

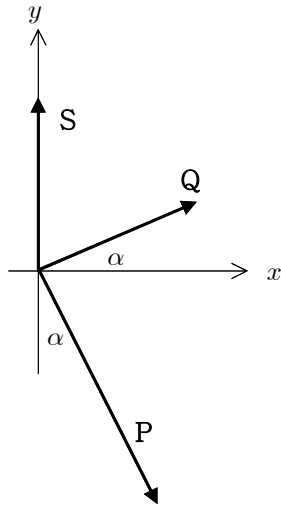
[2.2절]

2.39 $P = 170 \text{ N}$, $Q = 85 \text{ N}$, $S = 110 \text{ N}$

S; known : P , Q , S , 합력 성분 $R_y = 0$, unknown : α , 합력 성분 R_x

\Rightarrow 직각성분 합에 의한 힘의 합성

M; 자유물체도 (F.B.D.)



A;

$$(a) R_y = -P \cos\alpha + Q \sin\alpha + S = 0$$

$$\Rightarrow P \cos\alpha = Q \sin\alpha + S$$

$$\Rightarrow P \sqrt{1 - \sin^2\alpha} = Q \sin\alpha + S$$

$$\Rightarrow P^2 (1 - \sin^2\alpha) = (Q \sin\alpha + S)^2$$

$$= Q^2 \sin^2\alpha + 2QS \sin\alpha + S^2$$

$$\Rightarrow (P^2 + Q^2) \sin^2\alpha + 2QS \sin\alpha + (S^2 - P^2) = 0$$

$$\Rightarrow (170^2 + 85^2) \sin^2\alpha + 2(85)(110) \sin\alpha + (110^2 - 170^2) = 0$$

$$\Rightarrow 36,125 \sin^2\alpha + 18,700 \sin\alpha - 16,800 = 0$$

$$\Rightarrow 1,445 \sin^2\alpha + 748 \sin\alpha - 672 = 0$$

$$\Rightarrow \sin\alpha = \frac{-374 \pm \sqrt{374^2 - (1,445)(-672)}}{1,445} = -0.988, 0.4706 \quad (\sin\alpha > 0)$$

$$\Rightarrow \alpha = \sin^{-1}(0.4706) = 28.07^\circ \quad \Rightarrow \quad \alpha = 28.1^\circ$$

$$(b) R_x = P \sin\alpha + Q \cos\alpha$$

$$= (170 \text{ N}) (0.4706) + (85 \text{ N}) \cos 28.07^\circ = 155.00 \text{ N} \quad \Rightarrow \quad R_x = 155.0 \text{ N}$$

R; (과정의 타당성) (가령, 다각형 방법과 비교하면 어떤지?, $\sin\alpha = -0.988$ 이면?)

T; (결과 의미) (가령, 합력의 방향, R_x 방향 \rightarrow)