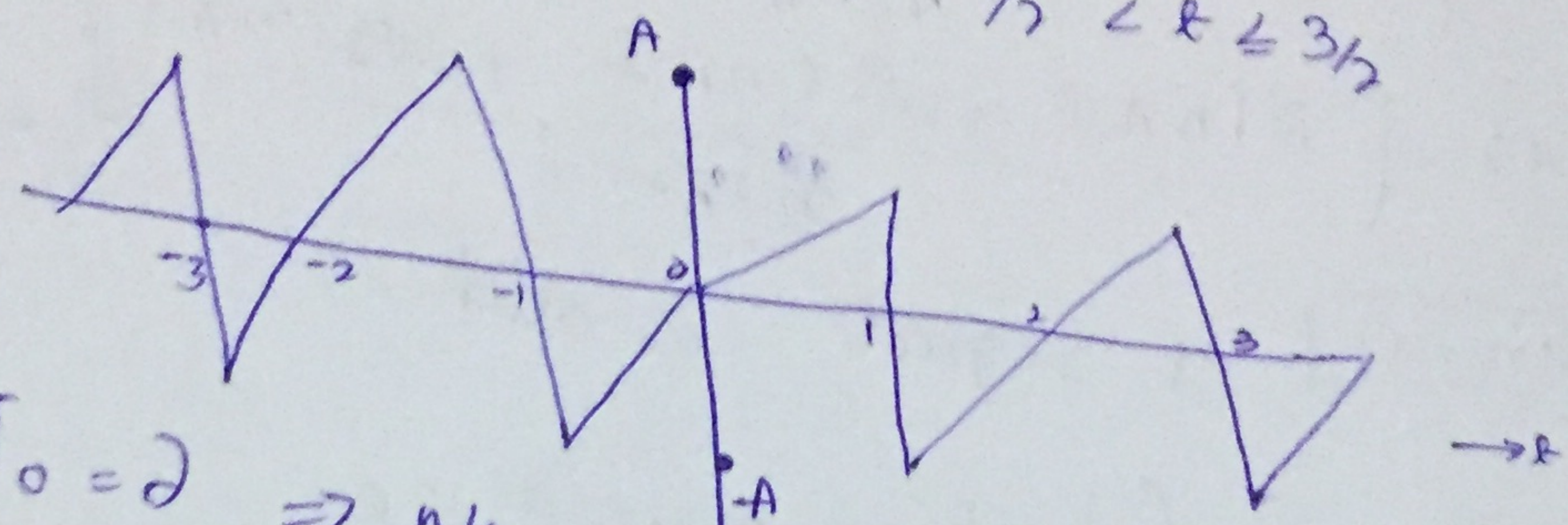
Signals Lab 8:

3.2

$$f(t) = \begin{cases} 2At & |t| \le 1/2 \\ 2A(1-t) & 1/2 < t \le 3/2 \end{cases}$$



$T_0 = 2 \Rightarrow w_0 = \frac{2\pi}{T_0} = \frac{2\pi}{2} = \pi$

$a_0 = \frac{1}{T_0} \int f(t)\, dt$

$a_0 = \frac{1}{2} \left[2 \int_{-1/2}^{1/2} t\, dt + \int_{1/2}^{3/2} 2(1-t)\, dt \right]$

$= 0 \left[\frac{t^2}{0} \right]_{1/2}^{3/2}$

$\boxed{a_0 = 0}$

we kno

$a_n = \frac{2}{T_0} \int f(t) \cos n w_0 t\, dt$

$a_n = \frac{2}{2} \left[\int_{-1/2}^{1/2} 2At \cos n\pi t\, dt + \int_{1/2}^{3/2} 2(1-t) \cos n\pi\, dt \right]$

$\boxed{A = 1}$

$$a_n = \left[2\left(\frac{n\pi t) \sin(n\pi t) + \cos n\pi t}{n^2\pi^2} \right]_{-1/2}^{1/2} + 2 - \left[\frac{2[n\pi t + \sin(n\pi t + \cos(n\pi t}{n^2\pi^2} \right]_{1/2}^{3/2}$$

$\boxed{a_n = 0}$ as Signal is odd

$$b_n = \frac{2}{T_0} \int f(t) \sin n w_0 t \, dt$$

$$b_n = \int_{-1/2}^{1/2} 2At \sin n\pi t \, dt + \int_{1/2}^{3/2} 2A(1-t) \sin n\pi t \, dt$$

$$b_n = \frac{8A}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right)$$

$0 \rightarrow$ w n is even

$\frac{8A}{n^2\pi^2}$, when $n = 1, 5, 9, 13, \ldots$

$\frac{-8A}{n^2\pi^2}$, when $n = 3, 7, 11, 15, \ldots$

Graph

$$f(t) = a_0 + \sum_{n=1}^{\infty} a_n \cos w_0 n t + b_n \sin w_0 n t$$

$$f(t) = \sum_{n=1} b_n \sin w_0 n t$$

$$f(t) = \sum_{n=1} \frac{8}{n^2\pi^2} \sin(n\pi t)$$

$$f(t) = \frac{8}{\pi^2}\left[\sin \pi t - \frac{1}{9}\sin 3\pi t + \frac{1}{25}\sin 5\pi t - \frac{1}{49}\sin 7\pi t + \cdots\right]$$

$\boxed{C_n = a_n}$

$\boxed{c_n = 0}$

$$C_n = \sqrt{a_n^2 + b_n^2}$$

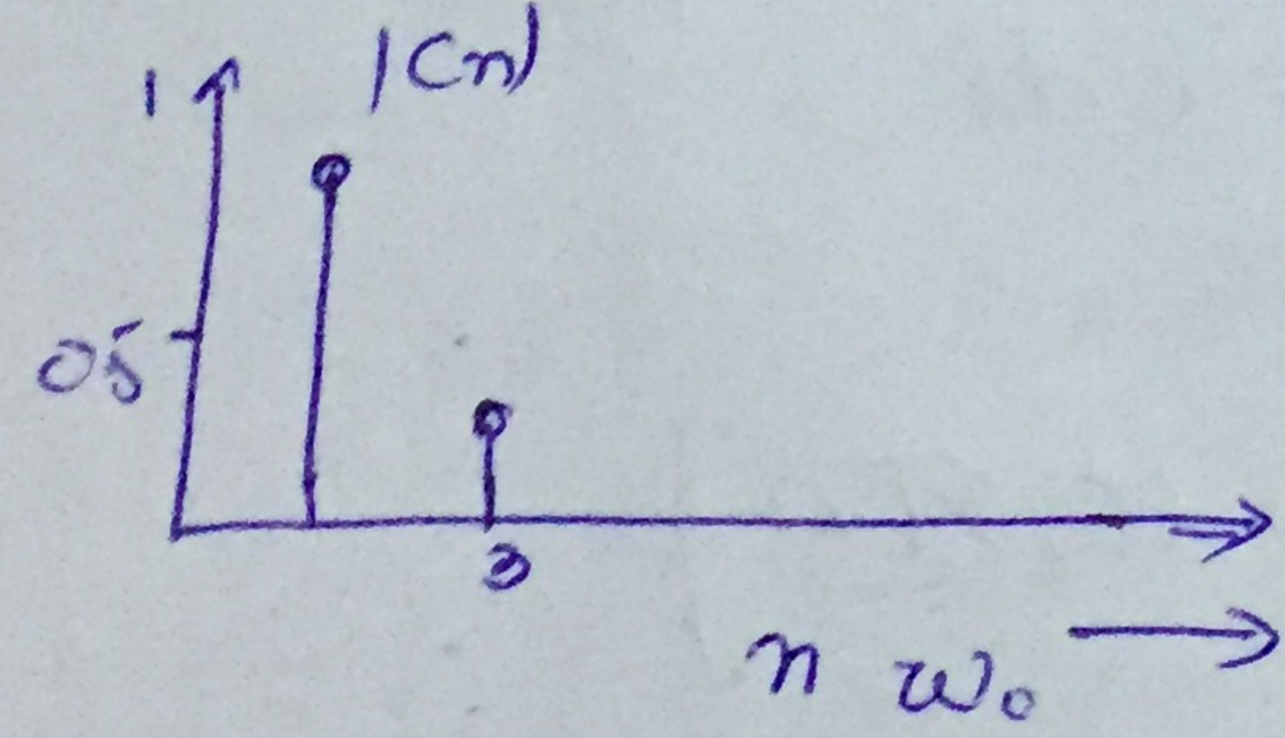
$$C_n = \sqrt{\frac{64}{n^4\pi^4}} = \frac{8}{n^2\pi^2}$$

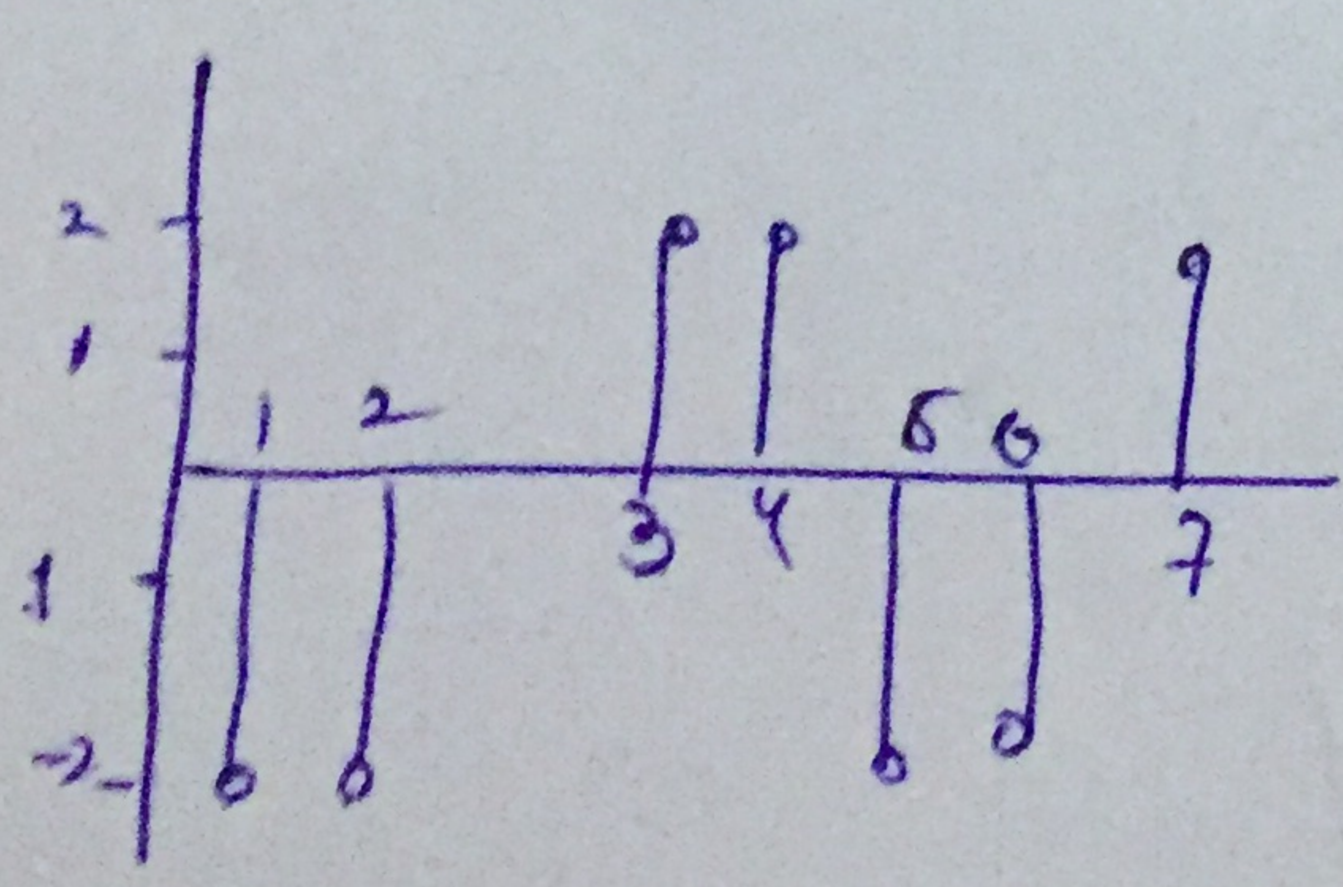
$$\theta = \tan^{-1} -\frac{b_n}{a_n}$$

$\theta = -90$ for $n = 1, 5, 9, 13$

$\theta = 90$ for $n = 3, 7, 11, 15$

graphs

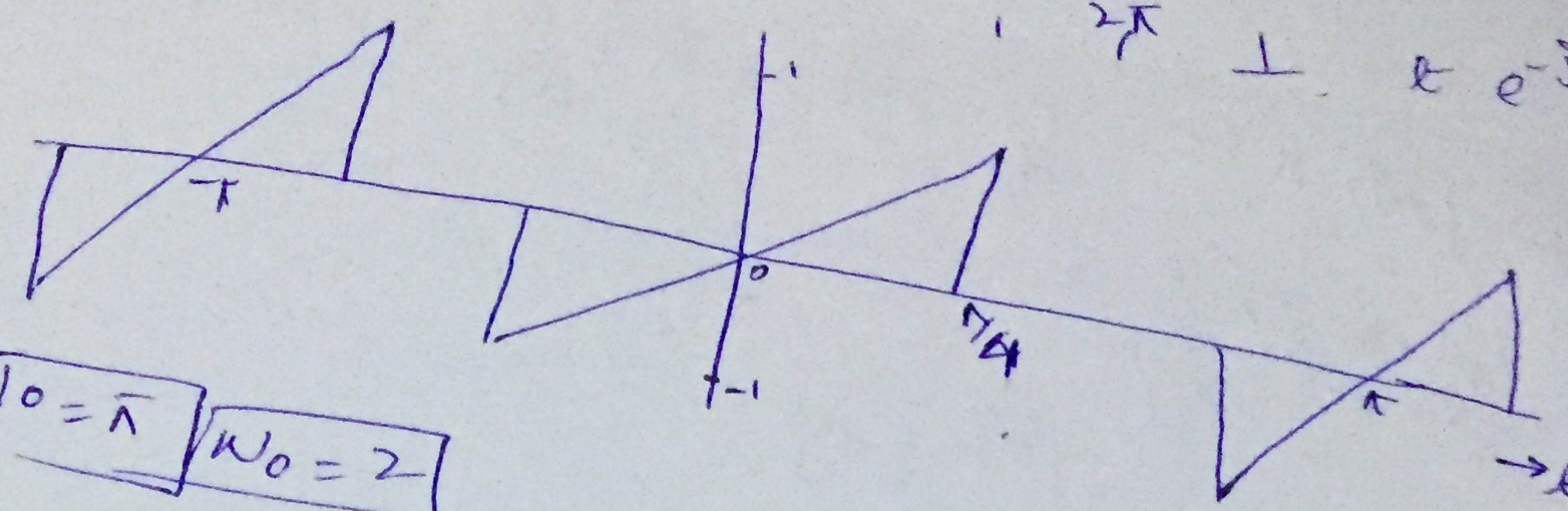




8.3

$D_n = \frac{1}{T_0} \int_{T_0} x(t) e^{-j \omega_0 n t} dt$

$\frac{2}{\pi} \frac{1}{} t e^{-j \omega t} d$



$\boxed{T_0 = \pi}$ $\boxed{\omega_0 = 2}$

$a_0 = \frac{1}{T_0} \int f(t) dt$

$\boxed{a_0 = 0}$

$a_n = \frac{2}{T_0} \int f(t) \cos n\omega t \, dt$

After integrate by part we get

Then $\boxed{a_n = 0}$

$b_n = \frac{2}{T_0} \int f(t) \sin n \omega_0 t \, dt$

$b_n = \frac{4}{\pi} \int_0^{\pi/4} \frac{4}{\pi} t \sin 2 \omega_0 t \, dt$

$b_n = \frac{2}{\pi n} \left[\frac{2}{\pi n} \sin \frac{\pi n}{2} - \cos \frac{\pi n}{2} \right]$

$\boxed{b_n = \frac{4}{\pi^2 n^2}}$

For n = odd

$b_n = \frac{4}{n^2 \pi^2} \left[(-1)^{n - \frac{1}{2}} \right]$

n = ev

$b_n = 4$

$\boxed{a_n = 0}$

$f(t) = b_n \sin n\omega_0 t$

$f(t) = \frac{4}{\pi^2 n^2} \sin n\pi t$

$C_n = \sqrt{a_n^2 + b_n^2}$

$\boxed{C_n = \frac{4}{\pi^2 n^2}}$

$\theta = \tan^{-1} \frac{-b_n}{a_n}$

$\theta = -90$ 1, 5, 9, 13, ...

$\theta = +90$ 3, 7, 11, 15, ...

$f(t) = C_0 + \sum_{n=1}^{\infty} C_n \cos(n\omega_0 t + \theta)$

$f(t) = \sum_{n=1}^{\infty} \frac{4}{n^2\pi^2} \cos(n\pi t \pm 90)$

Graphs