

[2.3절]

2.66 $m = 200 \text{ kg}$

S; known $W (= mg)$, β , unknown P

질점의 평형 문제 \Rightarrow 직각성분 방법 또는 힘 삼각형 방법

A; $W = (200 \text{ kg})(9.806 \text{ m/s}^2) = 1,961.2 \text{ N}$

$$\tan\beta = \frac{0.75}{2.4} = 0.3125$$

$$\beta = \tan^{-1}(0.3125) = 17.35^\circ$$

$$P = Q$$

<방법 1 : 직각 성분>

$$\Sigma F_x = 0 ; P \cos\alpha - 2Q \sin\beta = 0$$

$$\Rightarrow \cos\alpha = 2 \sin\beta = 2 \sin 17.35^\circ = 0.5965$$

$$\alpha = \cos^{-1}(0.5965) = \pm 53.38^\circ$$

(a) $\alpha = +53.38^\circ$

$$\Sigma F_y = 0 ; P \sin\alpha + 2Q \cos\beta - W = 0$$

$$\Rightarrow P = \frac{W}{\sin\alpha + 2\cos\beta} = \frac{1961.2 \text{ N}}{\sin 53.38^\circ + 2\cos 17.35^\circ} = 723.3 \text{ N}$$

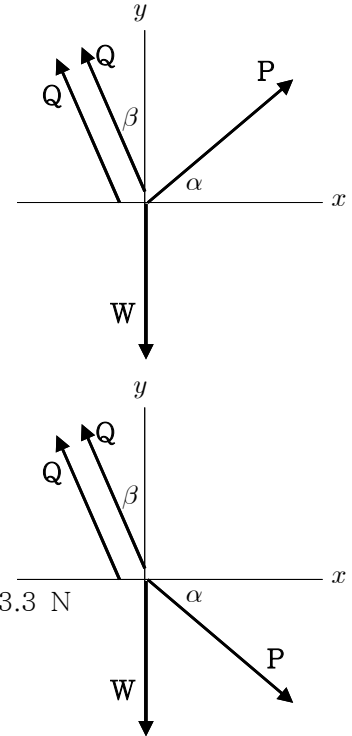
$$\Rightarrow \mathbf{P} = 723 \text{ N } \nearrow 53.4^\circ$$

(b) $\alpha = -53.38^\circ$

$$\Sigma F_y = 0 ; P \sin\alpha + 2Q \cos\beta - W = 0$$

$$\Rightarrow P = \frac{W}{\sin\alpha + 2\cos\beta} = \frac{1961.2 \text{ N}}{\sin(-53.38^\circ) + 2\cos 17.35^\circ} = 1772.6 \text{ N}$$

M; 자유물체도 (F.B.D.)



$$\Rightarrow \mathbf{P} = 1,773 \text{ N } \searrow 53.4^\circ$$

<방법 2 : 힘 삼각형>

$$\frac{2Q}{\sin\theta} = \frac{P}{\sin\beta}$$

$$\Rightarrow \sin\theta = 2 \sin\beta = 2 \sin 17.35^\circ = 0.5964$$

$$\Rightarrow \theta = \sin^{-1}(0.5964) = 36.61^\circ, 143.39^\circ$$

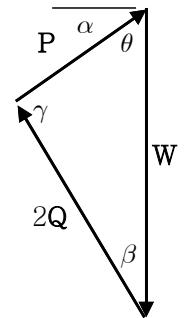
(a) $\theta = 36.61^\circ$

$$\alpha = 90^\circ - \theta = 90^\circ - 36.61^\circ = 53.39^\circ$$

$$\gamma = 180^\circ - (\beta + \theta) = 180^\circ - (17.35^\circ + 36.61^\circ) = 126.04^\circ$$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma} \Rightarrow P = W \frac{\sin\beta}{\sin\gamma} = (1961.2 \text{ N}) \frac{\sin 17.35^\circ}{\sin 126.04^\circ} = 723.3 \text{ N}$$

$$\Rightarrow \mathbf{P} = 723 \text{ N } \nearrow 53.4^\circ$$



(b) $\theta = 143.39^\circ$

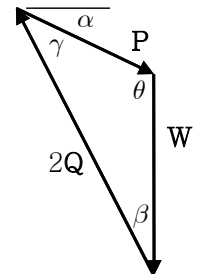
$$\alpha = \theta - 90^\circ = 143.39^\circ - 90^\circ = 53.39^\circ$$

$$\gamma = 180^\circ - (\beta + \theta) = 180^\circ - (17.35^\circ + 143.39^\circ) = 19.26^\circ$$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma}$$

$$\Rightarrow P = W \frac{\sin\beta}{\sin\gamma} = (1961.2 \text{ N}) \frac{\sin 17.35^\circ}{\sin 19.26^\circ} = 1773.0 \text{ N}$$

$$\Rightarrow \mathbf{P} = 1,773 \text{ N } \searrow 53.4^\circ$$



R; (과정의 타당성. 가령, 두 가지 방법 비교)

T; (결과의 의미. 가령, P의 방향 \nearrow, \searrow)