Re: directional derivative,−−

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- *From*: David C. Ullrich <ullrich@xxxxxxxxxxxxxxxx>
- *Date*: Wed, 25 Apr 2007 05:10:16 −0500

On Tue, 24 Apr 2007 14:53:06 +0100, JEMebius <jemebius@xxxxxxxxx>
wrote:

> David C. Ullrich wrote:
>
>> On Tue, 24 Apr 2007 01:43:40 +0100, JEMebius <jemebius@xxxxxxxxx>
>> wrote:
>>
>>> What about the well−known rectangular circular half−cone,
>>> the graph of (x, y) −> z = sqrt(x^2 + y^2)?
>>
>> That has no directional derivative in _any_ (non−zero) direction
>> (at the origin, which is presumably the point you're talking about.)
>>
>> At least not according to what I've always thought was the
>> standard definition, as at
>>
>> http://en.wikipedia.org/wiki/Directional_derivative
>
> That is absolutely correct, if it is indeed standard to consider only entire lines through the point in question. Is it standard in university and college math curricula? − I don't know.

I believe it is. Regardless, another, more important, question is
whether this is the definition being used in whatever course or
book the original question came from. Given that the question is
obviously wrong with the other definition I have a conjecture
about that...

When defining mathematical concepts I want to stay as closely as possible to everyday physical reality. So I identified "direction" with "half−line" rather than with "line".

But what _you_ _want_ has little to do with what a definition _is_.

In my opinion it is partly a matter of convention, partly a matter of to what degree one wants to change the common meaning of an everyday word into a precise mathematical meaning, and partly a matter of convenience whether one considers half−lines or entire lines through the point in question.

Johan E. Mebius

At first sight the problem seems underspecified?
incompletely posed? badly posed?
provocative, i.e. aimed at putting in motion the reader's creativity?

Or did the author mean to ask:
"Prove that no real−valued function f ==that has a continuous derivative at a point C==
has a positive directional derivative at C for every possible direction u."

BTW, the paraboloid (x, y) −> z = x^2 + y^2 does not qualify because the slope at (0, 0)
is zero in every direction.
This example shows that zero local slope is not in contradiction to positive average slope.

Ciao: Johan E. Mebius

chrizm7@xxxxxxxxx wrote:

A problem asks me to show that no real−valued function f has a positive directional derivative at a fixed point c for every possible direction u.

But wouldn't a paraboloid work? Fix c corresponding to the vertex.
Then for any direction u, the slope will always be positive
(increasing).

To be clear, the exact problem is worded:

Prove that there is no real−
valued function f such that f'(c;u) > 0 for a
fixed point c in R^n and
every nonzero vector u in R^n.

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David C. Ullrich

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David C. Ullrich
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