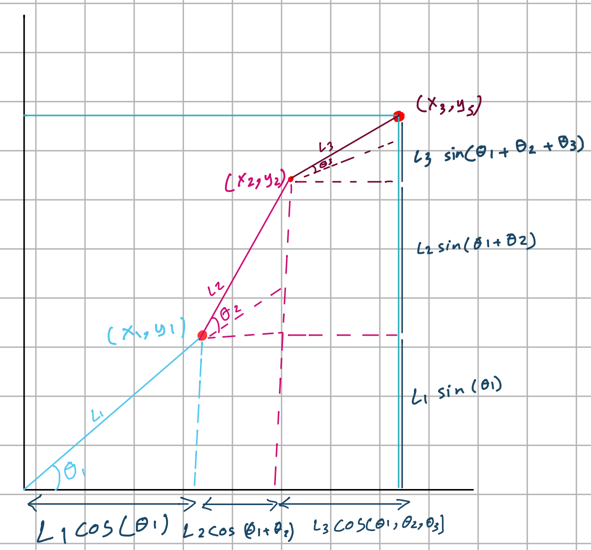

givin $\theta_1 = 30^\circ$ $\theta_2 = 45^\circ$ $\theta_3 = 60^\circ$ $L_1 = 2$ $L_2 = 2$ $L_3 = 1$

Forward

$$X_3 = L_1 \cos(\theta_1) + L_2 \cos(\theta_1 + \theta_2) + L_3 \cos(\theta_1 + \theta_2 + \theta_3)$$

$$X_3 = 2 \cos(30) + 2 \cos(30 + 45) + 1 \cos(30 + 45 + 60) = 1.54$$

$$y_3 = L_1 \sin(\theta_1) + L_2 \sin(\theta_1 + \theta_2) + L_3 \sin(\theta_1 + \theta_2 + \theta_3)$$

$$y_3 = 2 \sin(30) + 2 \sin(30 + 45) + 1 \sin(30 + 45 + 60) = 3.63$$

$$\theta = \theta_1 + \theta_2 + \theta_3$$

$$\theta = 135^\circ$$

givin $\theta = 135^\circ$ $X_3 = 1.54$ $y_3 = 3.63$ $L_1 = 2$ $L_2 = 2$ $L_3 = 1$

Inverse

$$X_2 = X_3 - L_3 \cos(\theta)$$

$$X_2 = 1.54 - 1\cos(135) = \boxed{2.24}$$

$$y_2 = y_3 - L_3 \sin(\theta)$$

$$y_2 = 3.63 - 1\sin(135) = \boxed{2.92}$$

$$\cos(\theta_2) = \frac{X_2^2 + y_2^2 - L_1^2 - L_2^2}{2L_1L_2}$$

$$\cos(\theta_2) = \frac{2.24^2 + 2.92^2 - 2^2 - 2^2}{2 \times 2 \times 2} = \boxed{0.693} \rightarrow \theta_2 = \cos^{-1}(0.70)$$

$$\theta_2 = \boxed{45^\circ}$$

$$\cos(\theta_1) = \frac{(L_1 + L_2\cos(\theta_2))X_2 + (L_2\sin(\theta_2))y_2}{X_2^2 + y_2^2}$$

$$\cos(\theta_1) = \frac{(2 + 2\cos(45))2.24 + (2\sin(45))2.92}{2.24^2 + 2.92^2} = \boxed{0.86}$$

$$\sin(\theta_1) = \frac{(L_1 + L_2\cos(\theta_2))y_2 - (L_2\sin(\theta_2))X_2}{X_2^2 + y_2^2}$$

$$\sin(\theta_1) = \frac{(2 + 2\cos(45))2.92 - (2\sin(45))2.24}{2.24^2 + 2.92^2} = \boxed{0.50}$$

$$\theta_1 = \tan^{-1}\left(\frac{\sin(\theta_1)}{\cos(\theta_1)}\right)$$

$$\theta_1 = \tan^{-1}\left(\frac{0.50}{0.86}\right) = 30^\circ$$

$$\theta_3 = \theta - (\theta_1 + \theta 2)$$

$$\theta_3 = 135 - (30 + 45) = 60^\circ$$