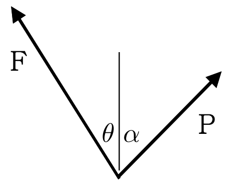
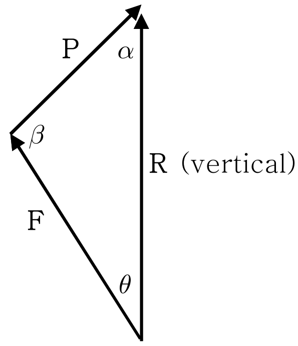
# 정 역 학　　연습과제 풀이　　제2장　　(2013년)

[2.1~6절]

## 2.5 [ 힘의 합성, 삼각법 ]




힘 삼각형




$F$ = 120 N,　 $\theta$ = 25°,　 $\alpha$ = 30°

$\beta$ = 180° − $\theta$ − $\alpha$ = 180° − 25° − 30° = 125°

(a) $\dfrac{P}{\sin\theta} = \dfrac{F}{\sin\alpha} \quad \Rightarrow \quad P = F\dfrac{\sin\theta}{\sin\alpha} = (120\ \text{N})\ \dfrac{\sin 25^\circ}{\sin 30^\circ} = 101.43\ \text{N}$

$\Rightarrow \qquad P = 101.4\ \text{N}$

(b) <방법 1>

$\dfrac{R}{\sin\beta} = \dfrac{F}{\sin\alpha} \quad \Rightarrow \quad R = F\dfrac{\sin\beta}{\sin\alpha} = (120\ \text{N})\ \dfrac{\sin 125^\circ}{\sin 30^\circ} = 196.60\ \text{N}$

$\Rightarrow \qquad R = 196.6\ \text{N}$

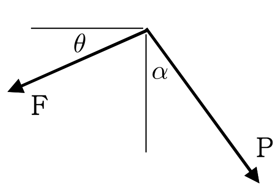
<방법 2>

$R^2 = F^2 + P^2 - 2FP\cos\beta$

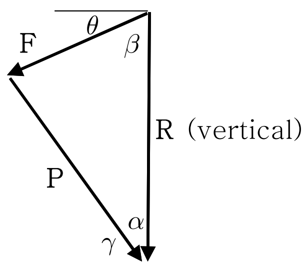
$= (120\ \text{N})^2 + (101.43\ \text{N})^2 - 2(120\ \text{N})(101.43\ \text{N})\cos 125^\circ = 38650.7\ \text{N}^2$

$R = (38650.7\ \text{N}^2)^{1/2} = 196.60\ \text{N} \qquad \Rightarrow \qquad R = 196.6\ \text{N}$

## 2.7 [ 힘의 합성, 삼각법 ]




힘 삼각형




$F$ = 1600 N,　 $\theta$ = 15°,

$R$ = 2500 N,　 $\beta$ = 90° − $\theta$ = 90° − 15° = 75°

$P^2 = F^2 + R^2 - 2FR\cos\beta = (1600\ \text{N})^2 + (2500\ \text{N})^2 - 2(1600\ \text{N})(2500\ \text{N})\cos 75^\circ$

$= 6739448\ \text{N}^2$

$P = (6739448\ \text{N}^2)^{1/2} = 2596\ \text{N} \qquad \Rightarrow \qquad P = 2600\ \text{N}$

$\dfrac{F}{\sin\alpha} = \dfrac{P}{\sin\beta} \quad \Rightarrow \quad \sin\alpha = \dfrac{F}{P}\sin\beta = \dfrac{1600\ \text{N}}{2596\ \text{N}}\sin 75^\circ = 0.5953$

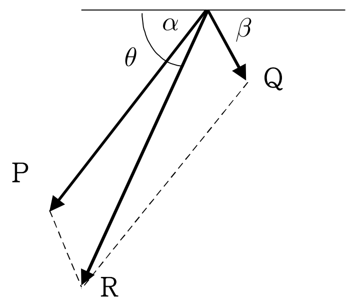
$\Rightarrow \quad \alpha = \sin^{-1}(0.5953) = 36.54^\circ$

$\Rightarrow \quad \gamma = 90^\circ - \alpha = 90^\circ - 36.54^\circ = 53.46^\circ$

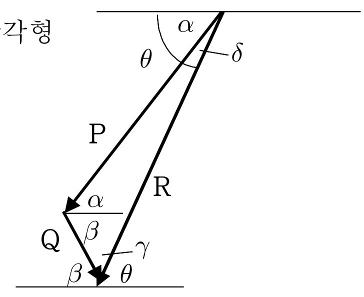
$\Rightarrow$　 P = 2600 N ↘53.5°

2.15 [ 힘의 합성, 삼각법 ]

B에서 $\alpha = \tan^{-1}\dfrac{2.5\text{ m}}{2\text{ m}} = 51.34°$ D에서 $\beta = \tan^{-1}\dfrac{2.5\text{ m}}{1.5\text{ m}} = 59.04°$




힘 삼각형




$P$ = 600 N, $Q$ = 200 N

$\alpha + \beta = 51.34° + 59.04° = 110.38°$

$\theta = \alpha + \delta = 51.34° + \delta$

$\gamma = 180° - (\beta + \theta) = 180° - (\beta + \alpha + \delta) = 180° - (110.38° + \delta) = 69.62° - \delta$

$\dfrac{Q}{\sin\delta} = \dfrac{P}{\sin\gamma}$

$\sin\gamma = \sin(69.62° - \delta)$

[ sin(A-B) = sinA cosB - cosA sinB ]

$= \sin 69.62° \cos\delta - \cos 69.62° \sin\delta$

$(600\text{ N}) \sin\delta = (200\text{ N}) (\sin 69.62° \cos\delta - \cos 69.62° \sin\delta)$

$[(600\text{ N}) + (200\text{ N}) \cos 69.62°] \sin\delta = (200\text{ N}) \sin 69.62° \cos\delta$

$(669.65\text{ N}) \sin\delta = (187.48\text{ N}) \cos\delta$

$\tan\delta = \dfrac{187.48\text{ N}}{669.65\text{ N}} = 0.27996$ ⇒ $\delta = \tan^{-1}0.2800 = 15.64°$

$\theta = \alpha + \delta = 51.34° + 15.64° = 66.98°$

$\dfrac{R}{\sin(\alpha + \beta)} = \dfrac{Q}{\sin\delta}$

$R = Q\dfrac{\sin(\alpha + \beta)}{\sin\delta} = (200\text{ N}) \dfrac{\sin 110.38°}{\sin 15.64°} = 695.4\text{ N}$

⇒ R = 695 N ↙67.0°