

Jacobian

$$\begin{pmatrix} -L_1 \cdot \sin(\theta_1) - L_2 \cdot \sin(\theta_1 + \theta_2) & -L_2 \cdot \sin(\theta_1 + \theta_2) \\ L_1 \cdot \cos(\theta_1) + L_2 \cdot \cos(\theta_1 + \theta_2) & L_2 \cdot \cos(\theta_1 + \theta_2) \end{pmatrix}$$

Determinant

$$-L_2 \cdot \cos(\theta_1 + \theta_2) \cdot L_1 \cdot \sin(\theta_1) + L_2 \cdot \sin(\theta_1 + \theta_2) \cdot L_1 \cdot \cos(\theta_1)$$

after simplifying:

$$-L_2 \cdot \cos(\theta_1 + \theta_2) \cdot L_1 \cdot \sin(\theta_1) + L_2 \cdot \sin(\theta_1 + \theta_2) \cdot L_1 \cdot \cos(\theta_1)$$

after expanding:

$$L_2 \cdot L_1 \cdot \sin(\theta_1)^2 \cdot \sin(\theta_2) + L_2 \cdot L_1 \cdot \cos(\theta_1)^2 \cdot \sin(\theta_2)$$

after factoring:

$$L_2 \cdot L_1 \cdot \sin(\theta_2) \cdot (\sin(\theta_1)^2 + \cos(\theta_1)^2)$$

after simplifying:

$$L_2 \cdot L_1 \cdot \sin(\theta_2)$$