MITx 18.02.1x
Multivariable Calculus 1: Vectors and Derivatives

Help   sandipan_dey ⌄

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🏠 Course / Unit 3: Optimization / Recitation 8: Critical point practice

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3. Critical points and gradients

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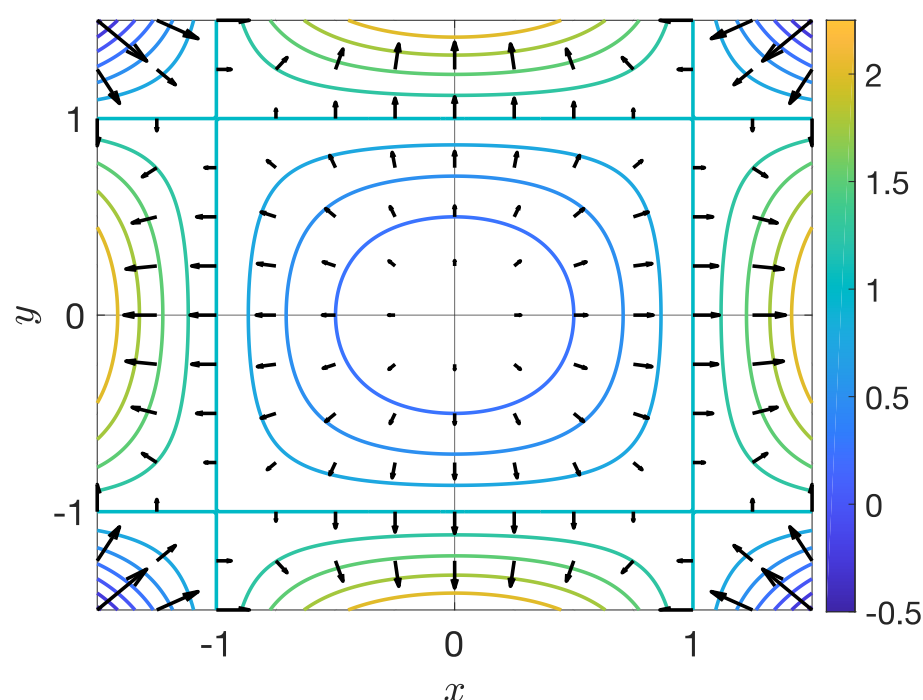Recitation due Sep 13, 2021 20:30 IST   Completed

Practice

Identify the type of critical points 1

3/3 points (graded)
Below is the level curves and gradient (scaled to fit into the picture) of the function

$$f(x, y) = x^2 + y^2 - x^2 y^2, \qquad\qquad (4.50)$$

which you found the critical points of on the previous page.

Identify the number of critical points of each type: local maximum, local minimum, and saddle points.

Number of local maxima: `0`   ✔ **Answer:** 0

Number of local minima: `1`   ✔ **Answer:** 1

Number of saddle points: `4`   ✔ **Answer:** 4

Solution:

The places where the gradient points towards the critical point in all directions indicate local maxima. We see no local maxima.

The places where the gradient points away from a critical point in all directions indicate local minima. We see one local minimum at the origin. .

The places where the gradient points away in some directions and towards in others are saddle points. We see four saddle points at the corners of the square about the origin with corners at the point $(1, 1)$, $(1, -1)$, $(-1, 1)$, and $(-1, -1)$.

Submit   You have used 2 of 3 attempts

ℹ   Answers are displayed within the problem

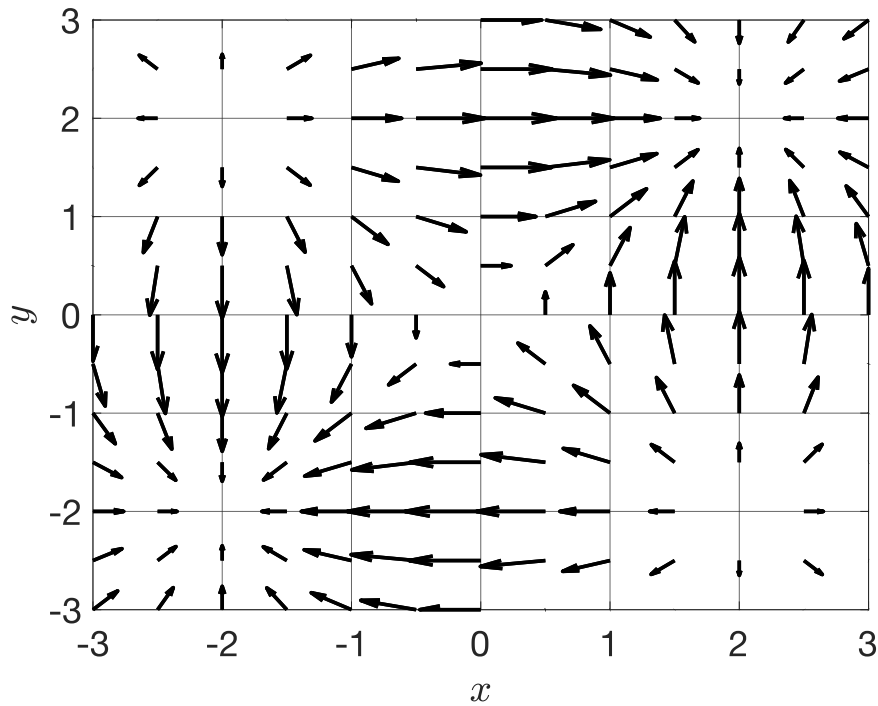## Identify the type of critical points 2

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3/3 points (graded)
Below is gradient (scaled to fit into the picture) of the function

$$f(x, y) = -xye^{(-x^2-y^2)/8},$$ (4.51)

which you found the critical points of on the previous page.

Identify the number of critical points of each type: local maximum, local minimum, and saddle points.

Number of local maxima: | 2 | ✔ **Answer:** 2

Number of local minima: | 2 | ✔ **Answer:** 2

Number of saddle points: | 1 | ✔ **Answer:** 1

Solution:

The places where the gradient points towards the critical point in all directions indicate local maxima. We see two local maxima in the lower left and upper right corners.

The places where the gradient points away from a critical point in all directions indicate local minima. We see two local minima in the upper left and lower right corners.
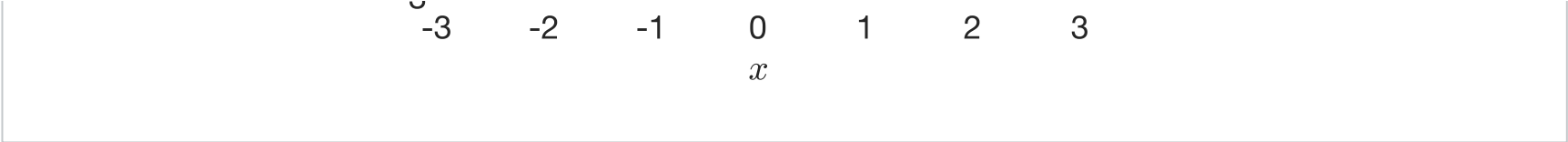
The places where the gradient points away in some directions and towards in others is a saddle point. We see one saddle point at the origin.

The level curves are drawn on top of the gradient to help illuminate the local behavior of the function near each critical point.

$$-3 \qquad -2 \qquad -1 \qquad 0 \qquad 1 \qquad 2 \qquad 3$$

$$x$$
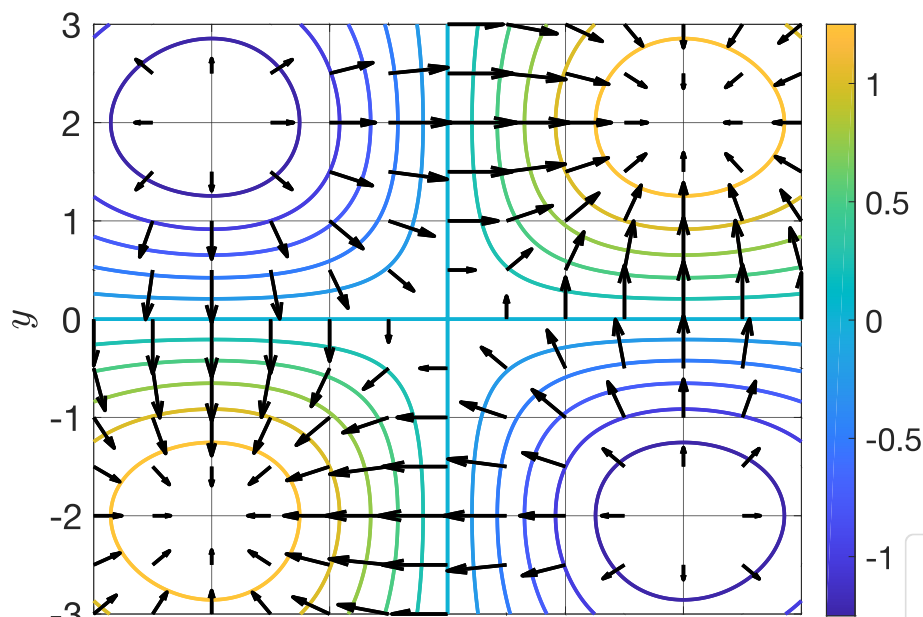
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