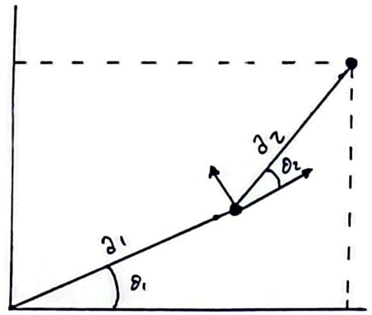
(2)



$a_1 = 20$
$a_2 = 50$
$P_x = 20$
$P_y = 30$

* Inverse kinematic

$$\theta_2 = \cos^{-1} \frac{P_Y^2 + P_x^2 - a_1^2 - a_2^2}{2 \cdot a_1 \cdot a_2}$$
$$= \cos^{-1} \frac{30^2 + 20^2 - 20^2 - 50^2}{2 \cdot 20 \cdot 50}$$
$$= \cos^{-1} \frac{900 + 400 - 400 - 2500}{2000}$$
$$= \cos^{-1} \frac{-1600}{2000} = 143,130$$

$$\theta_1 = \tan^{-1} \frac{P_Y}{P_x} - \tan^{-1} \frac{\cancel{a_2 \sin \theta_2}}{\cancel{a_1 \sin \theta}} \frac{a_2 \sin \theta_2}{a_1 + a_2 \cdot \cos \theta_2}$$
$$= \tan^{-1} \frac{30}{20} - \tan^{-1} \frac{50 \cdot \sin 143,130}{20 + 50 \cdot \cos 143,130}$$
$$= 56,309 - \tan^{-1} \frac{50 \cdot 0,6}{20 + 50 \cdot (-,8)}$$
$$= 56,309 - \tan^{-1} \frac{30}{-20}$$
$$= 56,309 - (-56,309)$$
$$= 112,619$$

* Forward kinematic

$$P_x = a_1 \cdot \cos(\theta_1) + a_2 \cdot \cos(\theta_1 + \theta_2)$$
$$= 20 \cdot \cos(112,619) + 50 \cdot \cos(112,619 + 173,130)$$
$$= 20(-0,384) + 50,(-0,246)$$
$$= -7,692 + (-12,308)$$
$$= -20$$

$$P_y = 20 \cdot \sin(112,619) + 50 \sin(112,169 + 143,130)$$
$$= 20 \cdot 0,973 + 50\,(0,969)$$
$$= 18,461 + (-48,461)$$
$$= -30$$

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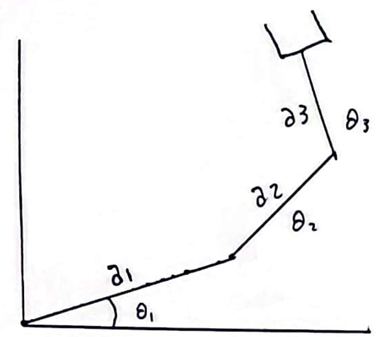
①



$a_1 = 40$ cm
$a_2 = 30$ cm
$a_3 = 25$ cm

$$\left.\begin{aligned} \theta_1 &= 15 \quad \frac{\pi}{12} = 0{,}262 \\ \theta_2 &= 30 \quad \frac{\pi}{3} = 1{,}047 \\ \theta_3 &= 60 \quad \frac{\pi}{6} = 0{,}524 \end{aligned}\right\} \text{Convert to Rad.}$$

* Forward kinematics

$$Q_x = 40\cos(0{,}262) + 30\cos(0{,}262 + 1{,}047) + 25\cos(0{,}262 + 1{,}047 + 0{,}524)$$
$$= 39{,}93$$

$$Q_Y = 40\sin(0{,}262) + 30\sin(0{,}262 + 1{,}047) + 25\sin(0{,}262 + 1{,}047 + 0{,}524)$$
$$= 63{,}48$$

* Inverse kinematic

$$r = \sqrt{Q_x^2 + Q_y^2}$$
$$= \sqrt{(39{,}93)^2 + (63{,}48)^2}$$
$$= \sqrt{(1.594{,}40) + (4.029{,}71)}$$
$$= 749{,}94$$