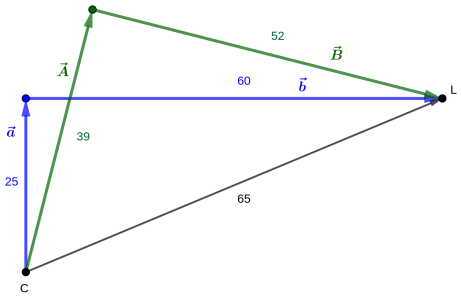
1. In the small town of Coriander, the library can be found by starting at the center of the town square, walking 25 meters north ($\vec{a}$), turning 90° to the right, and walking a further 60 meters ($\vec{b}$).
   - Draw a figure showing the displacement vectors $\vec{a}$ and $\vec{b}$, as well as their sum, the displacement vector $\vec{v} = \vec{a} + \vec{b}$.
   - How far is the library from the center of the town square?
   - Let $\hat{x}$ be the unit vector pointing east, and $\hat{y}$ be the unit vector pointing north. Express $\vec{a}$, $\vec{b}$, and $\vec{v}$ in terms of $\hat{x}$ and $\hat{y}$.
2. It turns out that magnetic north in Coriander is approximately 14° degrees east of true north. If you use a compass to find the library (!), the above directions will fail. Instead, you must walk 39 meters in the direction of magnetic north ($\vec{A}$), turn 90° to the right, and walk a further 52 meters ($\vec{B}$).
   - Draw a figure showing the displacement vectors $\vec{A}$ and $\vec{B}$, as well as their sum, the displacement vector $\vec{v} = \vec{A} + \vec{B}$.
   - How far is the library from the center of the town square?
   - Let $\hat{X}$ be the unit vector pointing towards "magnetic east", and $\hat{Y}$ be the unit vector pointing towards magnetic north. Express $\vec{A}$, $\vec{B}$, and $\vec{v}$ in terms of $\hat{X}$ and $\hat{Y}$.
3. Can any vector displacement within the town limits be expressed as the sum of two vectors, one of which points north and the other east?
4. **FOOD FOR THOUGHT:** Where on Earth is Coriander?!

Solution



The vectors $\vec{a}$, $\vec{b}$, $\vec{A}$, and $\vec{B}$ are shown in the figure, along with their magnitudes (in meters). The vector $\vec{v} = \vec{a} + \vec{b} = \vec{A} + \vec{B}$, is shown at the bottom, along with its magnitude, which is 65 meters.