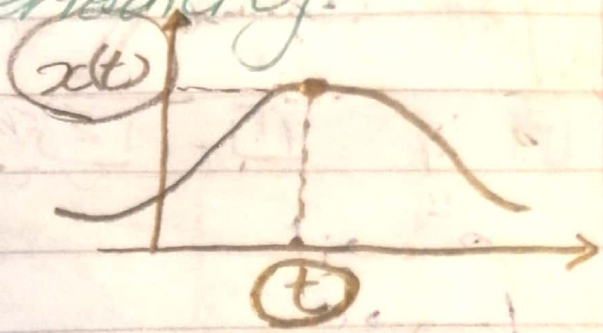
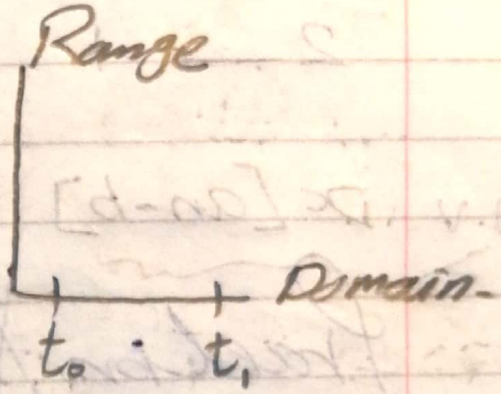
Lec.4 Signal Transformation 18/10

(followed) odd and even Signals, and Signal Periodicity.

Dependent Variable $x(t)$ Independent Variable.(s)





[1] Multiplication:-

Cts $\Leftarrow C \cdot x(t)$

Dts $\Leftarrow C \cdot x[n]$

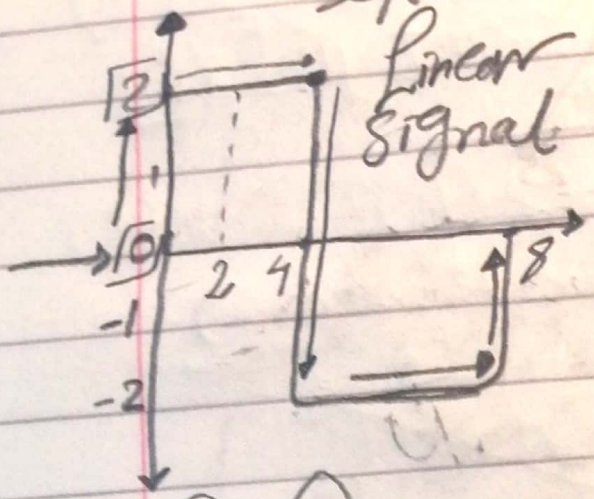
[2] Addition:-

Cts $\Leftarrow x_1(t) + x_2(t)$

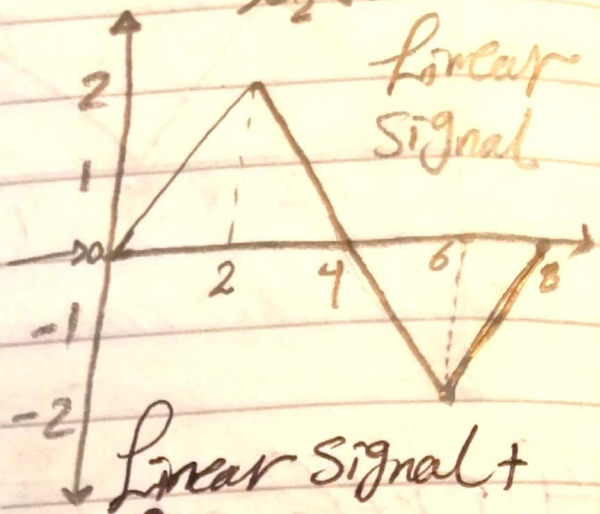
Dts $\Leftarrow x_1[n] + x_2[n]$.

.Key Point:- Change in behavior of the Signals

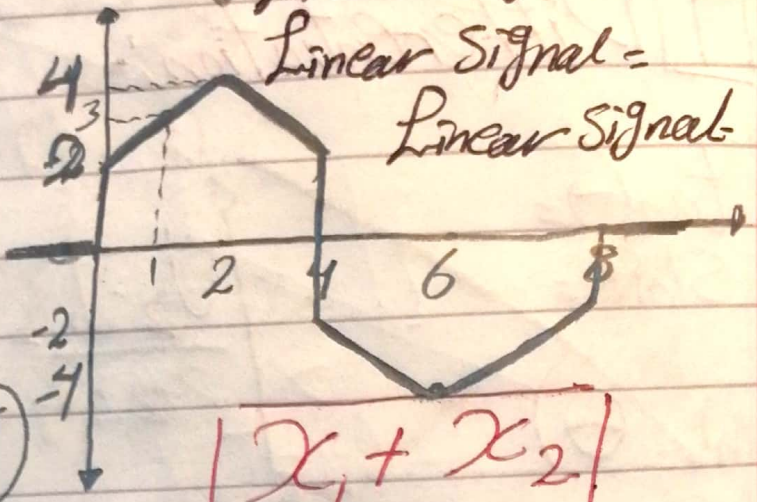
$x_1(t)$



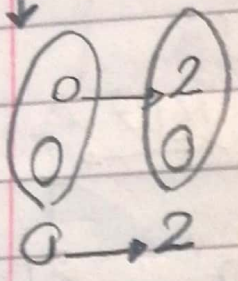
$x_2(t)$



Linear Signal + Linear Signal = Linear Signal



$|x_1 + x_2|$



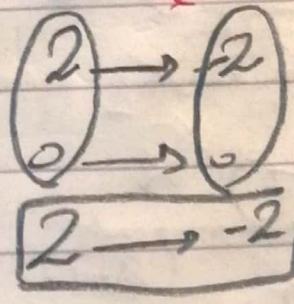
Graph1 = {0, 4, 8}

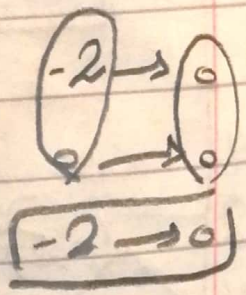
U

Graph2 = {0, 2, 6, 8}

U {0, 2, 4, 6, 8}

Final Key Point



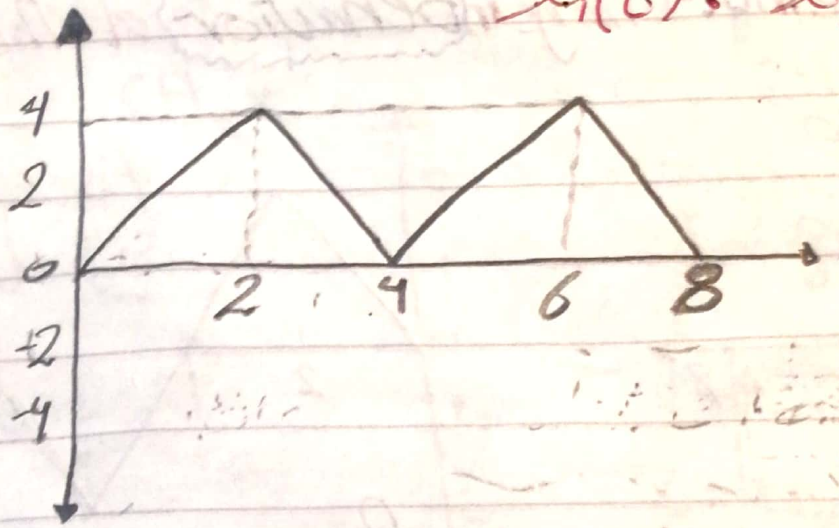


T_1 V_{11} V_{21} to V_{12} V_{22}

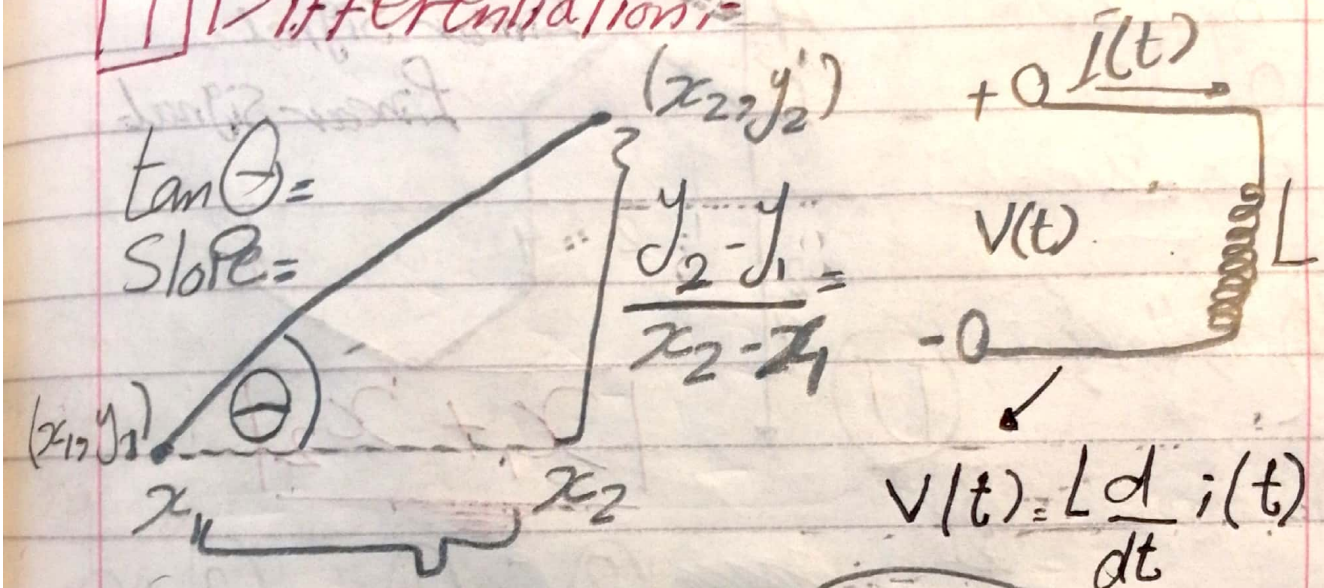
T_2 0 to 2

not transitions only value → 0 → 0

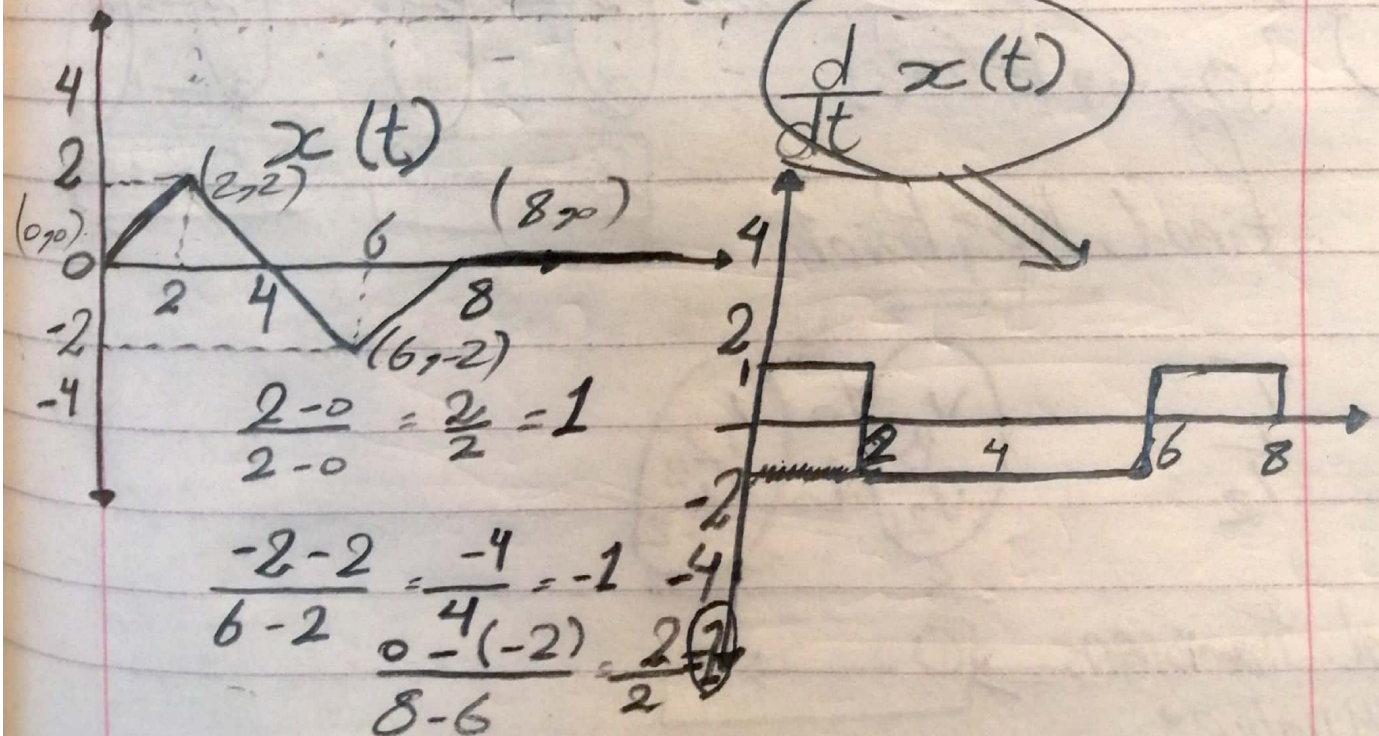
$x_1(t)$: $x_2(t)$.



4] Differentiation :-



$$V(t) = L \frac{d}{dt} i(t)$$



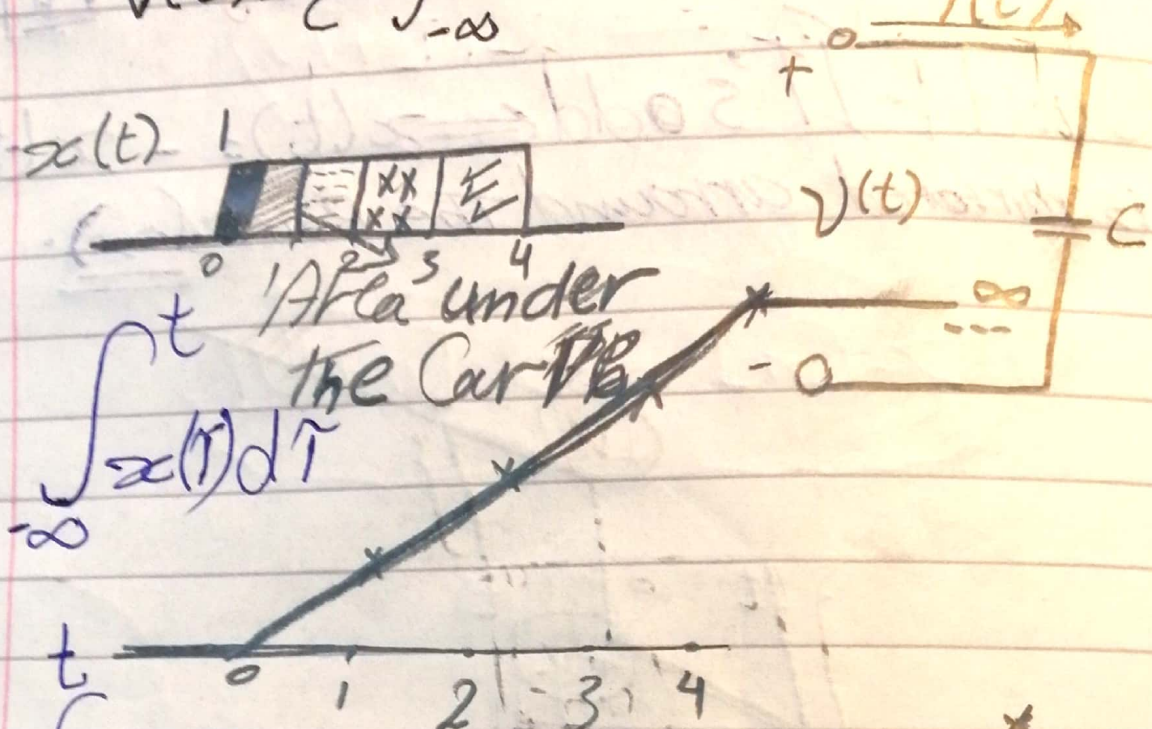
$$\frac{2-0}{2-0} = \frac{2}{2} = 1$$

$$\frac{-2-2}{6-2} = \frac{-4}{4} = -1$$

$$\frac{0-(-2)}{8-6} = \frac{2}{2} = 1$$

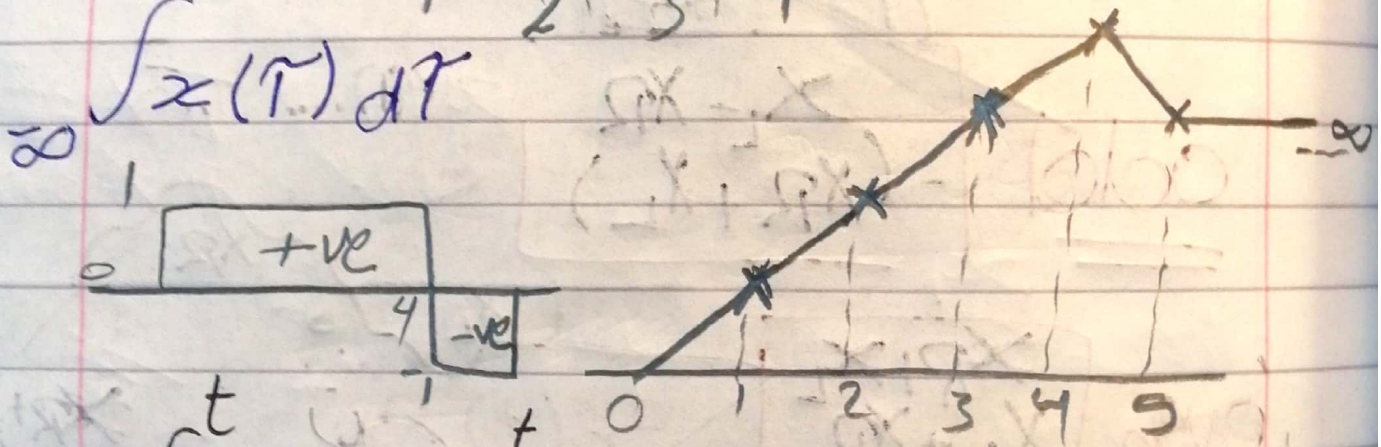
[5] Integration:- $y(t) = \int_{-\infty}^{t} x(t)\,dT$.

$$v(t) = \frac{1}{C}\int_{-\infty}^{t} i(T)\,dT$$



Area under the curve

$$\int_{-\infty}^{t} x(T)\,dT$$



$$\int_{-\infty}^{t} x(T)\,dT$$

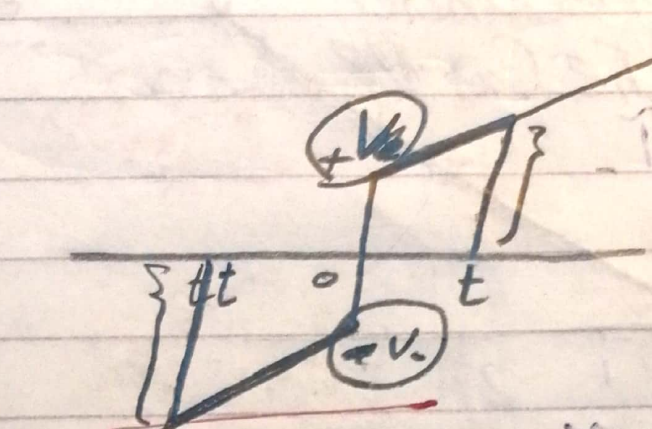
$$\int_{-\infty}^{t} 1.dt = \int_{0}^{t} dT = T\Big|_0^2 = 2-0 = \boxed{2}$$

Even :- It's even $\Longleftrightarrow x(t) = x(-t)$

is identical to it's time-reverse.

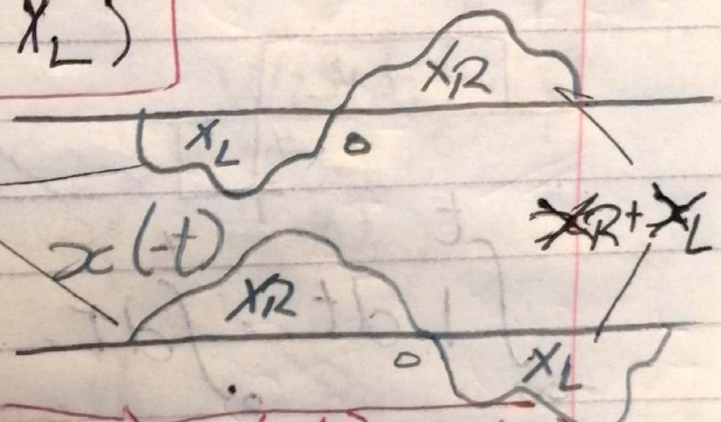
Odd :- It's odd $\Longleftrightarrow x(t) = -x(-t)$

is mirrored arround the Point (0,0).



odd $\boxed{\begin{matrix} X_L - X_R \\ -(X_R + X_L) \end{matrix}}$ $x(t)$

even $\boxed{\begin{matrix} X_R + X_L \\ X_L + X_R \end{matrix}}$ $x(-t)$



even signals $\boxed{x(-t) = x(t)}$

odd signals $\boxed{x(t) = -x(-t)}$

$$x_e(t) = x(t) + x(-t)$$
$$+\ x_o(t) = x(t) - x(-t)$$

$$x(t) = 2x(t)$$

$$x_e(t) = \frac{1}{2}\{x(t) + x(-t)\}$$

$$x_o(t) = \frac{1}{2}\{x(t) - x(-t)\}$$

$$x(t) \rightarrow \begin{cases} \mathcal{O}_{td}\{x(t)\} \rightarrow x_o \text{ odd Part of } x(t). \\ \mathcal{E}_{vn}\{x(t)\} \rightarrow x_e \text{ even Part of } x(t) \end{cases}$$

Proof → $x_{e_1}(t) = x_{e_1}(-t)$ (I)

$x_{e_2}(t) \quad x_{e_2}(-t)$ (II)

$y(t) = x_{e_1}(t) \cdot x_{e_2}(t) \rightarrow$ ① $\quad y(-t) = x_{e_1}(-t) \cdot x_{e_2}(-t)$

$x_{o_1}(t) = -x_{o_1}(-t)$ $\quad = x_{e_1}(t) \cdot x_{e_2}(t)$

$x_{o_2}(t) = -x_{o_2}(-t)$

$\therefore y_1(t) = y_1(-t)$

$\therefore$ fun. is even signal.

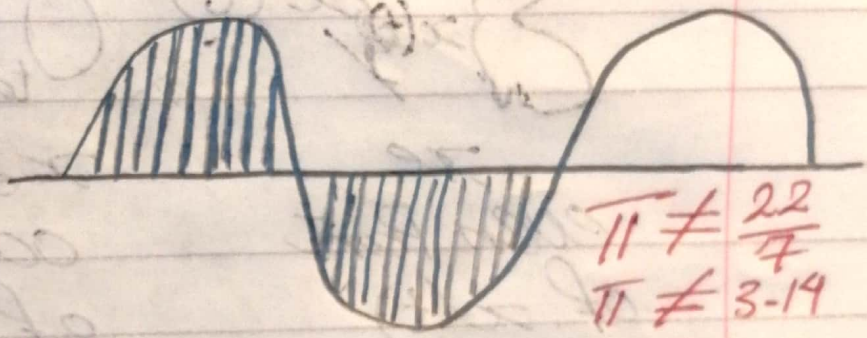
Periodicity

Fundamental Period → The Smallest Position Value of the Period

$$x(t) = x(t+T)$$

T → Period

$$x[n] = x[n+N]$$



$\pi \neq \frac{22}{7}$

$\pi \neq 3.14$

Integer values

x_1, T_1, N_1 + x_2, T_2, N_2

$\frac{1}{N} \times$ Rational Number → Not Periodic

T_1 (L) , T_2 (K)

$\frac{T_1}{T_2} = \frac{K}{L} = \frac{\text{integer}}{\text{integer}}$ → Rational numbers

$= \frac{\text{Real}}{\text{Real}}$ → may not be Periodic

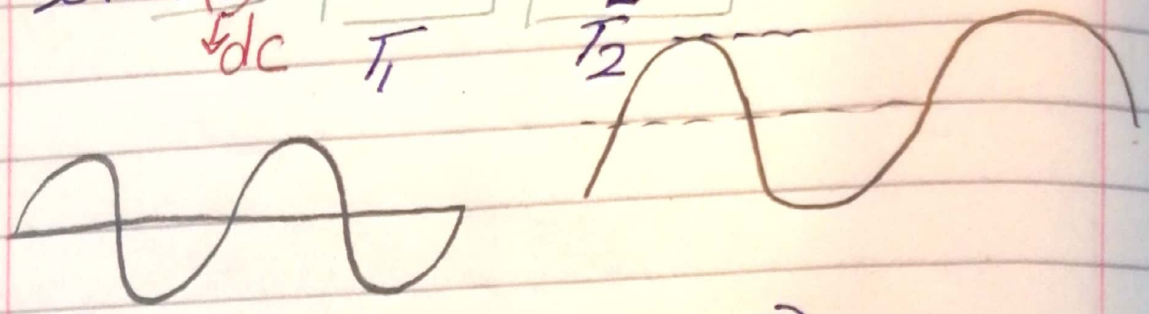
$$\frac{N_1}{N_2} = \frac{\text{integer}}{\text{integer}} = RN$$

$x(t) = 1 + x_1(t) + x_2(t)$ Component

1 → dc

$x_1(t)$ → T_1

$x_2(t)$ → T_2



$$LCM\{T_1, T_2, \dots\}$$

$$LCM = \frac{T_1 T_2}{GCD(T_1, T_2 \dots)}$$

T_1	T_2	T_3
2	3	6
4	6	

$x_2 = 12$

$2, 3, 5, 7, 11, 13, \dots$

	2
T_1	2
T_2	T_2
T_3	
⋮	