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2. What are directional derivatives?

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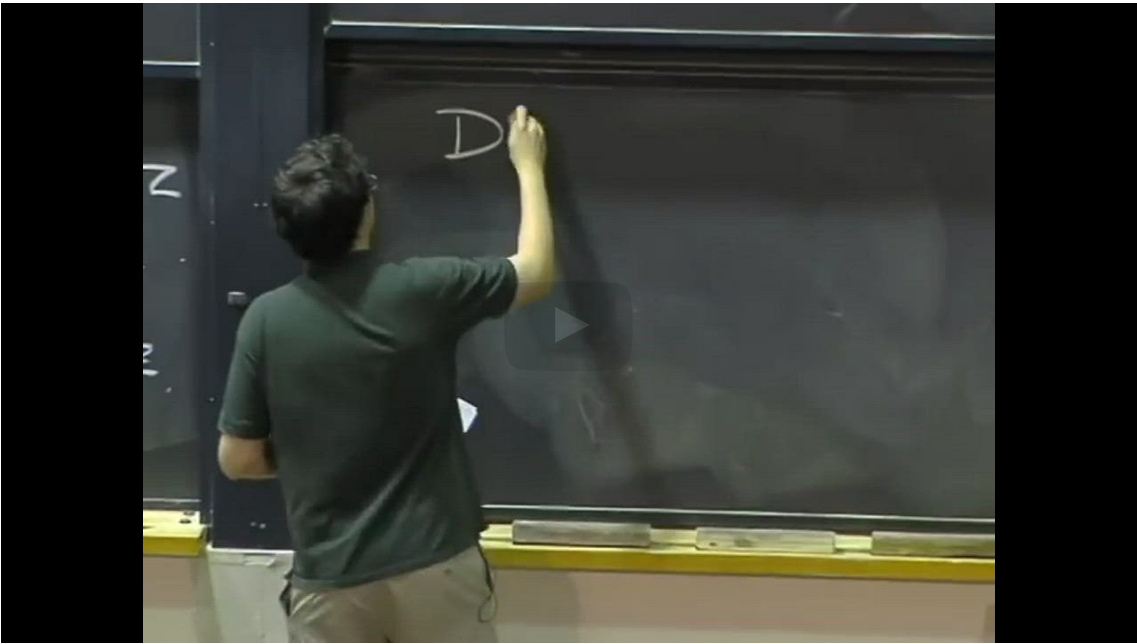
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Directional derivatives

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PROFESSOR: Directional derivatives-
-
OK, so let's say that we have a function of two variables, x and y .
Well, we know how to compute partial value of partial w over partial x or the partial w of a partial y , which measure

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We have seen that the partial derivative f_x is the rate of change of f in the positive x -direction. In other words, f_x is the rate of change of f in the direction of the vector $\langle 1, 0 \rangle$. Similarly, f_y is the rate of change of f in the positive y -direction, or in the direction of the vector $\langle 0, 1 \rangle$.

Now we are going to see how to find the rate of change of f in the direction of an arbitrary unit vector $\hat{u} = \langle u_1, u_2 \rangle$.

Note: We say \hat{u} is a unit vector if $|\hat{u}| = 1$.

We will denote by $D_{\hat{u}}f(x, y)$ the directional derivative of f in the direction of \hat{u} at the point (x, y) . This can be interpreted as the rate of change of f in the direction of the vector \hat{u} .

Directional derivative notation 1

1/1 point (graded)

Using the notation above, which of the following is equivalent to $f_x(x, y)$?

- ☐ $D_{\langle 0, 1 \rangle} f(x, y)$
- ☒ $D_{\langle 1, 0 \rangle} f(x, y)$
- ☐ $D_{\langle 1, 1 \rangle} f(x, y)$
- ☐ $D_{\langle -1, -1 \rangle} f(x, y)$

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Solution:


Recall that f_x is the rate of change of f in the positive x -direction, which is the same as the rate of change of f in the direction of $\langle 1, 0 \rangle$. The notation for this is therefore

$$f_x(x,y) = D_{\langle 1,0 \rangle} f(x,y).$$

(3.96)

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You have used 1 of 2 attempts

 Answers are displayed within the problem

Directional derivative notation 2

1/1 point (graded)
Using the notation above, which of the following is equivalent to $f_y(x,y)$?

- ☒ $D_{\langle 0,1 \rangle} f(x,y)$
- ☐ $D_{\langle 1,0 \rangle} f(x,y)$
- ☐ $D_{\langle 1,1 \rangle} f(x,y)$
- ☐ $D_{\langle -1,-1 \rangle} f(x,y)$



Solution:


Recall that f_y is the rate of change of f in the positive y -direction, which is the same as the rate of change of f in the direction of $\langle 0, 1 \rangle$. The notation for this is therefore

$$f_y(x,y) = D_{\langle 0,1 \rangle} f(x,y).$$

(3.97)

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 Answers are displayed within the problem


2. What are directional derivatives?


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2



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