

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  $90^\circ$  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  $\hat{\mathbf{x}}$  be the unit vector pointing east, and  $\hat{\mathbf{y}}$  be the unit vector pointing north. Express  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{v}$  in terms of  $\hat{\mathbf{x}}$  and  $\hat{\mathbf{y}}$ .
2. It turns out that magnetic north in Coriander is approximately  $14^\circ$  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  $90^\circ$  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  $\hat{\mathbf{X}}$  be the unit vector pointing towards “magnetic east”, and  $\hat{\mathbf{Y}}$  be the unit vector pointing towards magnetic north. Express  $\vec{A}$ ,  $\vec{B}$ , and  $\vec{v}$  in terms of  $\hat{\mathbf{X}}$  and  $\hat{\mathbf{Y}}$ .
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?!