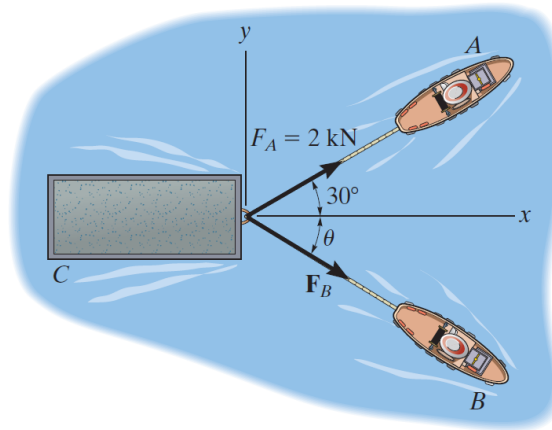


Problem 2-30

If $F_B = 3 \text{ kN}$ and $\theta = 45^\circ$, determine the magnitude of the resultant force of the two tugboats and its direction measured clockwise from the positive x axis.

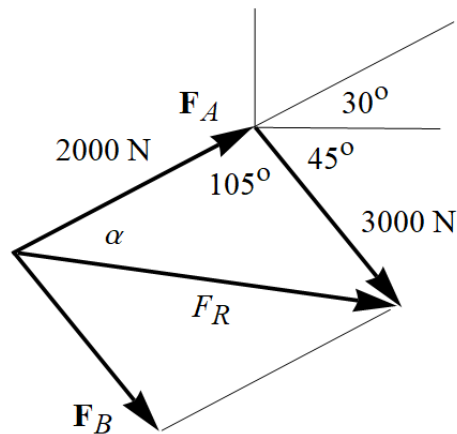


Probs. 2–29/30/31

[TYPO: This should be “from.”]

Solution

Draw the triangle that F_A and F_B and their resultant make.



Use the law of cosines to determine the magnitude of F_R .

$$F_R^2 = 2000^2 + 3000^2 - 2(2000)(3000) \cos 105^\circ$$

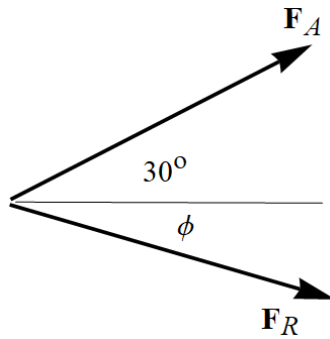
$$F_R = \sqrt{2000^2 + 3000^2 - 2(2000)(3000) \cos 105^\circ} \text{ N}$$

$$\approx 4.01 \times 10^3 \text{ N}$$

Use the law of sines to determine α , the angle between F_A and the resultant.

$$\frac{F_R}{\sin 105^\circ} = \frac{3000 \text{ N}}{\sin \alpha} \rightarrow \sin \alpha = \frac{3000 \text{ N}}{F_R} \sin 105^\circ \rightarrow \alpha \approx 46.2^\circ$$

The vector \mathbf{F}_A is shown below with the resultant.



The clockwise angle of the resultant vector from the positive x -axis is ϕ .

$$30^\circ + \phi = \alpha \quad \rightarrow \quad \phi = \alpha - 30^\circ \approx 16.2^\circ$$