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2. Local max and min warm up

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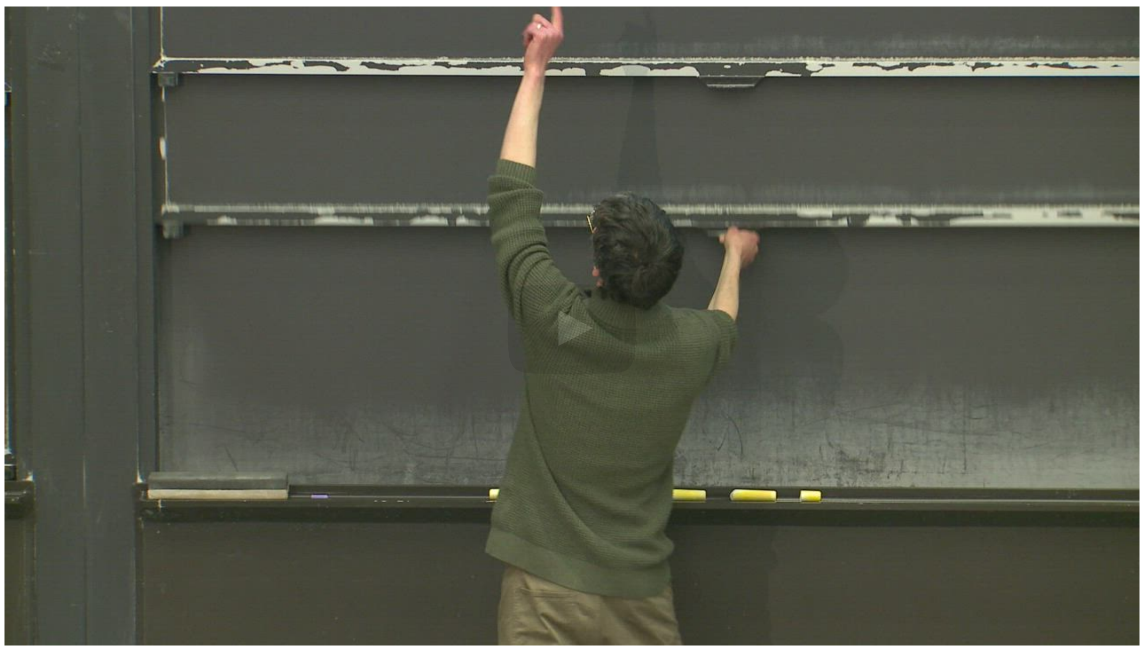
Lecture due Sep 13, 2021 20:30 IST Completed

Review

Use what you know about the gradient field and its connection to the behavior of the function to answer the following questions.

Warm up problem



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PROFESSOR: So in this picture, there's

that curve that you can see.

It looks-- I don't know-- a little bit like a peanut,

like a packing peanut.

And R is the region inside the curve.

And what I want you to figure out by looking at this picture

is, where is the maximum of the

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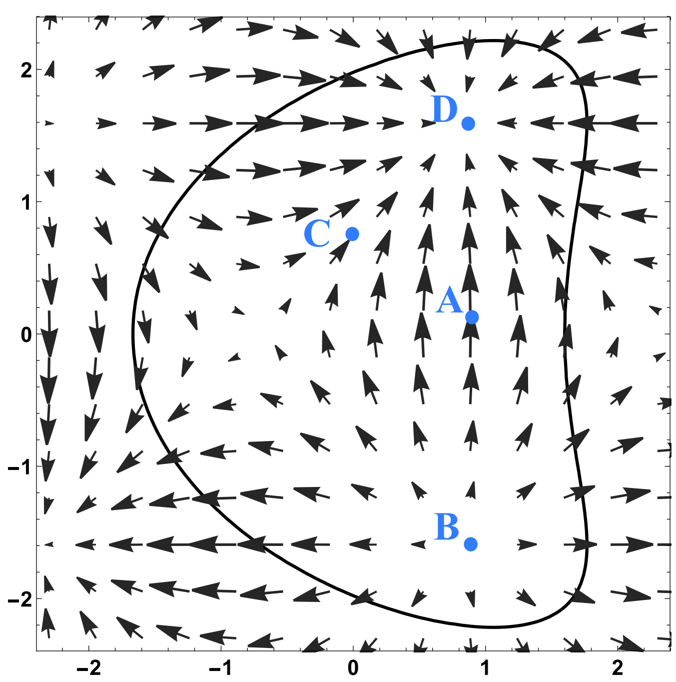
Gradient connection to local maximum

1/1 point (graded)

Consider the gradient field for the function $f(x, y)$. In this problem, we will only consider the region bounded by the curve shown. Consider the function behavior at the points labeled A, B, C, and D.



At which of the labeled points does the function attain its local maximum over the reg

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- A
- B
- C
- D

Solution:

Think of the function as hills and valleys. If we start at D and move in any direction, we will be moving against the gradient and therefore downhill. The top of a hill will be flat, which means $|\nabla f| = 0$. Notice that in the figure, the lengths of the vectors (and therefore the slope of f) get smaller and smaller as we go up the hill towards D.

We can check the behavior at the other points:

- Start at point A. Moving upward would lead to moving in the same direction as the gradient, and therefore, the function increases in that direction.
- Start at point B. Moving in any direction would lead to moving in the same direction as the gradient, and therefore, the function increases in every direction.
- Start at point C. Moving upward to the right would lead to moving in the same direction as the gradient, and therefore, the function increases in that directions.

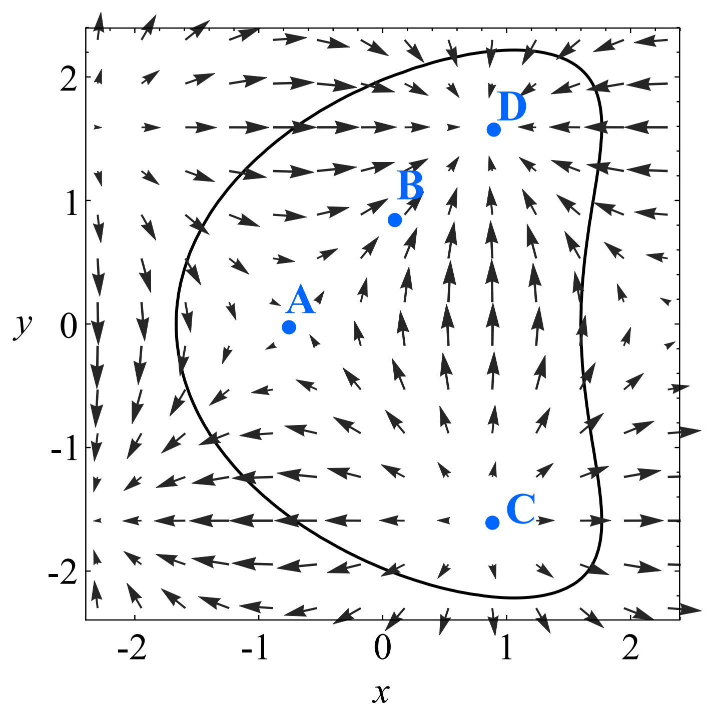
Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Gradient connection to local minimum

1/1 point (graded)

Consider the gradient field for the same function $f(x, y)$ as above. In this problem, we will only consider the region bounded by the curve shown. Consider the function behavior at the points labeled A, B, C, and D.



At which of the labelled points does the function attain its local minimum over the region bounded by the curve?

- A
- B

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- ( ) B
- (•) C
- ( ) D

✔

Solution:

If we start at C and move in any direction, we will be moving with the gradient and therefore uphill. The bottom of a hill will be flat, which means $|\nabla f| = 0$. Notice that in the figure, the lengths of the vectors (and therefore the slope of f) get smaller and smaller as we go down the hill towards C.

We can check the behavior at the other points:

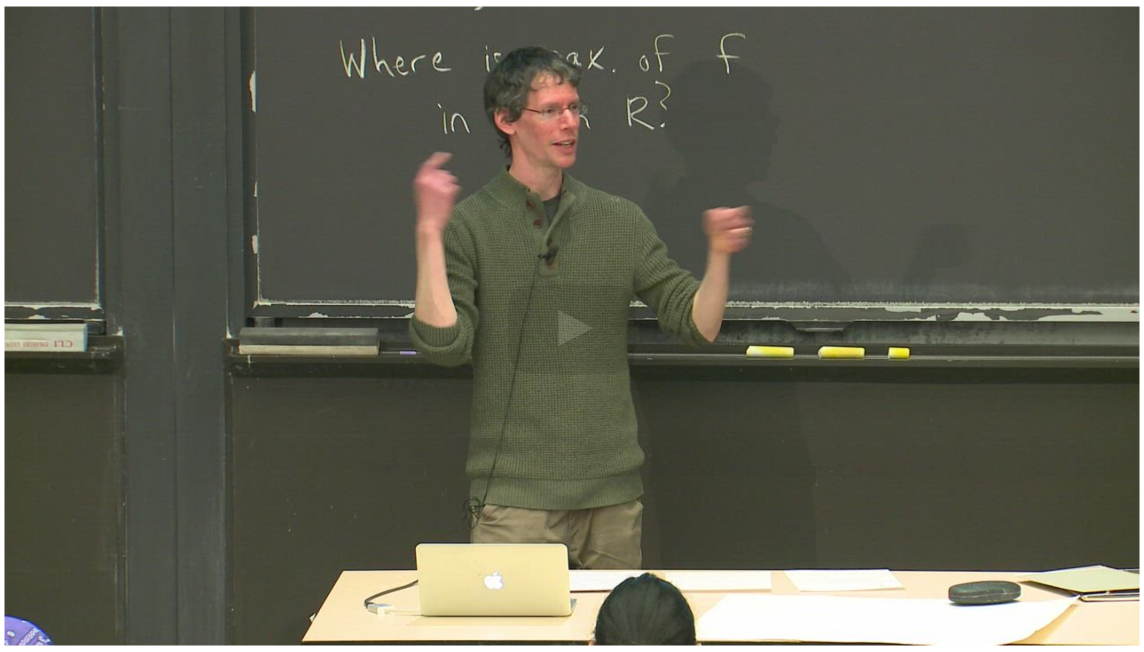
- Start at point A. Moving upward to the right or downward to the left would lead to moving in the same direction as the gradient, and therefore, the function increases in those directions.
- Start at point B. Moving upward to the right would lead to moving in the same direction as the gradient, and therefore, the function increases in that directions.
- Start at point D. Moving in any direction would lead to moving against the direction as the gradient, and therefore, the function decreases in every direction.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Solution

Start of transcript. Skip to the end.



0:00 / 0:00 2.0x

PROFESSOR: So you have just, I think, spent some time

visualizing what the graph of this function must look like.

I'm going to show you now what it really looks like.

This is the graph here.

And let's see.

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[Staff]Gradient connection to local minimum
Since we are talking about minimum, I think the answer of the question should talk about the function decreases in some directions ... 1

[Staff] Duplicate Text 2

[STAFF] Gradient connection to local maximum solution "off"
While the choice of local maximum is correct, the description of behavior at the other points does not match the given illustration an... 2

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