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2. Warm up: Linear approximations

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Lecture due Aug 18, 2021 20:30 IST Completed

Review

Getting started

0:00 / 0:00 2.0x

Start of transcript. Skip to the end.

PROFESSOR: Today, we're going to start the class--

today we're going to start the class

by doing a warm, which is a review of linear approximation.

So you're going to find the linear approximation

of this function.

And the main thing I want people to do--

the main point of the warm up is to

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The main goal of this warm up is to remind you of the two ways to write linear approximations.

Consider the function

$$f(x,y) = y^2 - x^3 - x$$

and note that $f(1,1) = -1$.

Compute

4/4 points (graded)
Fill in the following table:

$f_x(x,y) =$

-3*x^2-1

✔ **Answer:** -3*x^2-1

$-3 \cdot x^2 - 1$

$f_x(1,1) =$ -4 ✔

Answer: -4

$f_y(x,y) =$

2*y

✔ **Answer:** 2*y

$2 \cdot y$

$f_y(1,1) =$ 2 ✔

Answer: 2

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Solution:

$$f_x(x,y) = -3x^2 - 1, \quad f_x(1,1) = -4$$
$$f_y(x,y) = 2y, \quad f_y(1,1) = 2$$

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Answers are displayed within the problem

The linear approximation, two ways

6/6 points (graded)
Write the linear approximation in two ways by filling in the following:

- 1st way: (in terms of Δx and Δy)

  $f(1+\Delta x, 1+\Delta y) \approx$ -1 + ✔ **Answer:** -1 -4 $\Delta x +$ ✔ **Answer:** -4 2 Δy ✔ **Answer:** 2

- 2nd way: (in terms of x and y)

  If (x,y) is near $(1,1)$, then

  $f(x,y) \approx$ -4 $x +$ ✔ **Answer:** -4 2 $y +$ ✔ **Answer:** 2 1 . ✔ **Answer:** 1

Solution:

- 1st way:

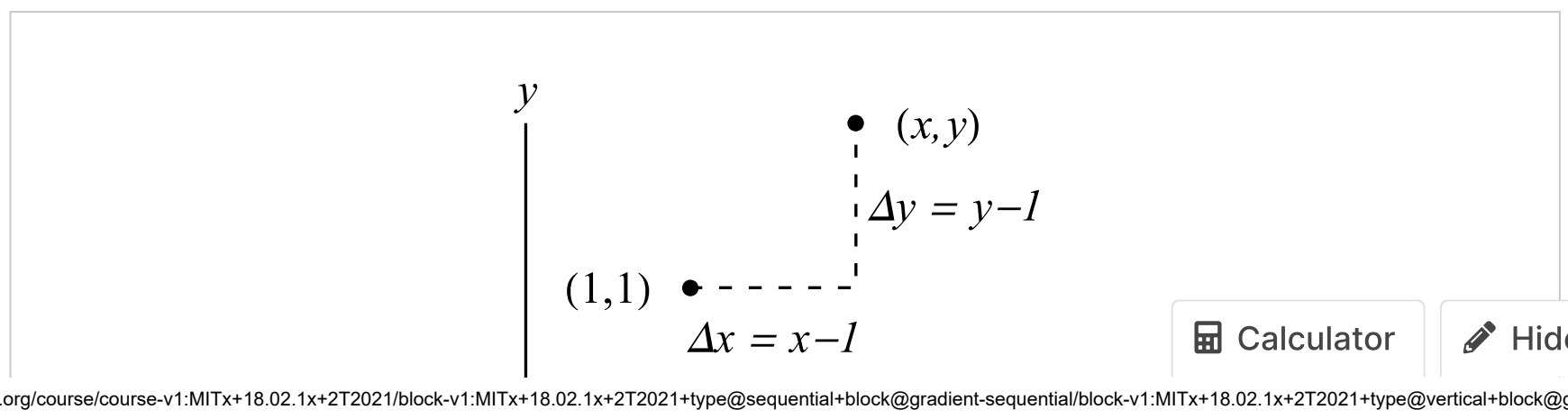
$$f(1+\Delta x, 1+\Delta y) \approx -1 + \boxed{-4}\,\Delta x + \boxed{2}\,\Delta y.$$

- 2nd way: If (x,y) is near $(1,1)$, then

$$f(x,y) \approx \boxed{-4}\,x + \boxed{2}\,y + \boxed{1}.$$

This comes from substituting $\Delta x = x - 1 \implies x = \Delta x + 1$ and $\Delta y = y - 1 \implies y = \Delta y + 1$. So we get

$$f(1+\Delta x, 1+\Delta y) = f(x,y) \approx -1 + -4(x-1) + 2(y-1) = -4x + 2y + 1.$$



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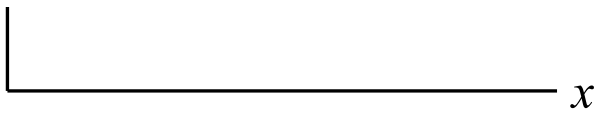

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2. Warm up: Linear approximations

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