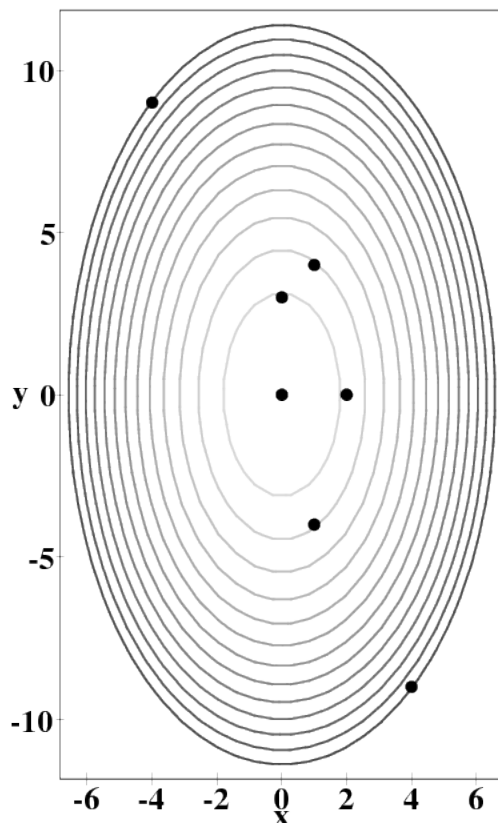


Suppose you are standing on a hill. You have a topographic map, which uses rectangular coordinates  $(x, y)$  measured in miles. Your global positioning system says your present location is at one of the following points (pick one):



**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.*