Sample Problem 2.1

SOLUTION:

• Graphical solution - construct a parallelogram with sides in the same direction as \( \mathbf{P} \) and \( \mathbf{Q} \) and lengths in proportion. Graphically evaluate the resultant which is equivalent in direction and proportional in magnitude to the diagonal.

• Trigonometric solution - use the triangle rule for vector addition in conjunction with the law of cosines and law of sines to find the resultant.

The two forces act on a bolt at \( A \). Determine their resultant.

Vector Mechanics for Engineers: Statics

Sample Problem 2.1

• Graphical solution - A parallelogram with sides equal to \( \mathbf{P} \) and \( \mathbf{Q} \) is drawn to scale. The magnitude and direction of the resultant or of the diagonal to the parallelogram are measured,

\[ R = 98 \text{ N} \quad \alpha = 35^\circ \]

• Graphical solution - A triangle is drawn with \( \mathbf{P} \) and \( \mathbf{Q} \) head-to-tail and to scale. The magnitude and direction of the resultant or of the third side of the triangle are measured,

\[ R = 98 \text{ N} \quad \alpha = 35^\circ \]

• Trigonometric solution - Apply the triangle rule. From the Law of Cosines,

\[
R^2 = P^2 + Q^2 - 2PQ \cos B \\
= (40\text{N})^2 + (60\text{N})^2 - 2(40\text{N})(60\text{N})\cos 155^\circ \\
\Rightarrow R = 97.73\text{N}
\]

From the Law of Sines,

\[
\frac{\sin A}{\sin B} = \frac{\sin \alpha}{R} \\
\sin A = \sin B \cdot \frac{60\text{N}}{97.73\text{N}} \\
A = 15.04^\circ \\
\alpha = 20^\circ + A \\
\alpha = 35.04^\circ
\]