

Nama : Maulana Ilham Mudhin Shozali

NIM : 21120118120018

Kelas : B

UAS Robotika

① Diketahui :

Frame B, rotasi(θ) = 30° terhadap z

translasi = 10 unit pada x, 5 unit pada y

$${}^B P = [3 \ 7 \ 0]^T = \begin{bmatrix} 3 \\ 7 \\ 0 \end{bmatrix} \quad \begin{aligned} l_x &= 10 \\ l_y &= 5 \\ l_z &= 0 \end{aligned}$$

Ditanya : ${}^A P : \dots ?$

Jawab :
$${}^A P = {}^A T_B + {}^B P$$

$${}^A T_B = \begin{bmatrix} \cos 30^\circ & -\sin 30^\circ & 0 & l_x \\ \sin 30^\circ & \cos 30^\circ & 0 & l_y \\ 0 & 0 & 1 & l_z \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0,866 & -0,5 & 0 & 10 \\ 0,5 & 0,866 & 0 & 5 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^A P = {}^A T_B \cdot {}^B P$$

$$\begin{bmatrix} A_P \\ 1 \end{bmatrix} = \begin{bmatrix} 0,866 & -0,5 & 0 & 10 \\ 0,5 & 0,866 & 0 & 5 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 7 \\ 0 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} A_P \\ 1 \end{bmatrix} = \begin{bmatrix} 9,098 \\ 12,562 \\ 0 \\ 1 \end{bmatrix} \quad \therefore {}^A P = \begin{bmatrix} 9,098 \\ 12,562 \\ 0 \end{bmatrix}$$

② Transformasi frame D ditinjau dari frame $F = F_0 T$
 Persamaan matriks transformasi :

$$F_0 T \quad A \quad E \quad F T = A \quad B \quad C \quad D T$$

$$F_0 T = A \quad E \quad F T^{-1} \quad A \quad B \quad C \quad D T$$

③ $B = A \tan 2 \left(\frac{-\sqrt{31}}{x}, \frac{\sqrt{r_{11}^2 + r_{21}^2}}{y} \right) \quad x = 0,354 \quad y = 0,935$

Jika $x > 0$ maka $A \tan 2 \Rightarrow \arctan \left(\frac{y}{x} \right) = 1,209 \text{ rad } (69,26^\circ)$

$\alpha = A \tan 2 (r_{21} / \cos \beta, r_{11} / \cos \beta) \quad x = 0,189 \quad y = 2,63$

Jika $x > 0$ maka $A \tan 2 \Rightarrow \arctan \left(\frac{y}{x} \right) = 85,89^\circ$

$\gamma = A \tan 2 (r_{32} / \cos \beta, r_{33} / \cos \beta) \quad x = 0,949 \quad y = 2,445$

Jika $x > 0$ maka $A \tan 2 \Rightarrow \arctan \left(\frac{y}{x} \right) = 67,78^\circ$

$\alpha = 85,89^\circ \quad \beta = 69,20^\circ \quad \gamma = 67,78^\circ$

4) Diketahui :

$$a_0 = 60.0$$

$$a_1 = 0.0$$

~~Di~~

$$t_f = 4 \text{ detik}$$

$$\theta_f = 30^\circ$$

$$\theta_0 = 60^\circ$$

$$a_2 = \frac{3}{t_f^2} (\theta_f - \theta_0) = \frac{3}{4^2} (30^\circ - 60^\circ) = \frac{3}{16} (-30^\circ)$$

$$= -5.625$$

$$a_3 = -\frac{2}{t_f^3} (\theta_f - \theta_0) = -\frac{2}{64} (30^\circ - 60^\circ) = -\frac{2}{64} (-30^\circ)$$

$$= \frac{60}{64}$$

$$= 0.937$$

Ditanya : Cari fungsi trayektori dan gambarkan grafik fungsi trayektori tsb beserta kecepatan dan percepatannya.

Jawab :

$$\theta(t) = a_0 + a_1 t + a_2 t^2 + a_3 t^3$$

$$= 60.0 + (-5.625)t^2 + 0.937t^3$$

$$= 60.0 - (5.625)t^2 + 0.937t^3$$

$$\dot{\theta}(t) = a_1 + 2a_2 t + 3a_3 t^2$$

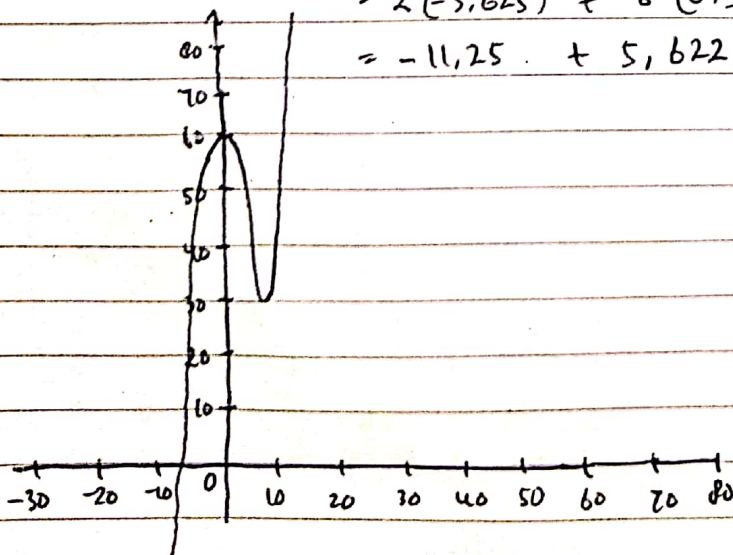
$$= 2(-5.625)t + 3(0.937)t^2$$

$$= -11.25t + 2.811t^2$$

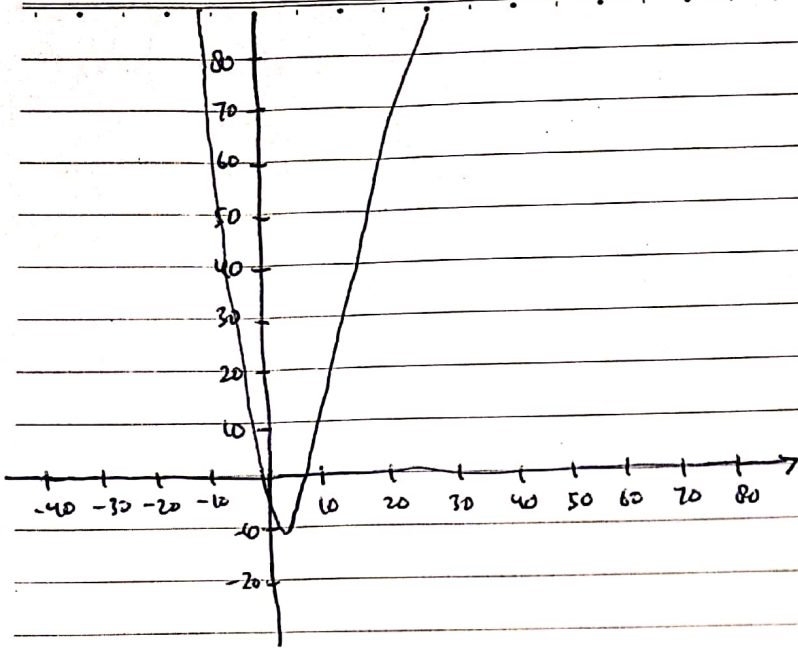
$$\ddot{\theta}(t) = 2a_2 + 6a_3 t$$

$$= 2(-5.625) + 6(0.937)t$$

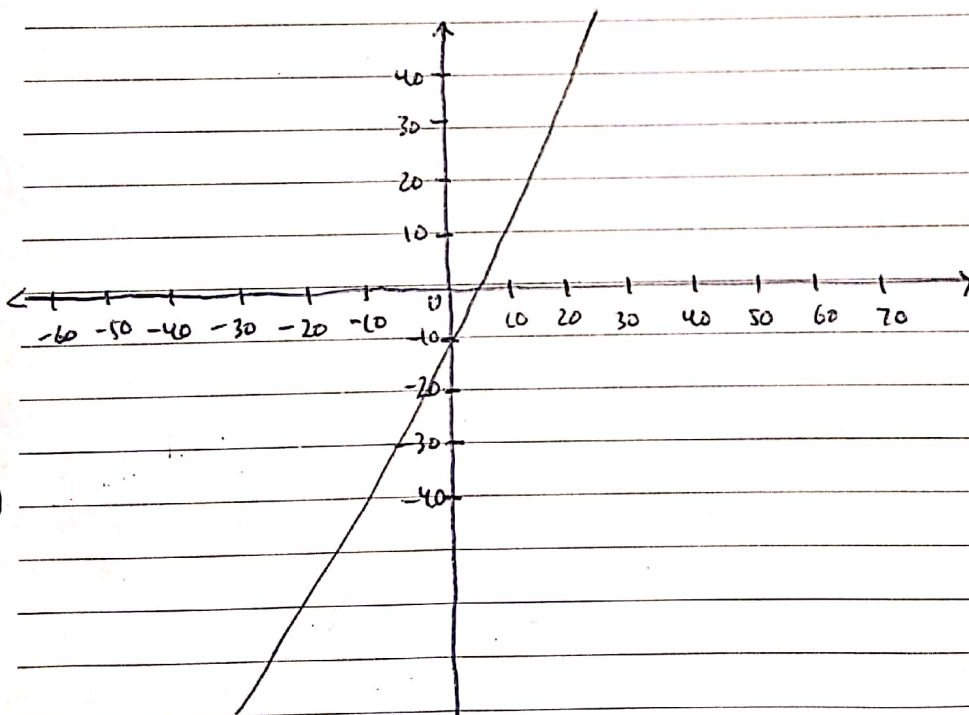
$$= -11.25 + 5.622t$$



5b). Grafik Posisi



Ob 2. Grafik Kecepatan



Ob 3. Grafik Percepatan