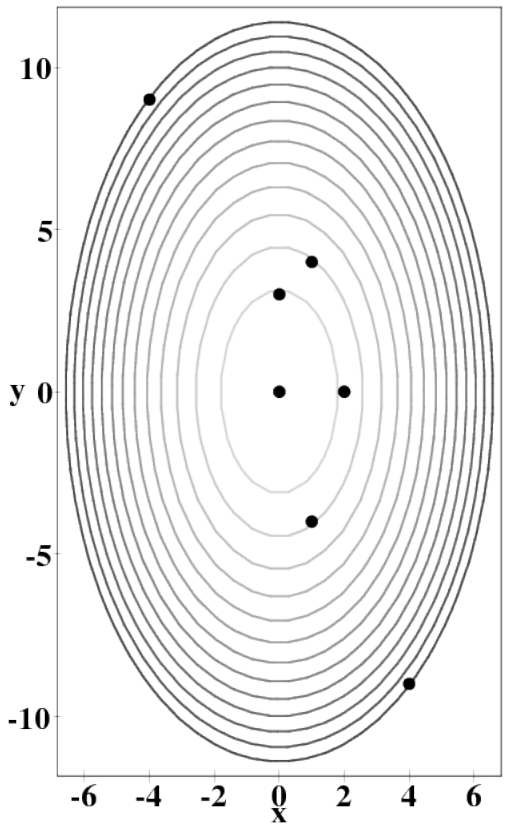
Suppose you are standing on a hill. You have a topographic map, which uses rectangular coordinates (x, y) measured in miles. Your global positioning system says your present location is at one of the following points (pick one):



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

$$h = a - bx^2 - cy^2$$

where $a = 5000\text{ft}$, $b = 30\,\frac{\text{ft}}{\text{mi}^2}$, and $c = 10\,\frac{\text{ft}}{\text{mi}^2}$.

- Starting at your present location, in what map 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.

- 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.

- In what direction in space (3-d vector) would you actually be moving if you started at your present location and walked in the map direction you found above?

  To simplify the computation, your answer does ***not*** *need to be a unit vector.*