

①

$$F_1 = 60 \text{ Nm}$$

$$F_2 = 50 \text{ Nm}$$

$$F_3 = 30 \text{ Nm}$$

$$F_4 = 40 \text{ Nm}$$

$$\vec{F}_1 = \begin{pmatrix} 60 \cos 40^\circ \\ 60 \sin 40^\circ \end{pmatrix}$$

$$\vec{F}_2 = \begin{pmatrix} 50 \cos 20^\circ \\ 50 \sin 20^\circ \end{pmatrix}$$

$$\vec{r}_1 = \begin{pmatrix} 0 \\ 40 \end{pmatrix}$$

②

1)

$$\alpha_0 = 20^\circ$$

$$\alpha = 16^\circ$$

$$\vec{r} = \begin{pmatrix} 60 \cos 16^\circ \\ 60 \sin 16^\circ \end{pmatrix}$$

$$\vec{R} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4$$

$$\vec{F}_3 + \vec{F}_4 = -\vec{R}$$

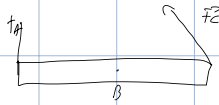
$$\vec{F}_3 + \vec{F}_4 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

2)

$$\vec{F}_1 = \begin{pmatrix} 60 \cos 40^\circ \\ 60 \sin 40^\circ \end{pmatrix}$$

$$\vec{F}_2 = \begin{pmatrix} 50 \cos 20^\circ \\ 50 \sin 20^\circ \end{pmatrix}$$

$$\vec{F}_3 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$



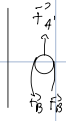
$$6) \vec{r}_A + \vec{r}_C + \vec{r}_B = 0$$



$$\vec{r}_A + \vec{r}_B = 0$$

$$\vec{r}_A - 2\vec{r}_B = 0$$

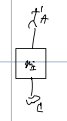
$$\vec{r} = 2\vec{r}_B$$



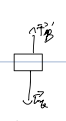
$$\vec{r}_A + \vec{r}_B = 0$$

$$\vec{r}_A - 2\vec{r}_B = 0$$

$$\vec{r}_B = 2\vec{r}_A$$

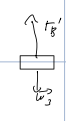


$$\vec{r}_A = \vec{r}_B$$



$$\vec{r}_B + \vec{r}_A = 0$$

$$\vec{r}_B = -\vec{r}_A$$



$$\vec{r}_B - \vec{r}_A = 0$$

$$\vec{r}_B = \vec{r}_A$$

$$d) \omega_2 = \vec{r}_{12} \cdot \vec{\omega}_1 \Rightarrow \omega_2 = \omega_1$$

$$\omega_3 = \vec{r}_{13} \cdot \vec{\omega}_1 \Rightarrow \omega_3 = \omega_1$$

$$\omega_4 = \omega_3 + \omega_2$$

$$e) \vec{r}_B = 80 \text{ cm} \Rightarrow \vec{r}_B = 16^\circ$$

$$\vec{r} = 30^\circ$$

$$m_1 = \frac{16^\circ}{\vec{r}_1} \cdot \vec{r}_1$$

$$m_2 = \frac{16^\circ}{\vec{r}_2} \cdot \vec{r}_2 \Rightarrow m_3$$