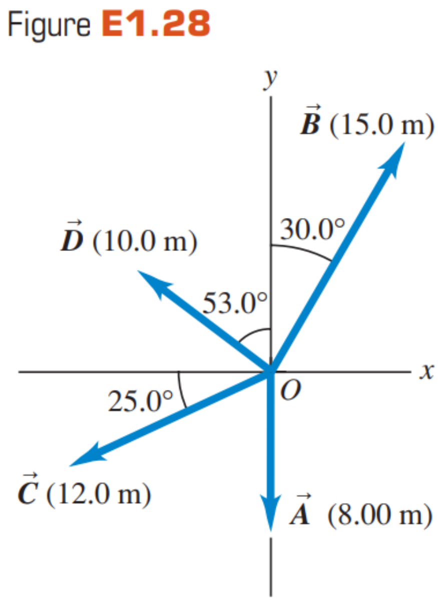
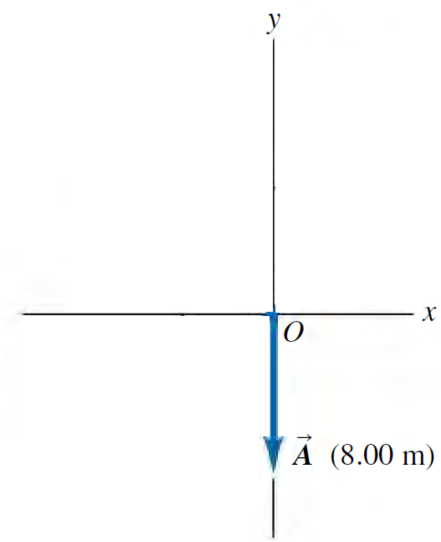
Exercise 1.31

Compute the x- and y-components of the vectors $\vec{A}$, $\vec{B}$, $\vec{C}$, and $\vec{D}$ in Fig. E1.28.

Solution



Vector $\vec{A}$

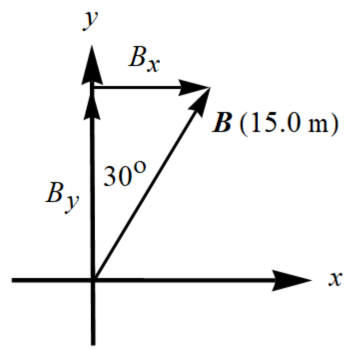


This vector lies entirely on the y-axis, so there is no x-component: $A_x = 0$. Since it points in the negative y-direction, $A_y = -8$.

$$\vec{A} = \langle A_x, A_y \rangle = \langle 0, -8 \rangle \text{ m}$$

Vector $\overrightarrow{B}$

Decompose the vector $\overrightarrow{\boldsymbol{B}}$ into components along the x- and y-axes.



Use trigonometry to determine B_x and B_y.

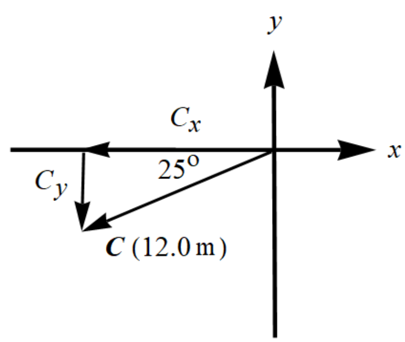
$$\sin 30^\circ = \frac{B_x}{15} \quad \rightarrow \quad B_x = 15 \sin 30^\circ = \frac{15}{2}$$
$$\cos 30^\circ = \frac{B_y}{15} \quad \rightarrow \quad B_y = 15 \cos 30^\circ = \frac{15\sqrt{3}}{2}$$

Since the components of $\overrightarrow{\boldsymbol{B}}$ point in the positive x- and y-directions, no minus signs are needed.

$$\overrightarrow{\boldsymbol{B}} = \langle B_x, B_y \rangle = \left\langle \frac{15}{2}, \frac{15\sqrt{3}}{2} \right\rangle \text{ m} \approx \langle 7.5, 13 \rangle \text{ m}$$

Vector $\overrightarrow{C}$

Decompose the vector $\overrightarrow{\boldsymbol{C}}$ into components along the x- and y-axes.



Use trigonometry to determine C_x and C_y.

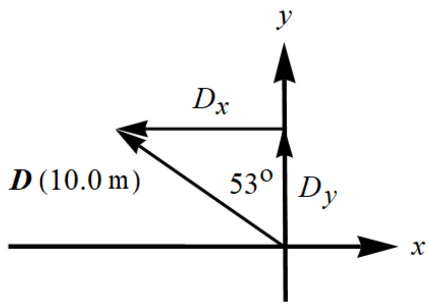
$$\cos 25^\circ = \frac{C_x}{12} \quad \rightarrow \quad C_x = 12 \cos 25^\circ \approx 10.9$$
$$\sin 25^\circ = \frac{C_y}{12} \quad \rightarrow \quad C_y = 12 \sin 25^\circ \approx 5.07$$

Since both components of $\overrightarrow{\boldsymbol{C}}$ point in the negative x- and y-directions, minus signs are needed in both.

$$\overrightarrow{\boldsymbol{C}} = \langle -C_x, -C_y \rangle = \langle -12 \cos 25^\circ, -12 \sin 25^\circ \rangle \text{ m}$$

Vector $\vec{D}$

Decompose the vector $\vec{D}$ into components along the x- and y-axes.



Use trigonometry to determine D_x and D_y.

$$\sin 53^\circ = \frac{D_x}{10} \quad \rightarrow \quad D_x = 10 \sin 53^\circ \approx 7.99$$
$$\cos 53^\circ = \frac{D_y}{10} \quad \rightarrow \quad D_y = 10 \cos 53^\circ \approx 6.02$$

Since the x-component of $\vec{D}$ points in the negative x-direction, a minus sign is needed here.

$$\vec{D} = \langle -D_x, D_y \rangle = \langle -10 \sin 53^\circ, 10 \cos 53^\circ \rangle \text{ m}$$