Re: question in spivak's calculus on manifolds

Source: http://sci.tech−archive.net/Archive/sci.math/2006−01/msg01785.html

- *From*: "Someonekicked" <someonekicked@xxxxxxxxxxx>

- *Date*: Sat, 14 Jan 2006 19:13:37 −0500

thx a lot for the replies

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Quotes from The Weather Man:
Robert Spritz: Do you know that the harder thing to do, and the right thing
to do, are usually the same thing? "Easy" doesn't enter into grown−up
life... to get anything of value, you have to sacrifice.
"Someonekicked" <someonekicked@xxxxxxxxxxx> wrote in message
news:lZqdnXxXJ8klpFTeRVn−ow@xxxxxxxxxxxxxx
> the notation is cumbersome, thats why if u have the book, maybe better to
> look up the question in the book.
>
> anyway, the question is page 33, 2−29 part c). For some reason, im stuck!
> I cant show why D_x f(a) = Df(a) (x).
>
>
> Let f : R^n −> R
> and let D_x f(a) = limit_(as t −> 0) [(f(a + tx) − f(a)) / t]
> (here x is column vector in R^n).
> the question is to show that if f is differentiable, then D_xf(a) =
> Df(a)(x)
> Df(a) is ,(a linear transformation), the derivative of f at a.
> The associated matrix with Df(a) would be f'(a).
>
>
> By definition, thats how to verify Df(a) (which also previously proven to
> be unique),
>
> lim_(as h −> 0) [| f(a+h) − f(a) − Df(a)(h) | / |h|] = 0
>
> Since here the range of f is in R, then norm in the numerator is not
> necessary, so
>
> lim_(as h −> 0) [(f(a+h) − f(a) − Df(a)(h)) / |h|] = 0
> that is,
> lim_(as h −> 0) [Df(a)(h) / |h|] = lim_(as h −> 0) [(f(a+h) − f(a)) /
> |h|]
>
> so its enough to show that,

> lim_(as h −> 0) [D_h f(a) / |h|] = lim_(as h −> 0) [(f(a+h) − f(a)) /
> |h|] (I)
>
> now,
> lim_(as h −> 0) [D_h f(a) / |h|]
> = lim_(as h −> 0) [limit_(as t −> 0) [(f(a + t h) − f(a)) / t] / |h|]
> = lim_(as h −> 0) [limit_(as t −> 0) [(f(a + t h) − f(a)) / (t
> |h|)]]
> now if we let vector K = t h, then we should be able to verify (I) ?
> t |h| is the denominator making it hard for me to do any substitution.
> any suggestions or hints?
>
> in part b), I proved that
> D_(s x) f(a) = s D_x f(a) (here s is constant in R).
> so I can write the expression above as
> lim_(as h −> 0) [limit_(as t −> 0) [(f(a + t h / |h|) − f(a)) / t]]
> but still not sure how to continue.
>
> btw, that question came on my mind, whats the derivative of f: R^n −> R^n
> defined as f(x) = x / |x|
> or more simply, derivative of g: R^n −> R where g(x) = |x|, at some a in
> R^n.
>
> thx in advance
>
>
> −−
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> life... to get anything of value, you have to sacrifice.
>

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- ***Follow−Ups***:
  - ♦ ***Re: question in spivak's calculus on manifolds***
    - ◊ *From:* smn

- ***References***:
  - ♦ ***question in spivak's calculus on manifolds***
    - ◊ *From:* Someonekicked

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