[2.3절]

2.55 W = 900N, α = 30°, β = 10°

S; known W, α, β,   unknown T_1 , T_2
질점의 평형 문제
⇒ 직각성분 방법 또는 힘 삼각형 방법

M; 자유물체도 (F.B.D.)

A;
<방법 1 : 직각 성분>
$\Sigma F_x = 0$; $T_1 \cos\beta - (T_1 + T_2) \cos\alpha = 0$
       ⇒ $T_1 (\cos\beta - \cos\alpha) - T_2 \cos\alpha = 0$ ··· ①
$\Sigma F_y = 0$; $T_1 \sin\beta + (T_1 + T_2) \sin\alpha - W = 0$
       ⇒ $T_1 (\sin\beta + \sin\alpha) + T_2 \sin\alpha = W$ ··· ②
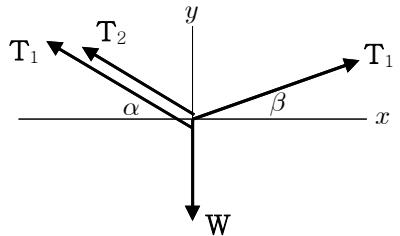
(a) ①×$\sin\alpha$ + ②×$\cos\alpha$
$T_1 (\cos\beta - \cos\alpha) \sin\alpha + T_1 (\sin\beta + \sin\alpha) \cos\alpha = W \cos\alpha$

⇒ $T_1 = W \dfrac{\cos\alpha}{\sin\alpha \cos\beta + \cos\alpha \sin\beta} = W \dfrac{\cos\alpha}{\sin(\alpha + \beta)}$

   $= (900 \text{ N}) \dfrac{\cos 30°}{\sin(30° + 10°)} = 1{,}212.6 \text{ N}$ ⇒ $T_1 = 1{,}213 \text{ N}$

(b) ① ⇒ $T_2 = T_1 \dfrac{\cos\beta - \cos\alpha}{\cos\alpha} = (1{,}212.6 \text{ N}) \dfrac{\cos 10° - \cos 30°}{\cos 30°} = 166.32 \text{ N}$

       ⇒ $T_2 = 166.3 \text{ N}$

<방법 2 : 힘 삼각형>
$\gamma = \alpha + \beta = 30° + 10° = 40°$

(a) $\dfrac{T_1}{\sin(90° - \alpha)} = \dfrac{W}{\sin\gamma}$

   ⇒ $T_1 = W \dfrac{\sin(90° - \alpha)}{\sin\gamma} = (900 \text{ N}) \dfrac{\sin(90° - 30°)}{\sin 40°}$
      $= 1{,}212.6 \text{ N}$ ⇒ $T_1 = 1{,}213 \text{ N}$
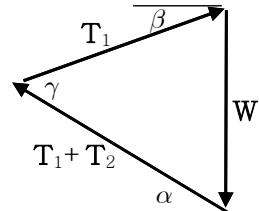
(b) $\dfrac{T_1 + T_2}{\sin(90° - \beta)} = \dfrac{W}{\sin\gamma}$

   ⇒ $T_1 + T_2 = W \dfrac{\sin(90° - \beta)}{\sin\gamma} = (900 \text{ N}) \dfrac{\sin(90° - 10°)}{\sin 40°} = 1{,}378.9 \text{ N}$

      ⇒ $T_2 = 1{,}378.9 \text{ N} - T_1 = 1{,}378.9 \text{ N} - 1{,}212.6 \text{ N} = 166.3 \text{ N}$

R; 과정의 타당성 (가령, 두 가지 방법 비교)

T; 결과 검토 (가령, $T_1 + T_2 > T_1$ ⇒ $\alpha > \beta$)