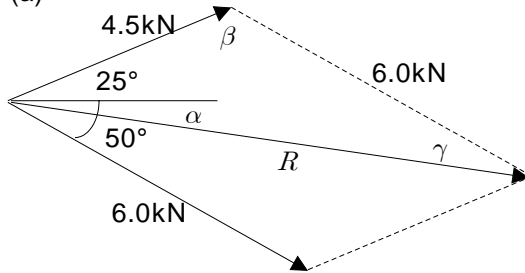
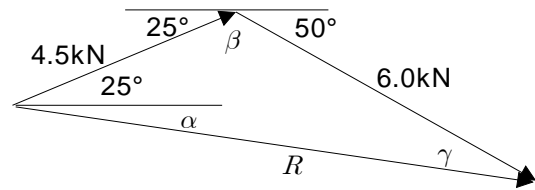


&lt;2.1~2.6 &gt;

2.1 (a)



(b)



$$\beta = 180^\circ - (25^\circ + 50^\circ) = 105^\circ$$

[ 1 ]

$$R^2 = (4.5 \text{ kN})^2 + (6.0 \text{ kN})^2 - 2 (4.5 \text{ kN}) (6.0 \text{ kN}) \cos 105^\circ = 70.226 (\text{kN})^2$$

$$R = 8.380 \text{ kN}$$

$$\frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}} = \frac{\sin \beta}{R}$$

$$\frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}} = \frac{\sin 105^\circ}{8.380 \text{ kN}}$$

$$\sin(25^\circ + \alpha) = \frac{(6.0 \text{ kN}) \sin 105^\circ}{8.380 \text{ kN}} = 0.6916$$

$$25^\circ + \alpha = \sin^{-1} 0.6916 = 43.76^\circ$$

$$\alpha = 18.76^\circ$$

$$R = 8.38 \text{ kN} \quad \angle 18.76^\circ$$

[ 2 ]

$$\gamma = 180^\circ - \beta - (25^\circ + \alpha) = 50^\circ - \alpha$$

$$\frac{\sin \gamma}{4.5 \text{ kN}} = \frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}} = \frac{\sin \beta}{R}$$

$$\frac{\sin \gamma}{4.5 \text{ kN}} = \frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}}$$

$$\frac{\sin(50^\circ - \alpha)}{4.5 \text{ kN}} = \frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}}$$

$$\sin(50^\circ - \alpha) = 0.75 \sin(25^\circ + \alpha)$$

$$\sin 50^\circ \cos \alpha - \cos 50^\circ \sin \alpha = 0.75 (\sin 25^\circ \cos \alpha + \cos 25^\circ \sin \alpha)$$

$$(\sin 50^\circ - 0.75 \sin 25^\circ) \cos \alpha = (\cos 50^\circ + 0.75 \cos 25^\circ) \sin \alpha$$

$$\tan \alpha = \frac{\sin 50^\circ - 0.75 \sin 25^\circ}{\cos 50^\circ + 0.75 \cos 25^\circ} = 0.3396$$

$$\alpha = \tan^{-1}(0.3396) = 18.76^\circ$$

$$\frac{\sin(25^\circ + \alpha)}{6.0 \text{ kN}} = \frac{\sin \beta}{R}$$

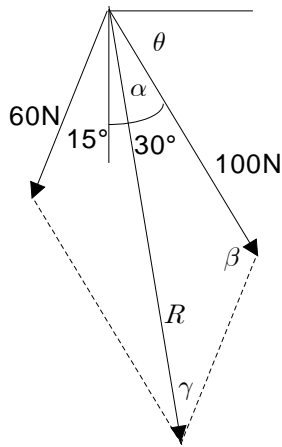
$$\frac{\sin(25^\circ + 18.76^\circ)}{6.0 \text{ kN}} = \frac{\sin 105^\circ}{R}$$

$$R = (6.0 \text{ kN}) \frac{\sin 105^\circ}{\sin 43.76^\circ} = (6.0 \text{ kN}) (1.397) = 8.38 \text{ kN}$$

$$R = 8.38 \text{ kN} \quad \angle 18.76^\circ$$

2.3

(a)



$$\beta = 180^\circ - (15^\circ + 30^\circ) = 135^\circ$$

[ 1 ]

$$R^2 = (100 \text{ N})^2 + (60 \text{ N})^2 - 2 (100 \text{ N}) (60 \text{ N}) \cos 135^\circ = 22085 (\text{N})^2$$

$$R = 148.61 \text{ N}$$

$$\frac{\sin \alpha}{60 \text{ N}} = \frac{\sin \beta}{R} \qquad \frac{\sin \alpha}{60 \text{ N}} = \frac{\sin 135^\circ}{148.61 \text{ N}}$$

$$\sin \alpha = \frac{(60 \text{ N}) \sin 135^\circ}{148.61 \text{ N}} = 0.28549$$

$$\alpha = \sin^{-1} 0.28549 = 16.59^\circ$$

$$\theta = 90^\circ - (30^\circ - 16.59^\circ) = 76.6^\circ$$

$$\mathbf{R} = 148.6 \text{ N } \overline{76.6^\circ}$$

[ 2 ]

$$\gamma = 180^\circ - \beta - \alpha = 45^\circ - \alpha$$

$$\frac{\sin \gamma}{100 \text{ N}} = \frac{\sin \alpha}{60 \text{ N}} = \frac{\sin \beta}{R}$$

$$\frac{\sin \gamma}{100 \text{ N}} = \frac{\sin \alpha}{60 \text{ N}} \qquad \frac{\sin(45^\circ - \alpha)}{100 \text{ N}} = \frac{\sin \alpha}{60 \text{ N}}$$

$$0.6 \sin(40^\circ - \alpha) = \sin \alpha$$

$$0.6 (\sin 45^\circ \cos \alpha - \cos 45^\circ \sin \alpha) = \sin \alpha$$

$$0.6 \sin 45^\circ \cos \alpha = (1 + 0.6 \cos 45^\circ) \sin \alpha$$

$$\tan \alpha = \frac{0.6 \sin 45^\circ}{1 + 0.6 \cos 45^\circ} = 0.2979$$

$$\alpha = \tan^{-1}(0.2979) = 16.59^\circ$$

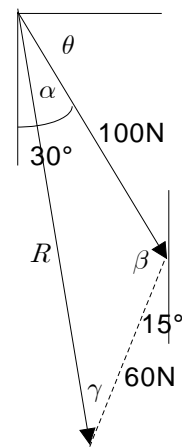
$$\theta = 90^\circ - (30^\circ - \alpha) = 90^\circ - (30^\circ - 16.59^\circ) = 76.6^\circ$$

$$\frac{\sin \alpha}{60 \text{ N}} = \frac{\sin \beta}{R} \qquad \frac{\sin 16.59^\circ}{60 \text{ N}} = \frac{\sin 135^\circ}{R}$$

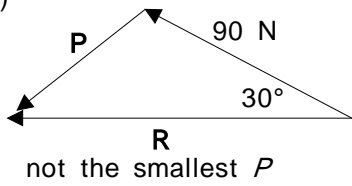
$$R = (60 \text{ N}) \frac{\sin 135^\circ}{\sin 16.59^\circ} = (60 \text{ N}) (2.477) = 148.6 \text{ N}$$

$$\mathbf{R} = 148.6 \text{ N } \overline{76.6^\circ}$$

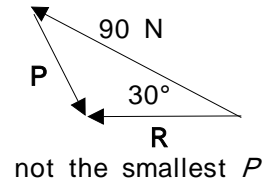
(b)



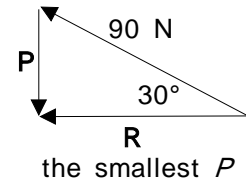
2.13 (a)



$$P = (90\text{ N}) \sin 30^\circ = 45\text{ N}$$



$$P = 45.0\text{ N}$$



(b)  $R = (90\text{ N}) \cos 30^\circ = 77.94\text{ N}$

$$R = 77.9\text{ N}$$