

8.9 $W = 600 \text{ N}$, $\alpha = 35^\circ$, $\mu_s = 0.25$, $\mu_k = 0.20$, $\theta = 60^\circ$

S; known $W, \alpha, \mu_s, \mu_k, \theta$, unknown $P \Rightarrow$ 마찰각 ϕ_s, ϕ_k , 힘 삼각형, 삼각법

A; 마찰각 $\phi_s = \tan^{-1}(0.25) = 14.04^\circ$
 $\phi_k = \tan^{-1}(0.20) = 11.31^\circ$

M;

F.B.D.

force triangle

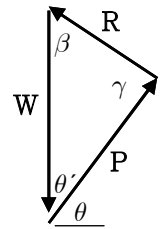
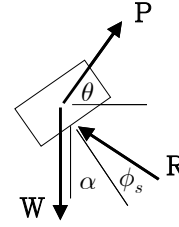
(a) 미끄러져 올라가려 할 때

$$\beta = \alpha + \phi_s = 35^\circ + 14.04^\circ = 49.04^\circ$$

$$\theta' = 90^\circ - \theta = 90^\circ - 60^\circ = 30^\circ$$

$$\begin{aligned} \gamma &= 180^\circ - \beta - \theta' \\ &= 180^\circ - 49.04^\circ - 30^\circ = 100.96^\circ \end{aligned}$$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma} \Rightarrow P = W \frac{\sin\beta}{\sin\gamma} = (600 \text{ N}) \frac{\sin 49.04^\circ}{\sin 100.96^\circ} = 461.5 \text{ N} \Rightarrow P = 462 \text{ N}$$



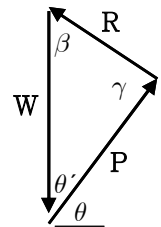
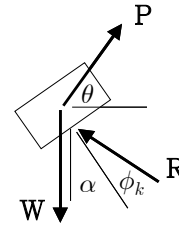
(b) 미끄러져 올라가고 있을 때

$$\beta = \alpha + \phi_k = 35^\circ + 11.31^\circ = 46.31^\circ$$

$$\theta' = 90^\circ - \theta = 90^\circ - 60^\circ = 30^\circ$$

$$\begin{aligned} \gamma &= 180^\circ - \beta - \theta' \\ &= 180^\circ - 46.31^\circ - 30^\circ = 103.69^\circ \end{aligned}$$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma} \Rightarrow P = W \frac{\sin\beta}{\sin\gamma} = (600 \text{ N}) \frac{\sin 46.31^\circ}{\sin 103.69^\circ} = 446.5 \text{ N} \Rightarrow P = 447 \text{ N}$$



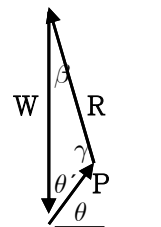
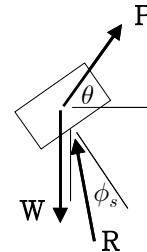
(c) 미끄러져 내려가려 할 때

$$\beta = \alpha - \phi_s = 35^\circ - 14.04^\circ = 20.96^\circ$$

$$\theta' = 90^\circ - \theta = 90^\circ - 60^\circ = 30^\circ$$

$$\begin{aligned} \gamma &= 180^\circ - \beta - \theta' \\ &= 180^\circ - 20.96^\circ - 30^\circ = 129.04^\circ \end{aligned}$$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma} \Rightarrow P = W \frac{\sin\beta}{\sin\gamma} = (600 \text{ N}) \frac{\sin 20.96^\circ}{\sin 129.04^\circ} = 276.3 \text{ N} \Rightarrow P = 276 \text{ N}$$



R;(과정의 타당성 검토) (가령, 수직반력과 마찰력의 합력 R 을 몰라도 풀이할 수 있는 이유)

T;(결과의 의미 검토) (가령, $462 \text{ N} > 447 \text{ N} \Rightarrow$ 운동마찰력이 정지마찰력 최대값 보다 작음)