

[2.12~2.14 ]

2.76 (a)  $F = 1900 \text{ N}$

$$F_y = F \cos 20^\circ = (1900 \text{ N}) \cos 20^\circ = 1785 \text{ N}$$

$$F_h = F \sin 20^\circ = (1900 \text{ N}) \sin 20^\circ$$

$$F_x = -F_h \sin 70^\circ = -(1900 \text{ N}) \sin 20^\circ \sin 70^\circ = -611 \text{ N}$$

$$F_z = F_h \cos 70^\circ = (1900 \text{ N}) \sin 20^\circ \cos 70^\circ = 222 \text{ N}$$

(b)  $\theta_y = 20.0^\circ$

$$\cos \theta_x = \frac{F_x}{F} = \frac{-611 \text{ N}}{1900 \text{ N}} = -0.3216 \quad \theta_x = \cos^{-1}(-0.3216) = 108.8^\circ$$

$$\cos \theta_z = \frac{F_z}{F} = \frac{222 \text{ N}}{1900 \text{ N}} = 0.11684 \quad \theta_z = \cos^{-1}(0.11684) = 83.3^\circ$$

2.80  $\alpha = 30^\circ$ ,  $\beta = 35^\circ$ ,  $F_x = 180 \text{ N}$

(a)  $F_h = F \sin \alpha$ ,  $F_x = F_h \cos \beta = F \sin \alpha \cos \beta$

$$F = \frac{F_x}{\sin \alpha \cos \beta} = \frac{180 \text{ N}}{\sin 30^\circ \cos 35^\circ} = 439 \text{ N}$$

(b)  $F_x = F \sin \alpha \cos \beta$   $\cos \theta_x = \frac{F_x}{F} = \sin \alpha \cos \beta = \sin 30^\circ \cos 35^\circ = 0.4096$

$$\theta_x = \cos^{-1}(0.4096) = 65.8^\circ$$

$$F_y = F \cos \alpha \quad \cos \theta_y = \frac{F_y}{F} = \cos \alpha \quad \theta_y = \alpha = 30^\circ$$

$$F_z = -F_h \sin \beta = -F \sin \alpha \sin \beta$$

$$\cos \theta_z = \frac{F_z}{F} = -\sin \alpha \sin \beta = -\sin 30^\circ \sin 35^\circ = -0.2868$$

$$\theta_z = \cos^{-1}(-0.2868) = 106.7^\circ$$

2.95  $T_{AB} = 510 \text{ N}$ ,  $T_{AC} = 765 \text{ N}$

$$\lambda_{AB} = \frac{-0.6 \text{ m } \mathbf{i} + 0.36 \text{ m } \mathbf{j} + 0.27 \text{ m } \mathbf{k}}{\sqrt{(-0.6 \text{ m})^2 + (0.36 \text{ m})^2 + (0.27 \text{ m})^2}} = \frac{1}{0.75}(-0.6 \mathbf{i} + 0.36 \mathbf{j} + 0.27 \mathbf{k})$$

$$\mathbf{T}_{AB} = T_{AB} \lambda_{AB} = \frac{510 \text{ N}}{0.75}(-0.6 \mathbf{i} + 0.36 \mathbf{j} + 0.27 \mathbf{k}) = -408 \mathbf{i} + 244 \mathbf{j} + 183.6 \mathbf{k} \text{ (N)}$$

$$\lambda_{AC} = \frac{-0.6 \text{ m } \mathbf{i} + 0.32 \text{ m } \mathbf{j} - 0.51 \text{ m } \mathbf{k}}{\sqrt{(-0.6 \text{ m})^2 + (0.32 \text{ m})^2 + (-0.51 \text{ m})^2}} = \frac{1}{0.85}(-0.6 \mathbf{i} + 0.32 \mathbf{j} - 0.51 \mathbf{k})$$

$$\mathbf{T}_{AC} = T_{AC} \lambda_{AC} = \frac{765 \text{ N}}{0.85}(-0.6 \mathbf{i} + 0.32 \mathbf{j} - 0.51 \mathbf{k}) = -540 \mathbf{i} + 288 \mathbf{j} - 459 \mathbf{k} \text{ (N)}$$

$$\begin{aligned} \mathbf{R} &= \mathbf{T}_{AB} + \mathbf{T}_{AC} = (-408 \mathbf{i} + 244 \mathbf{j} + 183.6 \mathbf{k}) + (-540 \mathbf{i} + 288 \mathbf{j} - 459 \mathbf{k}) \text{ (N)} \\ &= -948 \mathbf{i} + 532 \mathbf{j} - 275 \mathbf{k} \text{ (N)} \end{aligned}$$

$$R = \sqrt{(-948)^2 + (532)^2 + (-275)^2} \text{ N} = 1121 \text{ N}$$

$$\cos \theta_x = \frac{-948}{1121} = -0.846 \quad \theta_x = \cos^{-1}(-0.846) = 147.7^\circ$$

$$\cos \theta_y = \frac{532}{1121} = 0.474 \quad \theta_y = \cos^{-1}(0.474) = 61.7^\circ$$

$$\cos \theta_z = \frac{-275}{1121} = -0.245 \quad \theta_z = \cos^{-1}(-0.245) = 104.2^\circ$$