

Forward Kinematics

$$L_1 = 5$$

$$L_2 = 3$$

$$\theta_1 = 45$$

$$\theta_2 = 30$$

$$\begin{bmatrix} \cos 45 & -\sin 45 & 5 \cdot \cos 45 \\ \sin 45 & \cos 45 & 5 \cdot \sin 45 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos 30 & -\sin 30 & 3 \cdot \cos 30 \\ \sin 30 & \cos 30 & 3 \cdot \sin 30 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.259 & -0.966 & 4.312 \\ 0.966 & 0.259 & 6.433 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = 4.312$$

$$y = 6.433$$

Invers Kinematics

$$L_1 = 5 \quad x = 4.31$$

$$L_2 = 3 \quad y = 6.43$$

$$\theta_2 = \cos^{-1} \left(\frac{4.31^2 + 6.43^2 - 5^2 - 3^2}{5 \cdot 3} \right)$$

$$= \cos^{-1}(0.86403...)$$

$$\theta_2 = 29.96^\circ \approx 30^\circ$$

$$\theta_1 = \tan^{-1} \left(\frac{6.43}{4.31} \right) - \tan^{-1} \left(\frac{3 \cdot \frac{1}{2}}{5 + 3 \cdot \frac{\sqrt{3}}{2}} \right)$$

$$= \tan^{-1}(1.4918) - \tan^{-1}(0.1974)$$

$$\theta_1 = 45^\circ$$