Recorder: _____

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

THE HILL

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.

Suppose you are standing on a hill. You have a topographic map, which uses rectangular coordinates (x, y) measured in miles. Your global positioning system says your present location is at one of the following points (pick one):

A: $(1, 4)$ **B:** $(4, -9)$ **C:** $(-4, 9)$ **D:** $(1, -4)$ **E:** $(2, 0)$ **F:** $(0, 3)$

Your guidebook tells you that the height h of the hill in feet above sea level is given by

$$h = 5000 - ax^2 - by^2$$

where $a = 30\,\frac{\text{ft}}{\text{mi}^2}$, and $b = 10\,\frac{\text{ft}}{\text{mi}^2}$.

1. Draw a topographic map of the hill.
   Your map should have at least 3 level curves; label each with its height.
   Label your location on the map. What is your height?

2. Starting at your present location, in what compass direction (2-d unit vector) do you need to go in order to climb the hill as steeply as possible?
   Draw this vector on your topographic map.

3. How steep is the hill if you start at your present location and go in this compass direction?
   Draw a picture which shows the slope of the hill at your present location.

4. In what direction in space (3-d vector) would you actually be moving if you started at your present location and walked in the compass direction you found in the previous problem?
   To simplify the computation, your answer does ***not*** *need to be a unit vector.*