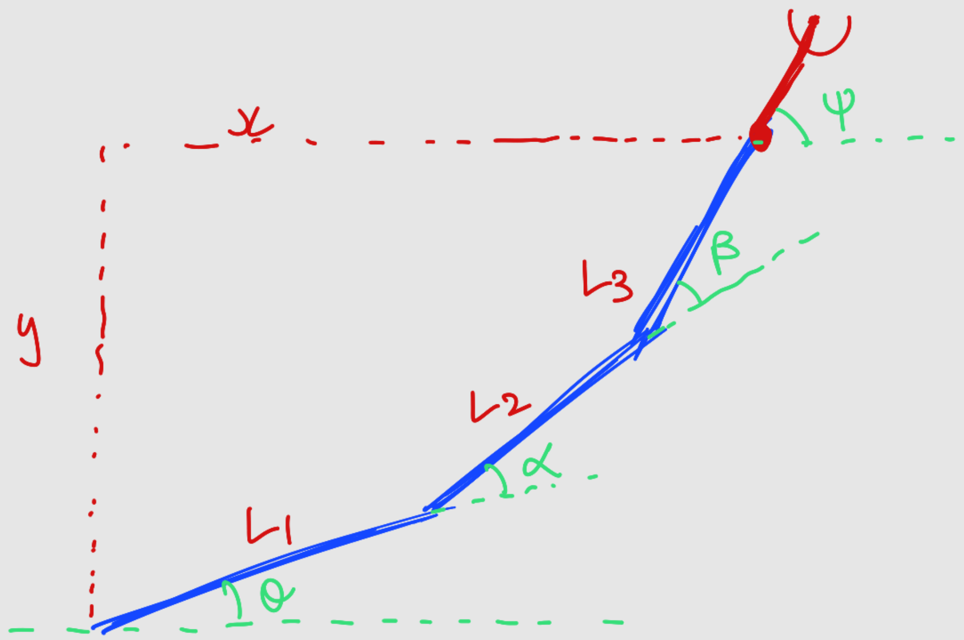
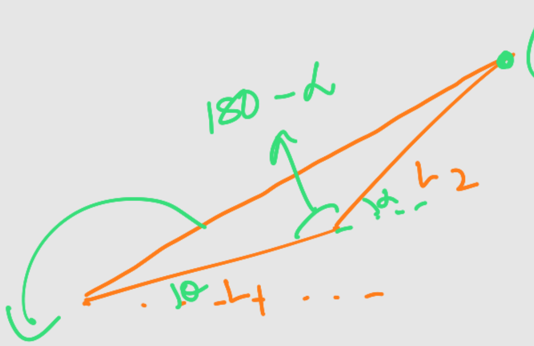


$$x = L_1\cos\theta + L_2\cos(\theta+\alpha) + L_3\cos(\theta+\alpha+\beta)$$
$$y = L_1\sin\theta + L_2\sin(\theta+\alpha) + L_3\sin(\theta+\alpha+\beta)$$

$\theta + \alpha + \beta = \psi$ = fixed

$$x = L_1\cos\theta + L_2\cos(\theta+\alpha) + L_3\cos(\psi)$$
$$y = L_1\sin\theta + L_2\sin(\theta+\alpha) + L_3\sin(\psi)$$

$$x - L_3\cos(\psi) = L_1\cos\theta + L_2\cos(\theta+\alpha)$$
$$y - L_3\sin(\psi) = L_1\sin\theta + L_2\sin(\theta+\alpha)$$



$$\sqrt{x^2+y^2+L_3^2 - 2(x\cos\psi + y\sin\psi)L_3}$$

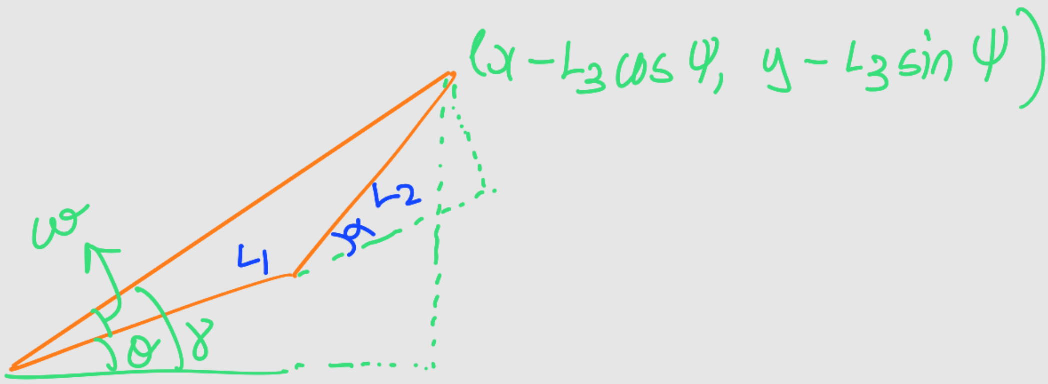
cos Law :-

$$\cos(180-\alpha) = \frac{L_1^2+L_2^2 - x^2 - y^2 - L_3^2 + 2(x\cos\psi + y\sin\psi)L_3}{2L_1L_2}$$

$-\cos\alpha$

$$\Rightarrow \alpha = \cos^{-1}\left(\frac{x^2+y^2+L_3^2-2(x\cos\varphi+y\sin\varphi)L_3-L_1^2-L_2^2}{2L_1L_2}\right)$$

Now,



$$\tan\omega = \frac{L_2\sin\alpha}{L_1+L_2\cos\alpha}$$

$$\tan\gamma = \frac{y-L_3\sin\varphi}{x-L_3\cos\varphi}$$

$$\theta = \gamma-\omega$$

$$\theta = \tan^{-1}\left(\frac{y-L_3\sin\varphi}{x-L_3\cos\varphi}\right)-\tan^{-1}\left(\frac{L_2\sin\alpha}{L_1+L_2\cos\alpha}\right)$$

Now $\beta = \varphi-\theta-\alpha$