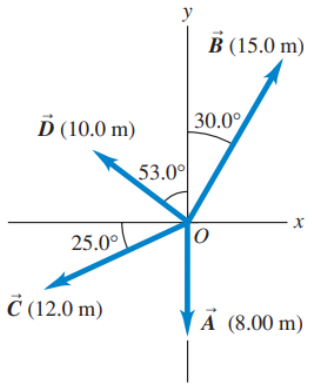
Exercise 1.28

For the vectors $\vec{A}$ and $\vec{B}$ in Fig. E1.28, use a scale drawing to find the magnitude and direction of (a) the vector sum $\vec{A} + \vec{B}$ and (b) the vector difference $\vec{A} - \vec{B}$. Use your answers to find the magnitude and direction of (c) $-\vec{A} - \vec{B}$ and (d) $\vec{B} - \vec{A}$. (See also Exercise 1.35 for a different approach to this problem.)

Figure **E1.28**

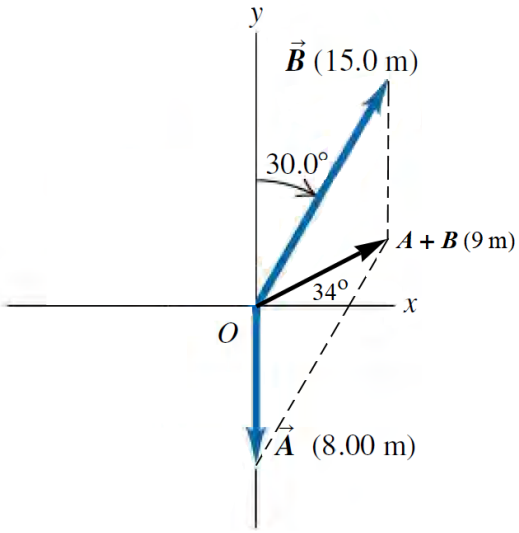


Solution

Use a ruler and protractor to measure the desired distances and angles, respectively.

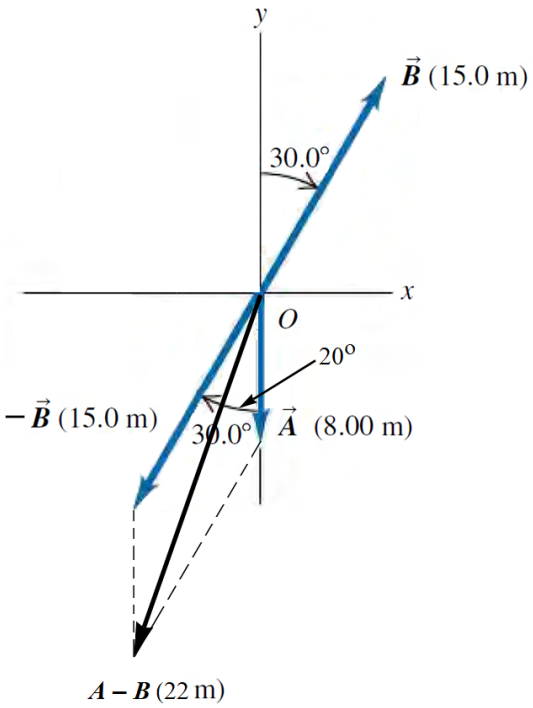
Part (a)

Draw the parallelogram formed by $\vec{A}$ and $\vec{B}$. Their sum is the vector from the origin to the opposite corner of the parallelogram.



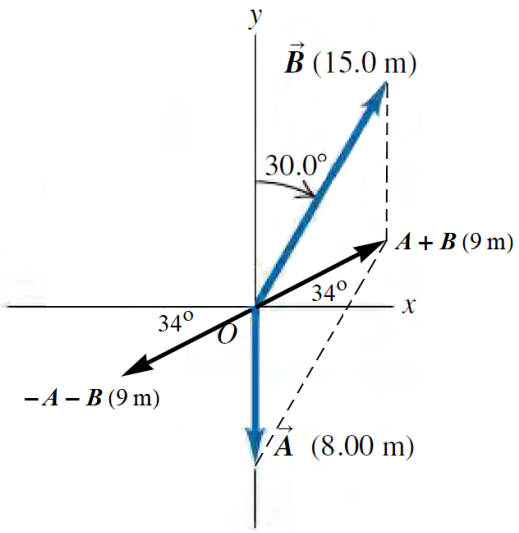
Part (b)

The vector $-\vec{B}$ has the same magnitude and direction as $\vec{B}$ but points in the opposite sense. Draw the parallelogram formed by $\vec{A}$ and $-\vec{B}$ and the vector from the origin to the opposite corner of the parallelogram. This is the sum $\vec{A} - \vec{B}$.



Part (c)

$-\vec{A} - \vec{B} = -(\vec{A} + \vec{B})$ has the same magnitude and direction as $\vec{A} + \vec{B}$ but opposite sense.



Part (d)

$\vec{B} - \vec{A} = -(\vec{A} - \vec{B})$ has the same magnitude and direction as $\vec{A} - \vec{B}$ but opposite sense.