7. Solution to partial derivatives problem

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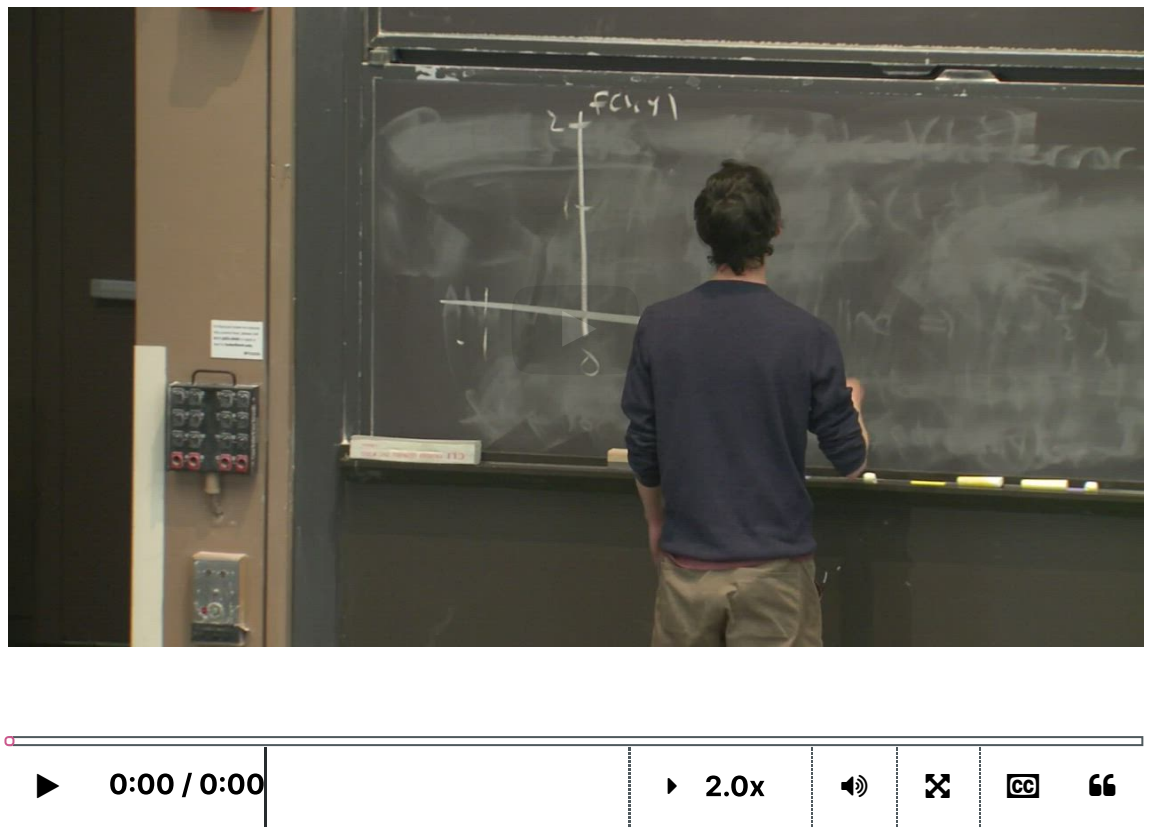
Solution



Start of transcript. Skip to the end.

PROFESSOR: Let's do it together.

I have to manage my time.

So how would I fill this in?

What should it be at 0?

So when y is 0, I'm supposed to put f of (1, comma 0).

f of (1, comma 0) I can read in the graph, in the picture.

So (1, comma 0) is on the level curve of height one.

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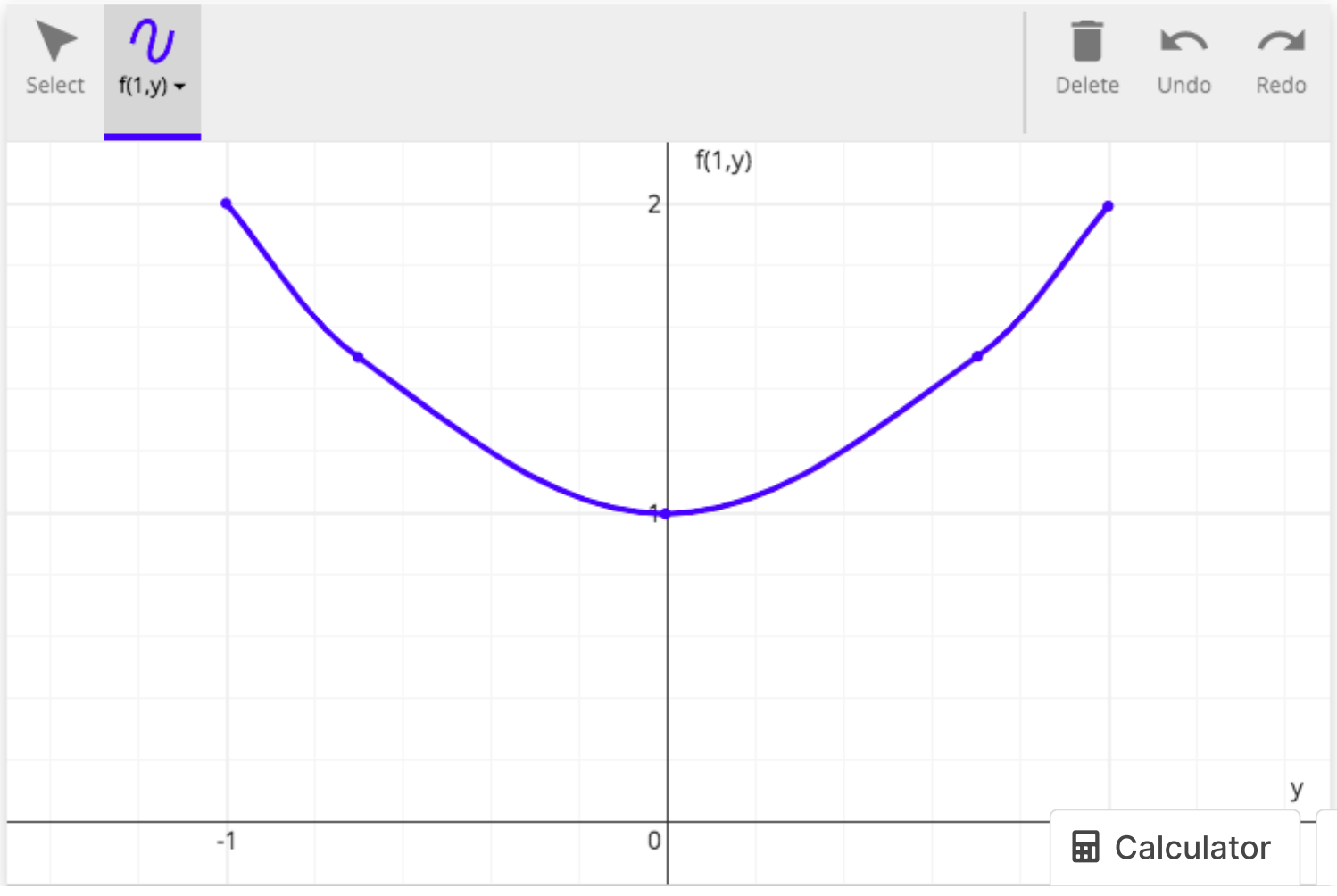
Using the level curves, or by direct computation, we find

$$f(1,0) = 1 \tag{7.25}$$

$$f(1,1) = 2 \tag{7.26}$$

$$f(1,-1) = 2 \tag{7.27}$$

The graph looks like so.



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Therefore to determine the sign of $f_y\left(1,0\right)$ we must look at the slope of this graph. The point $y=0$ is a minimum, therefore $f_y\left(1,0\right)=0$.

Direct computation shows that

$$f\left(x,y\right) = x^2+y^2 \tag{7.28}$$

$$f_y\left(x,y\right) = 2y \tag{7.29}$$

$$f_y\left(1,0\right) = 0 \tag{7.30}$$

Another way to think about this is by the fact that $\nabla f\left(1,0\right)=\left\langle f_x\left(1,0\right),f_y\left(1,0\right)\right\rangle$ is normal to the level curves. At the point $\left(1,0\right)$, the normal vector is pointing in the positive x direction. That is the y component of the gradient, which is $f_y\left(1,0\right)$, is zero.

Concept check

0 points possible (ungraded)

Which statement best describes the situation in this problem.

- ○ $\langle 0,\Delta y\rangle$ is normal to the level curve of height 1 of $f\left(x,y\right)$
- ◉ $\langle 0,\Delta y\rangle$ is tangent to the level curve of height 1 of $f\left(x,y\right)$
- ○ Neither

✔

Solution:

In this instance, when we are looking at a slice of the function along the y-direction at $\left(1,0\right)$, if we move along this direction, we are moving tangent to the level curve. This suggests that we are staying on this level curve, so the partial derivative $f_y\left(1,0\right)=0$. This bears out via direct computation.

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ℹ Answers are displayed within the problem

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