Re: help with a basic differentiability and derivative function

Source: http://sci.tech−archive.net/Archive/sci.math.num−analysis/2005−12/msg00302.html

- *From*: "David L. Wilson" <dwilson314@xxxxxxxxxxxx>

- *Date*: Tue, 20 Dec 2005 21:57:23 −0500

"David Wilkinson" <david@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote in message
news:do92n6$p1r$1@xxxxxxxxxxxxxxxxxxxxxxx
> David L. Wilson wrote:
>> "David Wilkinson" <david@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote in message
>> news:do8f40pjb1@xxxxxxxxxxxxxxxxxxxxxx
>>
>>>disanalysis wrote:
>>>
>>>>very basic problem...can anyone help me with the proof?
>>>>
>>>>f(x) = x^2−3x+8 if x>1
>>>>f(x) = 2x^2+x+3 if x=<1
>>>>
>>>>using epsilon−delta property can you prove that f(x) is differentiable
>>>>at all points except x=1
>>>>and that it is not differentiable at 1?
>>>>
>>>>thanx
>>>>
>>>
>>>At x = 1 f(x) = 6 from both expressions.
>>>
>>>for x > 1, df(x)/dx = 2x−3 −> −1 as x −> 1 from the first expression, and
>>>
>>>For x <= 1, df(x)/dx = 4x+1 = 5 at x=1.
>>>
>>>So the first derivative of f(x) is discontinuous at just above x = 1.
>>>But, at x = 1 it is differentiable from the second expression which holds
>>>up to and including x = 1.
>>
>>
>> Wrong. The derivative does NOT exit at x=1 because the limit defininig
>> the derivative at that point does not exist as the limit defining the
>> derivative at x=1 from the left is not equal to the limit defining the
>> derivative at x=1 from the right. Or were you intentionally giving him a
>> wrong answer on this obvious homework problem.
>>

>> Graphically, there is a sharp turn at x=1, hence, the derivative does not
>> exist at the point (1, 6) although the function is continuous there.
> Right. Since the second expression holds up to x = 1 the derivative is
> defined by it at x = 1. The first expression only holds for x > 1 so the
> derivative is different for x > 1, not at x = 1.

NO NO NO
The derivative at a point is defined as a limit (the usual definition in a calculus text). That limit exists if and only if that limit from the right and that limit from the left are the same. In this case, that limit from the left is 5 and that limit from the right is −1 so the limit that defines the derivative at x=1 does not exist. However, one can say at x=1, the left derivative is 5 and the right derivative is −1.

The fact that one of his equations defines the function for x<=1 does not allow one to use it alone to define the derivative at x=1−−−−Your sentence "Since the second expression holds up to x = 1 the derivative is defined by it at x = 1." is terribly wrong.

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- ***Follow−Ups***:
  - ♦ ***Re: help with a basic differentiability and derivative function***
    - ◊ *From:* David L. Wilson

- ***References***:
  - ♦ ***help with a basic differentiability and derivative function***
    - ◊ *From:* disanalysis
  - ♦ ***Re: help with a basic differentiability and derivative function***
    - ◊ *From:* David Wilkinson
  - ♦ ***Re: help with a basic differentiability and derivative function***
    - ◊ *From:* David L. Wilson
  - ♦ ***Re: help with a basic differentiability and derivative function***
    - ◊ *From:* David Wilkinson

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