Forward Kinematics

$$H_1^0 = \begin{bmatrix} \cos 90^\circ & -\sin 90^\circ & 0 \\ \sin 90^\circ & \cos 90^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix}, \quad H_2^1 = \begin{bmatrix} 1 & 0 & 73 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$H_3^2 = \begin{bmatrix} \cos 30^\circ & -\sin 30^\circ & 0 \\ \sin 30^\circ & \cos 30^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad H_4^3 = \begin{bmatrix} 1 & 0 & 50 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$H_4^0 = \begin{bmatrix} \cos 70^\circ & -\sin 70^\circ & 73\cos 90^\circ + 50\cos(70^\circ) \\ \sin 70^\circ & \cos 70^\circ & 73\sin 90^\circ + 50\sin(70^\circ) \\ 0 & 0 & 1 \end{bmatrix}$$

X-coordinate $= 73\cos 90^\circ + 50\cos 70^\circ = 55.92 + 17.1 = 73.02\text{mm}$ //

Y-coordinate $= 73\sin 90^\circ + 50\sin 70^\circ = 46.92 + 46.98 = 93.90\text{mm}$ //

Inverse Kinematics

$$\cos\theta_2 = \left(\frac{x^2 + y^2 - L_1^2 - L_2^2}{2 \cdot L_1 L_2}\right) \rightarrow \frac{x^2 + y^2 - 7829}{1.825 \times 10^7} = 0.866$$

$$\theta_2 = \cos^{-1}(0.866) = 30^\circ //$$

$$\theta_1 = \tan^{-1}\left(\frac{93.9}{73.02}\right) - \tan^{-1}\left(\frac{50\sin 30^\circ}{73 + 50\cos 30^\circ}\right) = 52.13^\circ - 12.13^\circ$$

$$= 39.998 \approx 40^\circ$$