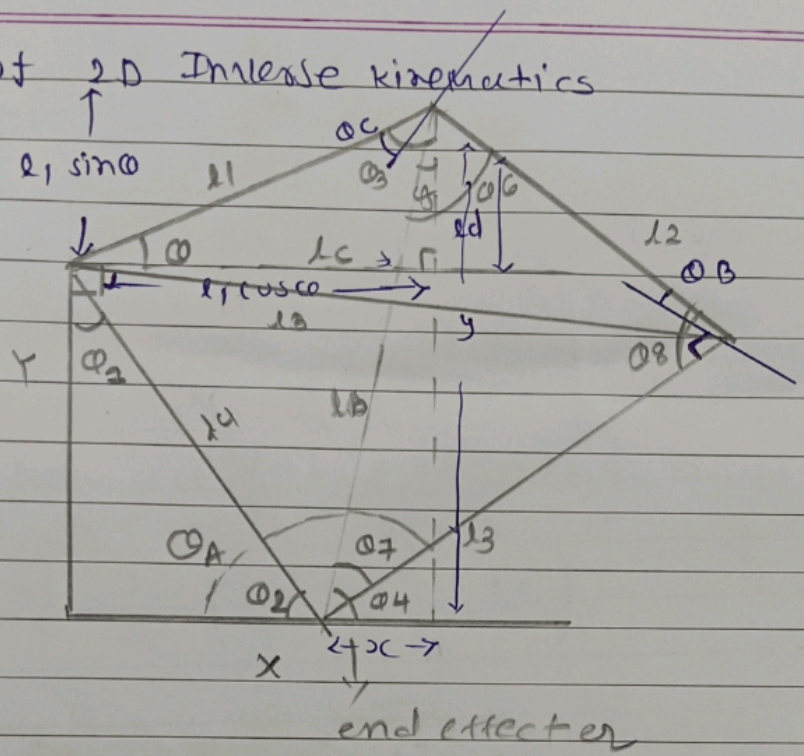
→ 3 out 2D Inverse kinematics



$l_d = \sqrt{x^2+y^2}$ (By pythgorus)

$\theta_1 = \tan^{-1}\frac{x}{y}$ $\theta_2 = \tan^{-1}\frac{y}{x}$

$l_c = l_1 \cos\theta$ $l_d = l_1 \sin\theta$

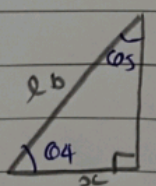
→ By triangle property

$\theta_3 + \theta + \pi/2 = \pi$

$\theta_3 = \pi/2 - \theta$

$x = x - l_c = x - l_1\cos\theta$

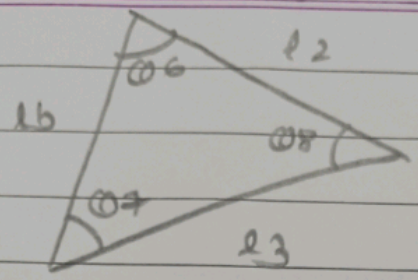
$y = y + l_d = y + l_1 \sin\theta$



by pythagorus

$l_6 = \sqrt{x^2+y^2}$

$\theta_4 = \tan^{-1} y/x$ $\theta_5 = \tan^{-1}\frac{x}{y}$



→ Apply cosine rule for all angles

$$\theta_6 = \cos^{-1}\left(\frac{l_2^2 + l_6^2 - l_3^2}{2 l_2 l_6}\right)$$

$$\theta_7 = \cos^{-1}\left(\frac{l_6^2 + l_3^2 - l_2^2}{2 l_3 l_6}\right)$$

$$\theta_8 = \cos^{-1}\left(\frac{l_2^2 + l_3^2 - l_e^2}{2 l_2 l_3}\right)$$

$$\theta_B = \theta_8 - \pi/2$$

$$\theta_A = \pi - \theta_4 + \theta_7$$

$$\theta_C = \theta_6 + \theta_3 - \theta_5 - \pi/2$$