1. Classical model ~~of~~ for the Kundur 11 bus system utilizes the same reduced Ybus matrix : Ygen for the power flow equations.
(Refer to ~~HW~~ A04 for its computation).

$$\underset{3\times1}{\dot{\theta}_i} = (\omega_i - 1)\,\omega_s \qquad i = 2 \text{ to } N_{pv}+1$$

$$\underset{3\times1}{\dot{\omega}_i} = \frac{1}{2H_i}\left[P_{m_i} - \sum_{k=1}^{N_{pv}+1} Y_{gen_{ik}}\, E'_k \cdot E'_i \cos(\gamma_{ik} + \theta_k - \theta_i) - K_{D_i}(\omega_i - 1) \right]$$

$$i = 2 \text{ to } N_{pv}+1$$

Assumptions:
Angle dynamics are much faster than Voltage dynamics.

- ~~E~~ Machine internal voltages $\sqrt{E'^2_{q_i} + E'^2_{d_i}} = E'_i$ are ~~co~~ assumed constant. They are obtained either by initialization or simply given in the system

$E'_{q_i}, E'_{d_i} \Leftarrow$ assumed slow variables.

$\Downarrow$

$E'_{q_i} \to c$
$E'_{d_i} \to c$
$\partial E' \to c$

- $E'_{q_i} >> E'_{d_i} \Rightarrow \gamma \approx \frac{\pi}{2}$

and $\because$ ~~$E' \angle \theta \angle (\theta - \frac{\pi}{2}) = E$~~

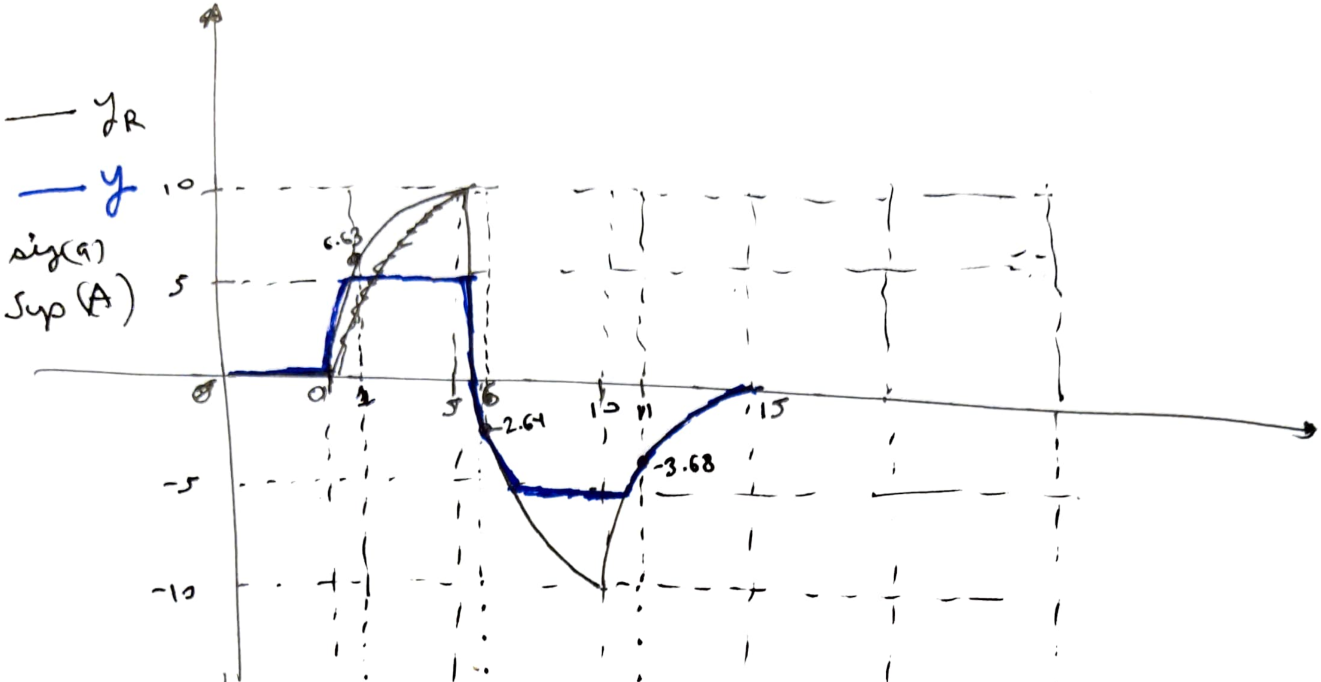
$\because (E_{d_i} + jE_{q_i}) \angle (\theta_i - \frac{\pi}{2}) = E'_i \angle \gamma_i$

& $E'_i \angle \frac{\pi}{2} \angle \theta_i - \frac{\pi}{2} = E'_i \angle \gamma_i$

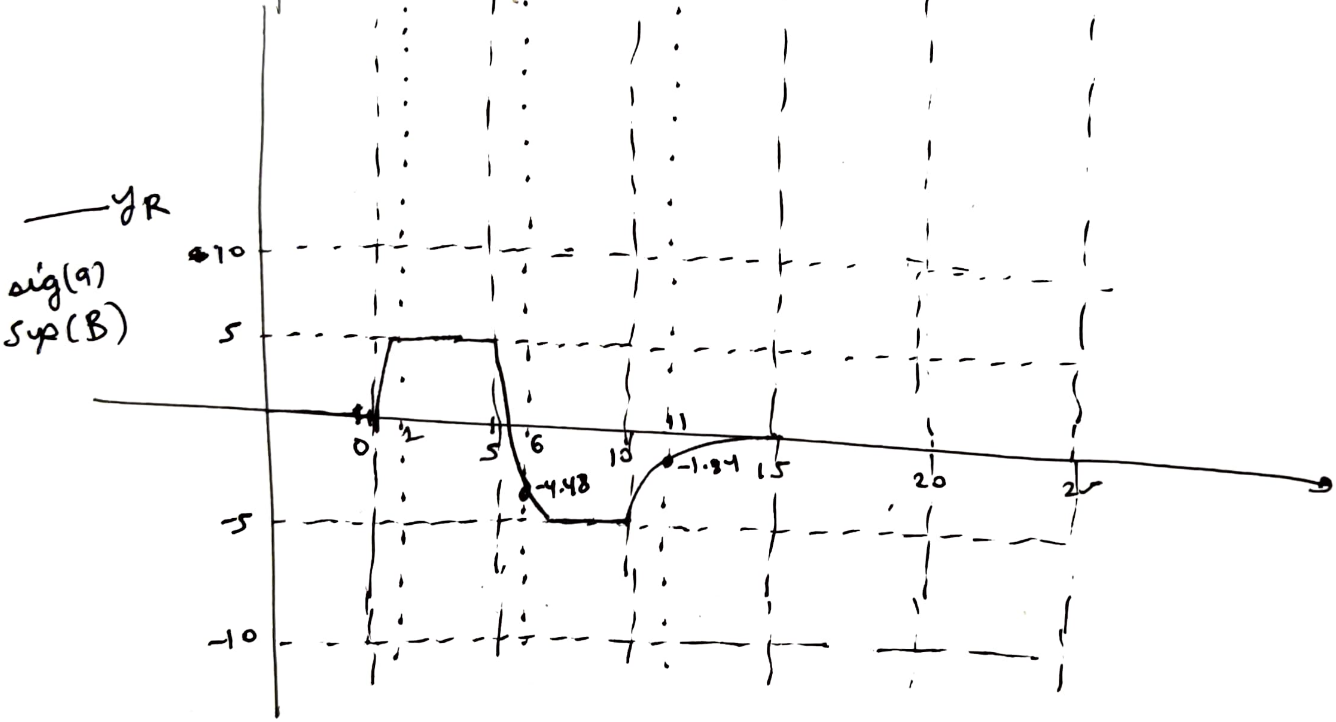
$\Rightarrow$ $\theta_i \approx \gamma_i$.

So ~~we~~ can use θ_i instead of γ_i ~~is~~ as ~~was~~ ~~stated~~ was the case in Type 2.

2.)

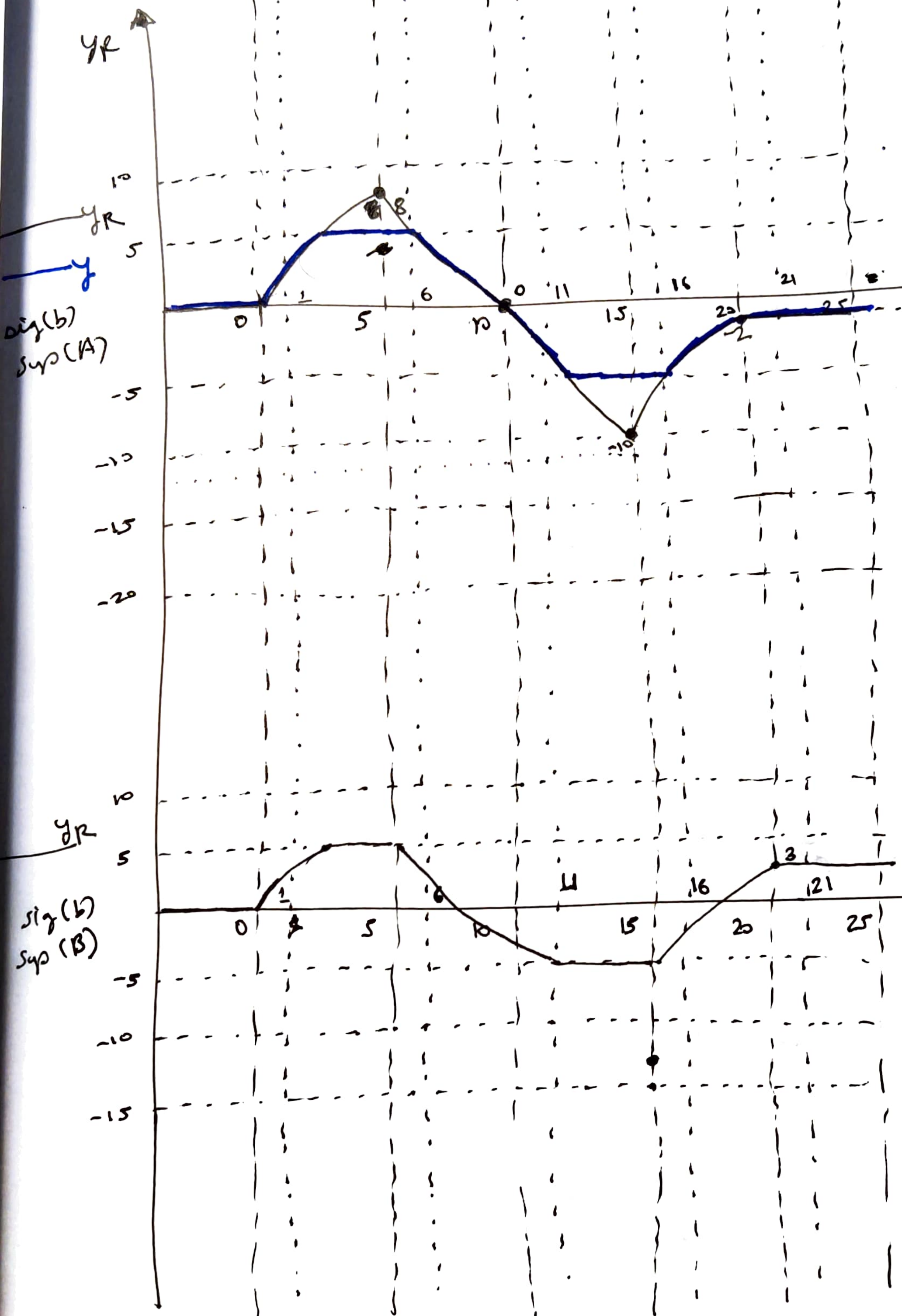


y_R
y
sig(q)
Sup(A)
10
5
-5
-10
0
1
5
6
10
11
15
6.63
-2.64
-3.68



y_R
sig(q)
Sup(B)
10
5
-5
-10
0
1
5
6
10
11
15
20
-4.48
-1.84

$\boxed{2.2}$



R.W.

if $x(t) = Kt\,u(t)$

$y(t) = K(t-1+e^{-t})\,u(t)$

for $K = K_1K_2$

$H(s) = \frac{K_2}{1+s}$

Here $K = K_1K_2$
$= 0.2\times 10$
$= 2$

$x(t) = -0.2t$

$-2(5-1-e^{-5})$

8

S(t).

$2(t-1+e^{-t}) = 5$

$t-1 \doteq 2.5$

$t = 3.5$

for

$-2(t)$

$-2(t-1)$

$-2(5) = -10$

-10

$-2(t-1) = -10$

$t-1 = 5$

$t = 6$

$-2(t-1) = -18$

$t-1 = 9$

$t = 10$

$2(t-1)$

$2(\cdot)$