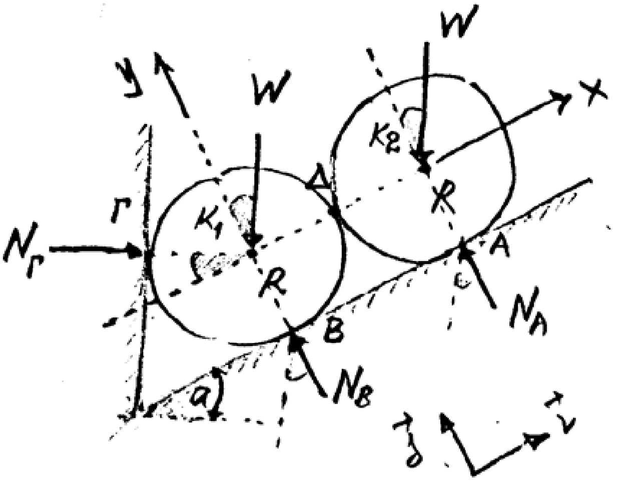
16η ΑΣΚΗΣΗ



Δίνονται

$\alpha = 30^\circ$, R, W, λεία εδάφη.

Ζητούνται

$N_A, N_B, N_Γ$ και $N_Δ$.

Λύση

$$\circlearrowleft \Sigma M_{K_1} = 0 \Rightarrow \cancel{2R} \times N_A - \cancel{2R} \times W\cos\alpha = 0 \Rightarrow \boxed{N_A = W\cos\alpha = \frac{\sqrt{3}}{2} W} \text{ kN}$$

$$\boxed{\vec{N_A} = \frac{W\sqrt{3}}{2}\vec{j} \text{ kN}}$$

$K_2(2R, 0)$ m

$Γ(-R\cos 30^\circ, R\sin 30^\circ) = \left(-\frac{R\sqrt{3}}{2}, \frac{R}{2}\right)$ m

$$\vec{ΓK_2} = (x_{K_2} - x_Γ)\vec{i} + (y_{K_2} - y_Γ)\vec{j} = \left(2R + \frac{R\sqrt{3}}{2}\right)\vec{i} + \left(0 - \frac{R}{2}\right)\vec{j} =$$

$$= \frac{R}{2}(4+\sqrt{3})\vec{i} - \frac{R}{2}\vec{j} \text{ m}$$

$$\vec{ΓK_1} = +R\cos 30^\circ \vec{i} - R\sin 30^\circ \vec{j} = +\frac{R\sqrt{3}}{2}\vec{i} - \frac{R}{2}\vec{j} \text{ m}$$

$$\vec{N_B} = N_B\vec{j} \text{ kN}, \quad \vec{W} = -W\sin 30^\circ \vec{i} - W\cos 30^\circ \vec{j} = -\frac{W}{2}\vec{i} - \frac{W\sqrt{3}}{2}\vec{j} \text{ kN}$$

$$\vec{M_Γ} = \vec{ΓK_1} \times (\vec{W} + \vec{N_B}) + \vec{ΓK_2} \times (\vec{W} + \vec{N_A}) +$$

$$= \cancel{\frac{R}{2}}(\sqrt{3}\vec{i} - \vec{j}) \times \left[-\frac{W}{2}\vec{i} - \left(\frac{W\sqrt{3}}{2} - N_B\right)\vec{j}\right] +$$

$$+ \cancel{\frac{R}{2}}\left[(4+\sqrt{3})\vec{i} - \vec{j}\right] \times \left[-\frac{W}{2}\vec{i} - \cancel{\left(\frac{W\sqrt{3}}{2} - \frac{W\sqrt{3}}{2}\right)}^{0}\vec{j}\right] = \vec{0}$$

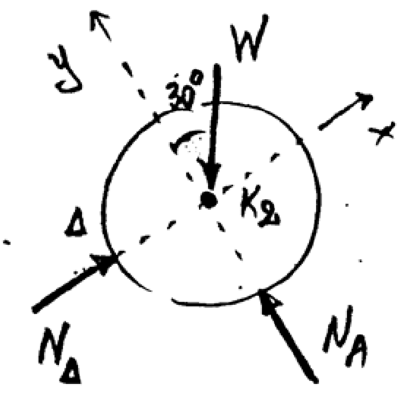
$$\Rightarrow -\sqrt{3}\left(\frac{W\sqrt{3}}{2} - N_B\right)\vec{k} + \frac{W}{2}\vec{k} - \frac{W}{2}\vec{k} = 0\vec{k} \Rightarrow$$

$$\Rightarrow -\frac{3W}{2} + N_B\sqrt{3} - W = 0 \Rightarrow \boxed{N_B = \frac{5}{2\sqrt{3}} W} \text{ kN}$$

(3-43)

$$\Sigma F_x = 0 \Rightarrow N_\Gamma \cos 30^\circ - 2W \sin 30^\circ = 0 \Rightarrow$$

$$\Rightarrow N_\Gamma \frac{\sqrt{3}}{\cancel{2}} - 2W \frac{1}{\cancel{2}} = 0 \Rightarrow \boxed{N_\Gamma = \frac{2W}{\sqrt{3}}} \text{ kN}$$



$$\Sigma F_x = 0 \Rightarrow N_\Delta - W \sin 30^\circ = 0 \Rightarrow$$

$$\Rightarrow \boxed{N_\Delta = \frac{W}{2}} \text{ kN}$$