Answer to B3

-15 $\cos\theta_1$+15 $\cos\theta_2$= 2.5
-$\cos\theta_1$+$\cos\theta_2$= $\frac{1}{6}$ .....(1)
15 $\sin\theta_1$+15 $\sin\theta_2$= 12
- $\sin\theta_1$+ $\sin\theta_2$= $\frac{4}{5}$ .....(2)

Square and add equations (1) and (2)

2 - 2$\cos\theta_1\cos\theta_2$ + 2$\sin\theta_1\sin\theta_2$ = $\frac{16}{25}$ + $\frac{1}{36}$
2 - $\cos(\theta_1+\theta_2)$ - $\cos(\theta_1-\theta_2)$ + $\cos(\theta_1-\theta_2)$- $\cos(\theta_1+\theta_2)$=$\frac{16}{25}$ + $\frac{1}{36}$
2$\cos(\theta_1+\theta_2)$= 2 - $\frac{16}{25}$ - $\frac{1}{36}$
$\cos(\theta_1+\theta_2)$=0.666
$\theta_1+\theta_2$=48.2323
Substitute in (1)
-$\cos(48.2323-\theta_2)$+$\cos\theta_2$=$\frac{1}{6}$
-2$\sin(48.2323/2)\sin(\theta_2-48.2323/2)$=$\frac{1}{6}$
$\sin(\theta_2-48.2323/2)$= -0.20395
θ_2-48.2323/2= -11.7683
θ_1=35.88
θ_2=12.35

20 + 15$\cos\theta_3$ - 15$\cos\theta_4$=7.5
15$\cos\theta_3$ - 15$\cos\theta_4$= -12.5
$\cos\theta_3$ - $\cos\theta_4$= -$\frac{5}{6}$.....(3)
15$\sin\theta_3$+15$\sin\theta_4$=12.5
$\sin\theta_3$+$\sin\theta_4$=$\frac{4}{5}$.....(4)
Square and add equations (3) and (4)
2 - 2$\cos\theta_3\cos\theta_4$ + 2$\sin\theta_3\sin\theta_4$ = $\frac{25}{36}$ + $\frac{16}{25}$
2 - $\cos(\theta_3+\theta_4)$ - $\cos(\theta_3-\theta_4)$ + $\cos(\theta_3-\theta_4)$- $\cos(\theta_3+\theta_4)$=$\frac{25}{36}$ + $\frac{16}{25}$
2$\cos(\theta_3+\theta_4)$= 2 - $\frac{25}{36}$ - $\frac{16}{25}$
$\cos(\theta_3+\theta_4)$=0.332
$\theta_3+\theta_4$=70.563
Substitute in (4)
$\sin(70.563-\theta_4)$ + $\sin\theta_4$=$\frac{4}{5}$
2$\sin(70.563/2)\cos(70.563/2-\theta_4)$= $\frac{4}{5}$
$\cos(70.563/2-\theta_4)$= 0.6925
35.2815-θ_4=46.1695
θ_4=-10.88
θ_3=81.44

Convention:If we take θ_1,θ_2,θ_3 and θ_4 anticlockwise position and front arm angles wrt base arm angles then
θ_1=144.12
θ_2=228.23
θ_3=81.44
and θ_4=109.44