{2.4절}

2.91

   S; (전략)

   M; 자유물체도(F.B.D.)

   A; ① 힘 **P**의 직각성분

P = 300 N, α = 30°, β = 15°

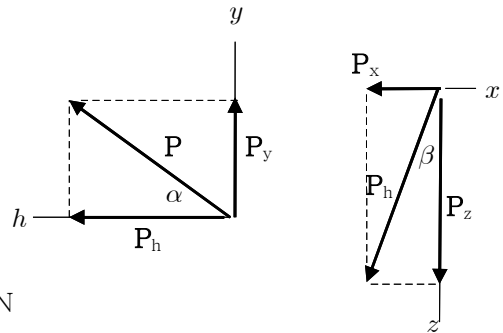$P_y = P \sin\alpha = (300 \text{ N}) \sin30°$

      = 150.0 N

$P_h = P \cos\alpha$

$P_x = -P_h \sin\beta = -P \cos\alpha \sin\beta$

      $= -(300 \text{ N}) \cos30° \sin15° = -67.2$ N

$P_z = P_h \cos\beta = P \cos\alpha \cos\beta$

      $= (300 \text{ N}) \cos30° \cos15° = 251.0$ N

  ⇒   **P** = −67.2 **i** + 150.0 **j** + 251.0 **k** (N)

  ② 힘 **Q**의 직각성분

Q = 400 N, γ = 50°, ϕ = 20°

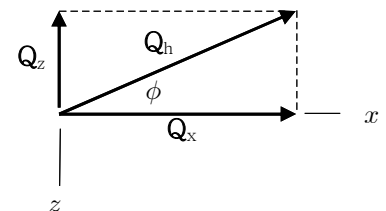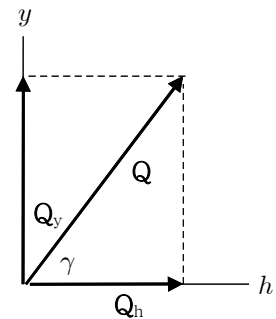$Q_y = Q \sin\gamma = (400 \text{ N}) \sin50°$

      = 306.4 N

$Q_h = Q \cos\gamma$

$Q_x = Q_h \cos\phi = Q \cos\gamma \cos\phi$

      $= (400 \text{ N}) \cos50° \cos20°$

      = 241.6 N

$Q_z = -Q_h \sin\phi = -Q \cos\gamma \sin\phi$

      $= -(400 \text{ N}) \cos50° \sin20° = -87.9$ N

  ⇒   **Q** = 241.6 **i** + 306.4 **j** − 87.9 **k** (N)

③ 합력의 크기와 방향

R = **P** + **Q**

   = (−67.2 **i** + 150.0 **j** + 251.0 **k**) + (241.6 **i** + 306.4 **j** − 87.9 **k**) (N)

   = 174.4 **i** + 456.4 **j** + 163.1 **k** (N)

$R = \sqrt{R_x^2 + R_y^2 + R_z^2}$

   $= \sqrt{(174.4)^2 + (456.4)^2 + (163.1)^2}$ (N) = 515.1 (N)   ⇒ R = 515 N

$\cos\theta_x = \dfrac{R_x}{R} = \dfrac{174.4 \text{ N}}{515.1 \text{ N}} = 0.3386$ ⇒ $\theta_x = \cos^{-1}(0.3386) = 70.2°$

$\cos\theta_y = \dfrac{R_y}{R} = \dfrac{456.4 \text{ N}}{515.1 \text{ N}} = 0.8860$ ⇒ $\theta_x = \cos^{-1}(0.8860) = 27.6°$

$\cos\theta_z = \dfrac{R_z}{R} = \dfrac{163.1 \text{ N}}{515.1 \text{ N}} = 0.3166$ ⇒ $\theta_z = \cos^{-1}(0.3166) = 71.5°$

   R; (과정의 타당성)

   T; (결과 검토)