

[2.1~2.6]

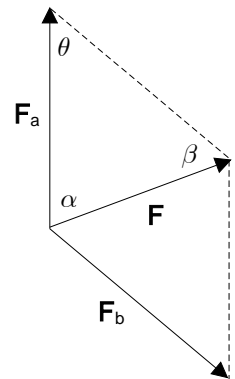
2.5 $F = 200 \text{ N}, \quad \theta = 45^\circ$

(a) $F_a = 150 \text{ N}$

$$\frac{\sin\theta}{F} = \frac{\sin\beta}{F_a} \quad \sin\beta = \frac{F_a}{F} \sin\theta = \frac{150 \text{ N}}{200 \text{ N}} \sin 45^\circ = 0.5303$$

$$\beta = \sin^{-1}(0.5303) = 32.0^\circ$$

$$\alpha = 180^\circ - (\theta + \beta) = 103.0^\circ = 180^\circ - (45^\circ + 32.0^\circ) = 103.0^\circ$$



(b) < 1 >

$$\frac{\sin\beta}{F_a} = \frac{\sin\alpha}{F_b} \quad F_b = F_a \frac{\sin\alpha}{\sin\beta} = (150 \text{ N}) \frac{\sin 103^\circ}{\sin 32^\circ} = 276 \text{ N}$$

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$$F_b^2 = F_a^2 + F^2 - 2 F_a F \cos\alpha$$

$$= (150 \text{ N})^2 + (200 \text{ N})^2 - 2 (150 \text{ N}) (200 \text{ N}) \cos 103^\circ = 75,997 \text{ N}^2$$

$$F_b = \sqrt{75,997 \text{ N}^2} = 276 \text{ N}$$

2.10 $F_{BC} = 80 \text{ N}, \quad F_{DE} = 60 \text{ N}, \quad \theta = 10^\circ$

(a) $\frac{\sin\theta}{F_{BC}} = \frac{\sin\alpha}{F_{DE}} \quad \sin\alpha = \frac{F_{DE}}{F_{BC}} \sin\theta = \frac{60 \text{ N}}{80 \text{ N}} \sin 10^\circ = 0.1302$

$$\alpha = \sin^{-1}(0.1302) = 7.48^\circ$$

(b) $\beta = 180^\circ - (10^\circ + 7.48^\circ) = 162.52^\circ$

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$$\frac{\sin\theta}{F_{BC}} = \frac{\sin\beta}{R}$$

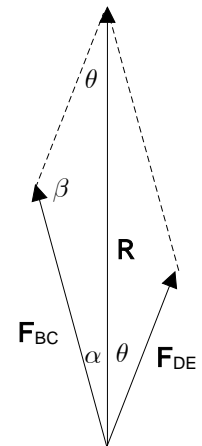
$$R = F_{BC} \frac{\sin\beta}{\sin\theta} = (80 \text{ N}) \frac{\sin 162.52^\circ}{\sin 10^\circ} = 138.4 \text{ N}$$

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$$R^2 = F_{BC}^2 + F_{DE}^2 - 2 F_{BC} F_{DE} \cos\beta$$

$$= (80 \text{ N})^2 + (60 \text{ N})^2 - 2 (80 \text{ N}) (60 \text{ N}) \cos 162.52^\circ = 19156.7 \text{ N}^2$$

$$R = \sqrt{19156.7 \text{ N}^2} = 138.4 \text{ N}$$



2.15 $P = 15 \text{ N}, \quad Q = 25 \text{ N}$

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

$$R^2 = P^2 + Q^2 - 2 P Q \cos\gamma$$

$$= (15 \text{ N})^2 + (25 \text{ N})^2 - 2 (15 \text{ N}) (25 \text{ N}) \cos 135^\circ = 1380.3 \text{ N}^2$$

$$R = \sqrt{1380.3 \text{ N}^2} = 37.2 \text{ N}$$

$$\frac{\sin\alpha}{Q} = \frac{\sin\gamma}{R}$$

$$\sin\alpha = \frac{Q}{R} \sin\gamma = \frac{25 \text{ N}}{37.2 \text{ N}} \sin 135^\circ = 0.475$$

$$\alpha = \sin^{-1}(0.475) = 28.4^\circ$$

$$\theta = 180^\circ - [(90^\circ - 15^\circ) + 28.4^\circ] = 76.6^\circ$$

$$R = 37.2 \text{ N} \quad \text{---} 76.6^\circ$$

