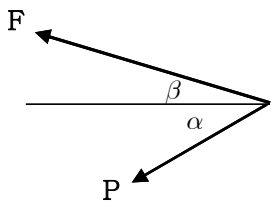
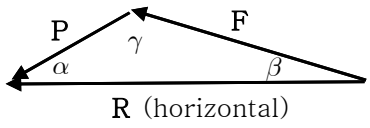
[2.1~6절]

2.7 [힘의 합성, 삼각법]



힘 삼각형



F = 50 N, β = 25°, P = 35 N

(a) $\dfrac{F}{\sin\alpha} = \dfrac{P}{\sin\beta} =$ ⇒ $\sin\alpha = \dfrac{F}{P}\sin\beta = \dfrac{50\text{ N}}{35\text{ N}}\sin 25° = 0.6037$

⇒ $\alpha = \sin^{-1}(0.6037) = 37.1°$

(b) $\gamma = 180° - (\alpha + \beta) = 180° - (37.1° + 25°) = 117.9°$

<방법 1>

$\dfrac{R}{\sin\gamma} = \dfrac{P}{\sin\beta}$ ⇒ $R = P\dfrac{\sin\gamma}{\sin\beta} = (35\text{ N})\dfrac{\sin 117.9°}{\sin 25°} = 73.22\text{ N}$

⇒ R = 73.2 N

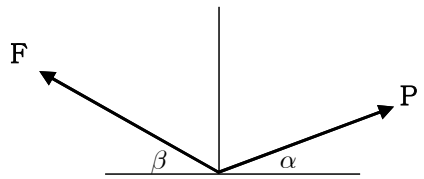
<방법 2>

$R^2 = F^2 + P^2 - 2FP\cos\gamma = (50\text{ N})^2 + (35\text{ N})^2 - 2(50\text{ N})(35\text{ N})\cos 117.9°$

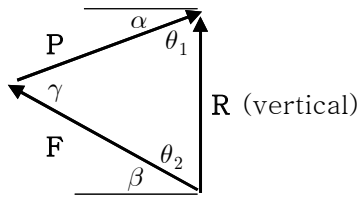
$= 5362.75\text{ N}^2$

$R = (5362.75\text{ N}^2)^{1/2} = 73.23\text{ N}$ ⇒ R = 73.2 N

2.11 [힘의 합성, 삼각법]



힘 삼각형



F = 2125 N, α = 20°, β = 30°

$\theta_1 = 90° - \alpha = 90° - 20° = 70°$, $\theta_2 = 90° - \beta = 90° - 30° = 60°$

(a) $\dfrac{P}{\sin\theta_2} = \dfrac{F}{\sin\theta_1}$ ⇒ $P = F\dfrac{\sin\theta_2}{\sin\theta_1} = (2125\text{ N})\dfrac{\sin 60°}{\sin 70°} = 1958.4\text{ N}$

⇒ P = 1958 N

(b) $\gamma = \alpha + \beta = 20° + 30° = 50°$

<방법 1>

$\dfrac{R}{\sin\gamma} = \dfrac{F}{\sin\theta_1}$ ⇒ $R = F\dfrac{\sin\gamma}{\sin\theta_1} = (2125\text{ N})\dfrac{\sin 50°}{\sin 70°} = 1732.3\text{ N}$

⇒ R = 1732 N

<방법 2>

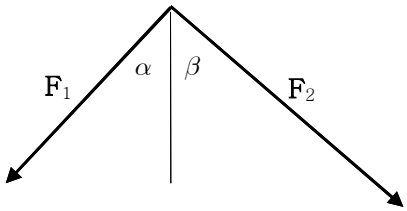
$R^2 = F^2 + P^2 - 2FP\cos\gamma$

$= (2125\ \text{N})^2 + (1958.4\ \text{N})^2 - 2(2125\ \text{N})(1958.4\ \text{N})\cos 50°$

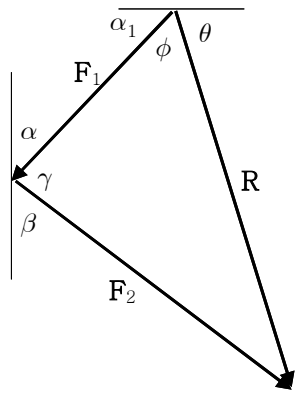
$= 3000906\ \text{N}^2$

$R = (3000906\ \text{N}^2)^{1/2} = 1732.3\ \text{N} \quad \Rightarrow \quad R = 1732\ \text{N}$

2.17 [힘의 합성, 삼각법]



힘 삼각형



$F_1 = 2\ \text{kN}, \quad F_2 = 3\ \text{kN}$

$\alpha = 40°, \quad \beta = 60°$

$\gamma = 180° - (\alpha + \beta) = 180° - (40° + 60°) = 80°$

합력 R의 크기

$R^2 = F_1^2 + F_2^2 - 2F_1F_2\cos\gamma = (2\ \text{kN})^2 + (3\ \text{kN})^2 - 2(2\ \text{kN})(3\ \text{kN})\cos 80°$

$= 10.916\ \text{kN}^2$

$R = (10.916\ \text{kN}^2)^{1/2} = 3.304\ \text{kN}$

합력 R의 방향

$\dfrac{F_2}{\sin\phi} = \dfrac{R}{\sin\gamma} \quad \Rightarrow \quad \sin\phi = \dfrac{F_2}{R}\sin\gamma = \dfrac{3\ \text{kN}}{3.304\ \text{kN}}\sin 80° = 0.8942$

$\Rightarrow \quad \phi = \sin^{-1}(0.8942) = 63.41°$

$\alpha_1 = 90° - \alpha = 90° - 40° = 50°$

$\theta = 180° - (\alpha_1 + \phi) = 180° - (50° + 63.41°) = 66.59°$

합력 R = 3.30 kN ↘66.6°