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4. Practice computing directional derivatives

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Lecture due Aug 18, 2021 20:30 IST Completed



Practice

Practice 1

1/1 point (graded)
Suppose f is a function such that $\nabla f(2, 3) = \langle -5, 20 \rangle$. Let $\hat{u} = \langle 3/5, 4/5 \rangle$. What is $D_{\hat{u}} f(2, 3)$?

$D_{\hat{u}} f(2, 3) =$ Answer: 13

Solution:

$$D_{\hat{u}} f(2, 3) = \langle -5, 20 \rangle \cdot \langle 3/5, 4/5 \rangle = -3 + 16 = 13$$

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Answers are displayed within the problem

Practice 2

1/1 point (graded)
Let $f(x, y) = y^2 + e^x$. Find the directional derivative of f at the point $(x, y) = (0, 1)$ in the direction of the unit vector $\hat{u} = \langle \frac{2}{\sqrt{5}}, \frac{1}{\sqrt{5}} \rangle$.

$D_{\hat{u}} f(0, 1) =$ Answer: 4/sqrt(5)

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Solution:

We have

$$\nabla f = \langle e^x, 2y \rangle$$

and so

$$\nabla f(0, 1) = \langle 1, 2 \rangle.$$

So we compute

$$D_{\hat{u}} f(0, 1) = \nabla f(0, 1) \cdot \hat{u} = \langle 1, 2 \rangle \cdot \langle \frac{2}{\sqrt{5}}, \frac{1}{\sqrt{5}} \rangle = \frac{4}{\sqrt{5}}.$$

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Practice 3

1/1 point (graded)
Let $g(x, t) = \sin(x - t)$. Find the directional derivative of g at the point $(x, t) = (\pi, 0)$ in the direction of the unit vector $\hat{u} = \langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle$.

$D_{\hat{u}}g(\pi, 0) =$  Answer: 0

Solution:

We have

$$\nabla g = \langle g_x(x, t), g_t(x, t) \rangle = \langle \cos(x - t), -\cos(x - t) \rangle$$

and so

$$\nabla g(\pi, 0) = \langle -1, 1 \rangle.$$

So we compute

$$D_{\hat{u}}g(\pi, 0) = \nabla g(\pi, 0) \cdot \hat{u} = \langle -1, 1 \rangle \cdot \langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle = 0.$$

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4. Practice computing directional derivatives


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 [staff] bug: solution in bright yellow box

Practice 1 on this page has its solution in a bright yellow box (!) and is probably missing the dollar signs around the TeX.

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