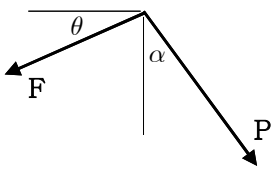
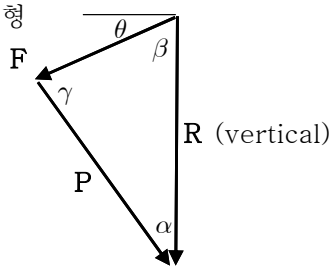
<2.1~6절>

2.9 [힘의 합성, 삼각형법]



힘 삼각형



F = 1600 N,　θ = 15°,　α = 25°

$\beta = 90° - \theta = 90° - 15° = 75°$

$\alpha + \beta + \gamma = 180°$

$\Rightarrow \quad \gamma = 180° - \alpha - \beta = 180° - 25° - 75° = 80°$

(a) $\dfrac{P}{\sin\beta} = \dfrac{F}{\sin\alpha} \quad \Rightarrow \quad P = F\dfrac{\sin\beta}{\sin\alpha} = (1600\text{ N})\dfrac{\sin75^\circ}{\sin25^\circ} = 3657\text{ N}$

$\Rightarrow \quad P$ = 3660 N

(b) <방법 1>

$\dfrac{R}{\sin\gamma} = \dfrac{F}{\sin\alpha} \quad \Rightarrow \quad R = F\dfrac{\sin\gamma}{\sin\alpha} = (1600\text{ N})\dfrac{\sin80^\circ}{\sin25^\circ} = 3728\text{ N}$

$\Rightarrow \quad R$ = 3730 N

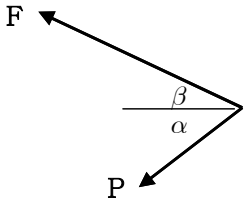
<방법 2>

$R^2 = F^2 + P^2 - 2FP\cos\gamma = (1600\text{ N})^2 + (3657\text{ N})^2 - 2(1600\text{ N})(3657\text{ N})\cos80°$

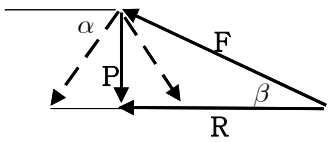
$= 13901548\text{ N}^2$

$R = (13901548\text{ N}^2)^{1/2} = 3728\text{ N} \quad \Rightarrow \quad R$ = 3730 N

2.13 [힘의 분해, 한 성분의 방향을 알고 다른 성분의 크기를 최소화]



힘 삼각형

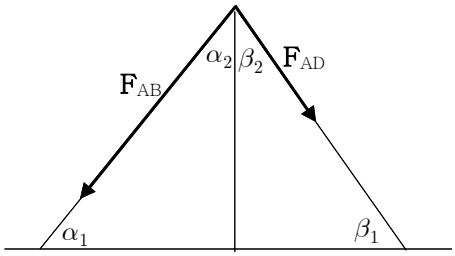


F = 50 N,　β = 25°,　P가 최소이려면 α = 90°

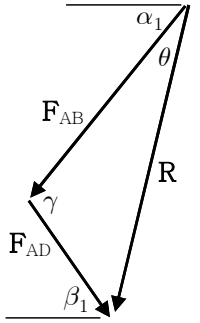
(a) $P = F\sin\beta = (50\text{ N})\sin25° = 21.13\text{ N} \quad \Rightarrow \quad$ P = 21.1 N ↓

(b) $R = F\cos\beta = (50\text{ N})\cos25° = 45.32\text{ N} \quad \Rightarrow \quad R$ = 45.3 N

2.16 [힘의 합성, 삼각형법]



힘 삼각형



F_{AB} = 60 N, F_{AD} = 20 N

$\alpha_1 = \tan^{-1}\frac{3\text{ m}}{2.5\text{ m}} = \tan^{-1}(1.20) = 50.2°$ ⇒ $\alpha_2 = 90° - \alpha_1 = 90° - 50.2° = 39.8°$

$\beta_1 = \tan^{-1}\frac{3\text{ m}}{2\text{ m}} = \tan^{-1}(1.50) = 56.3°$ ⇒ $\beta_2 = 90° - \beta_1 = 90° - 56.3° = 33.7°$

$\gamma = \alpha_1 + \beta_1 = 50.2° + 56.3° = 106.5°$

합력 R의 크기

$R^2 = F_{AB}^2 + F_{AD}^2 - 2\,F_{AB}\,F_{AD}\cos\gamma = (60\text{ N})^2 + (20\text{ N})^2 - 2(60\text{ N})(20\text{ N})\cos 106.5°$
$= 4681.6\text{ N}^2$

$R = (4681.6\text{ N}^2)^{1/2} = 68.42\text{ N}$

합력 R의 방향

$\frac{F_{AD}}{\sin\theta} = \frac{R}{\sin\gamma}$ ⇒ $\sin\theta = \frac{F_{AD}}{R}\sin\gamma = \frac{20\text{ N}}{68.42\text{ N}}\sin(106.5°) = 0.2803$

⇒ $\theta = \sin^{-1}(0.2803) = 16.28°$

$\alpha_1 + \theta = 50.2° + 16.28° = 66.48°$

합력 R = 68.4 N ∠66.5°