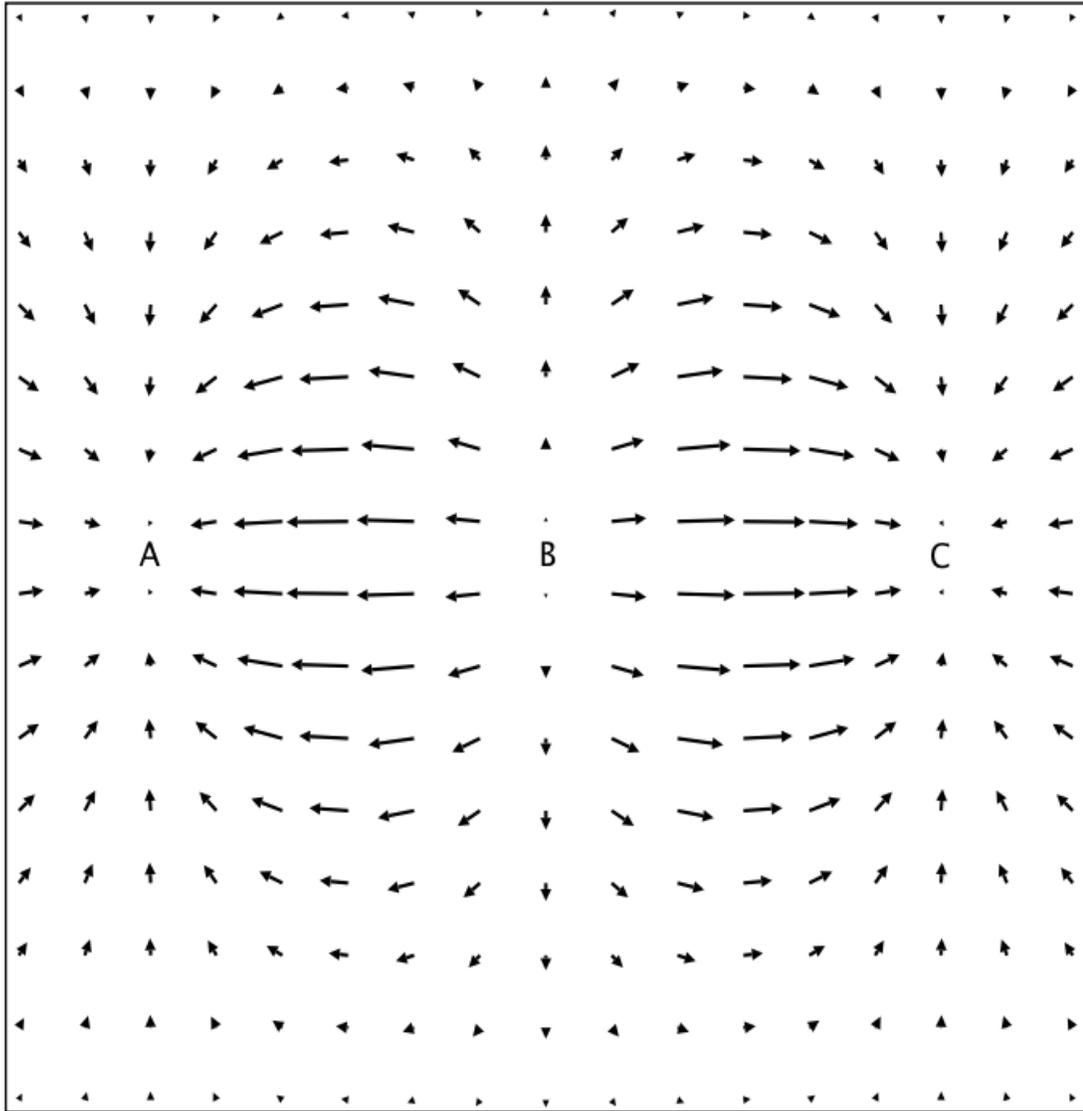1. The picture below shows the plot of the gradient of a function at various sample points. For each of the labelled points A, B, C, determine if the function attains a local maximum, local minimum, or neither at that location.
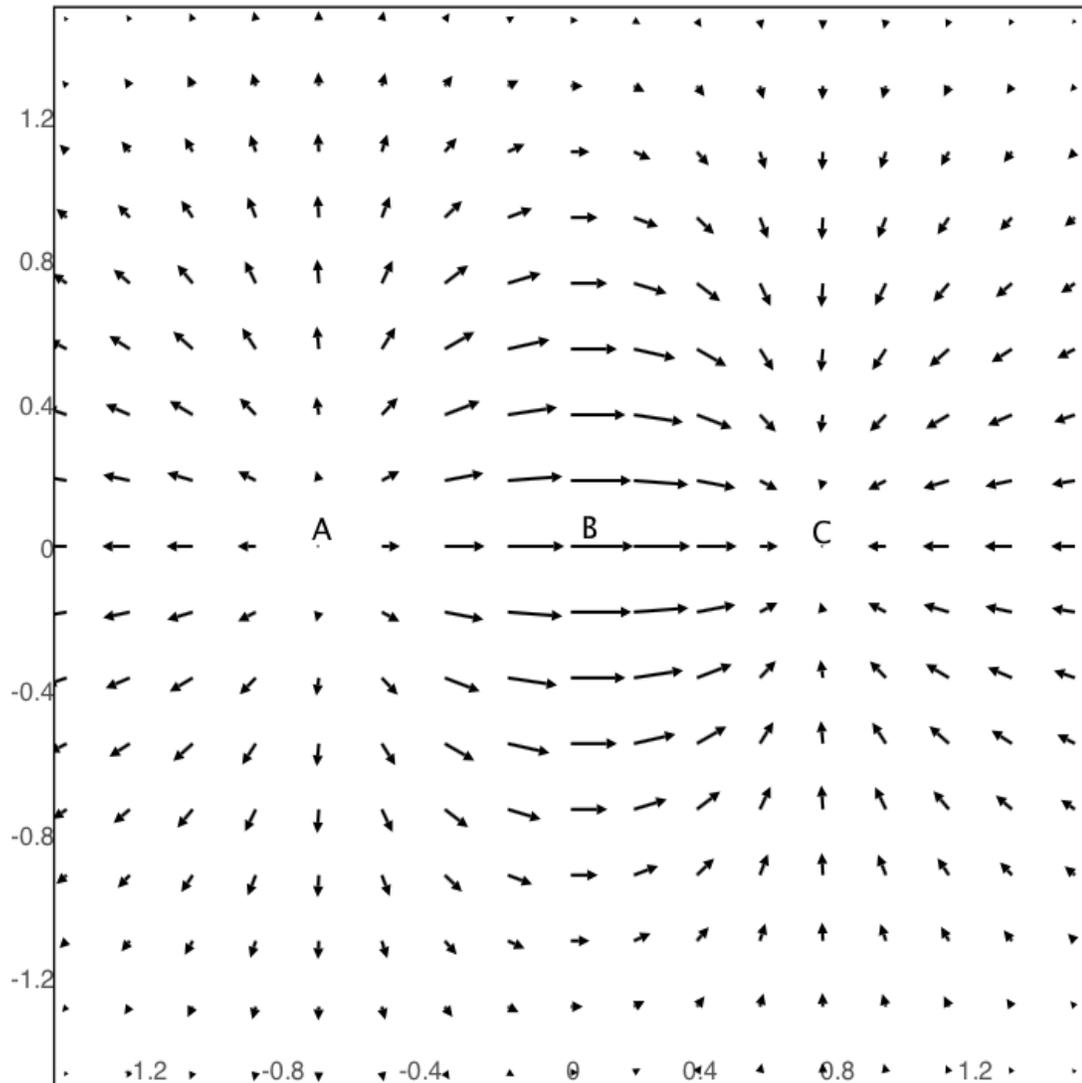
2. The picture below shows the plot of the gradient of a function at various sample points. For each of the labelled points A, B, C, determine if the function attains a local maximum, local minimum, or neither at that location.

3. The temperature at any point (x, y) in the xy-plane is given by $f(x, y)$. The picture below shows the plot of the gradient of $f(x, y)$ at various sample points.

(a) A crazy fire ant starts moving at the point $(-1/2, 2)$ and always moves in the direction of greatest increase in temperature, until it reaches the highest temperature possible. Make an approximate sketch of the path of the ant, and label where the ant stops.
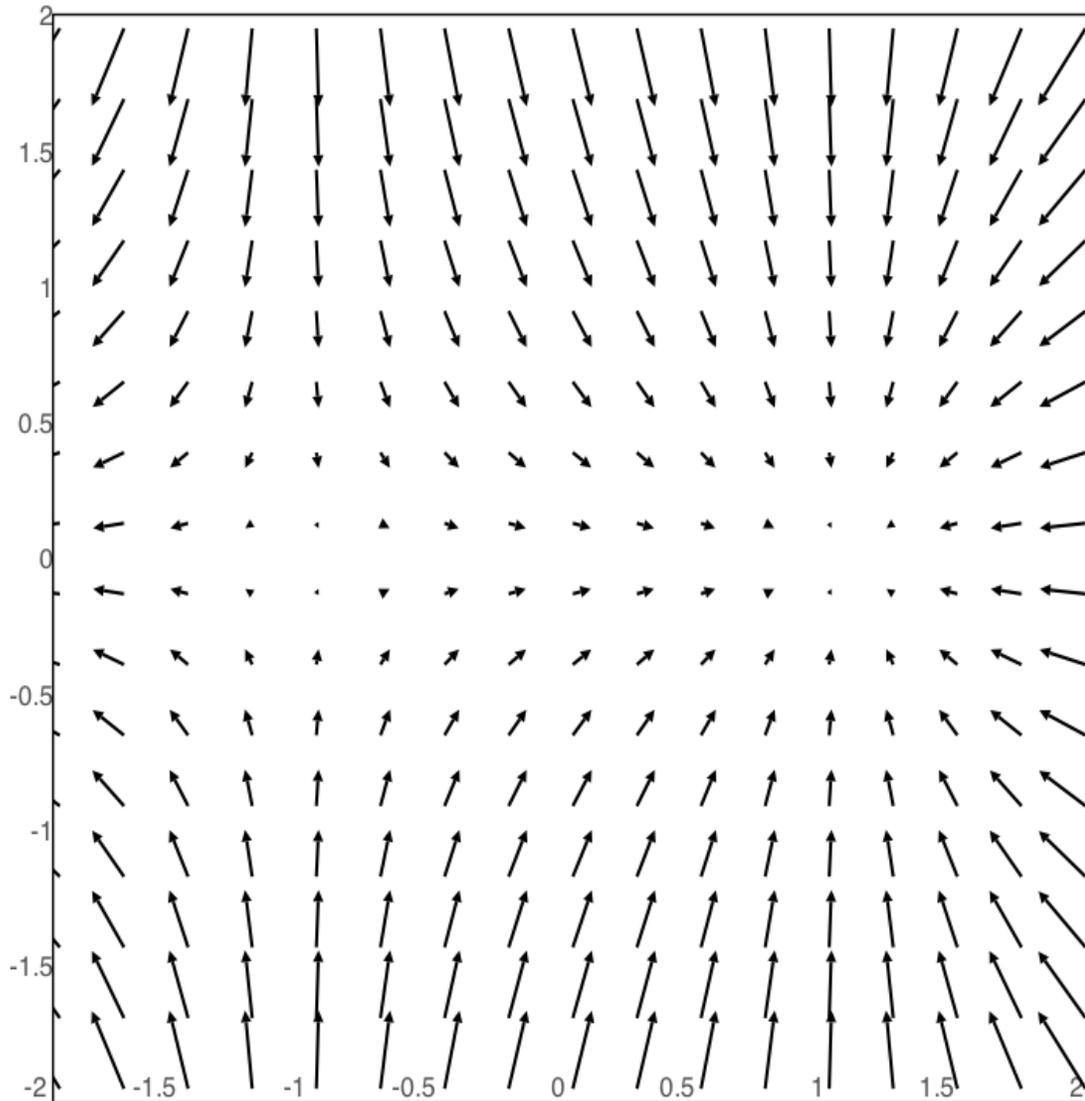
(b) What would the path look like if the crazy ant started at the point $(2, -2)$ instead?

Set up integrals for the volumes of the given solids. (But don't evaluate them.)

1. The solid between $z = 5 - x^2 - y^2$ and $z = 4x^2 + 4y^2$

2. The solid between $z = x^2 + y^2 + 1$ and $z = x^2 + y^2 + 3$, inside $x^2 + y^2 = 4$

3. The solid between $z = x^2 + y^2$ and $z = 4y$.

4. The solid that lies below $z = 9 - x^2 - y^2$, above the xy-plane, and *inside* $x^2 + y^2 = 1$

5. The solid that lies below $z = 9 - x^2 - y^2$, above the xy-plane, and *outside* $x^2 + y^2 = 1$

6. The solid between $x^2 + (y - 1)^2 = 1$ and $x^2 + (y - 2)^2 = 4$, below $z = x^2 + y^2 + 3$, and above the xy-plane

7. The solid between $z = 6 - x^2 - y^2$ and $z = \sqrt{x^2 + y^2}$

8. The solid bounded by $x^2 + y^2 + z^2 = 4$, $x^2 + y^2 = 2$, and $x^2 + y^2 = 3$

9. The smaller solid between $x^2 + y^2 + z^2 = 2$ and $z = x^2 + y^2$