Recorder: _____

Task Master: _____   **Cynic:** _____   **Other:** _____

WHICH WAY IS NORTH?

Working in small groups (3 or 4 people), solve as many of the problems below as possible. Try to resolve questions within the group before asking for help. The Recorder is responsible for writing up the group's results and turning it in. Show your work! Full credit will only be given if your answer is supported by calculations and/or explanations as appropriate.

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 ($\vec{b}$).

(a) Draw a figure showing the displacement vectors $\vec{a}$ and $\vec{b}$, as well as their sum, the displacement vector $\vec{v} = \vec{a} + \vec{b}$.

(b) How far is the library from the center of the town square?

(c) Let $\hat{\imath}$ be the unit vector pointing east, and $\hat{\jmath}$ be the unit vector pointing north. Express $\vec{a}$, $\vec{b}$, and $\vec{v}$ in terms of $\hat{\imath}$ and $\hat{\jmath}$.

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 ($\vec{B}$).

(a) Draw a figure showing the displacement vectors $\vec{A}$ and $\vec{B}$, as well as their sum, the displacement vector $\vec{v} = \vec{A} + \vec{B}$.

(b) How far is the library from the center of the town square?

(c) Let $\hat{I}$ be the unit vector pointing towards "magnetic east", and $\hat{J}$ be the unit vector pointing towards magnetic north. Express $\vec{A}$, $\vec{B}$, and $\vec{v}$ in terms of $\hat{I}$ and $\hat{J}$.

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?!