

<u>Help</u>

sandipan_dey ~

<u>Course</u> <u>Progress</u> <u>Dates</u> <u>Calendar</u> <u>Discussion</u> <u>Notes</u>

☆ Course / Unit 2: Geometry of Derivatives / Problem Set 2A



You are taking "Exam (Timed, No Correctness Feedback)" as a timed exam. Show more



43:40:21





9. Gradients and steepest increase

□ Bookmark this page

Problem Set A due Aug 18, 2021 20:30 IST Completed

2A-11(a)

1/1 point (graded)

Suppose that $f(x,y)=x^3+xy^2+y^3$. It's straightforward to compute that f(1,1)=3, $f_x(1,1)=4$, and $f_y(1,1)=5$, and so $\nabla f(1,1)=\langle 4,5\rangle$.

Suppose that we want to find the closest point to (1,1) where f(x,y)=3.01. Suppose that this closest point is $\langle 1+\Delta x, 1+\Delta y \rangle$. Decide which of the following is true and carefully think about your reasoning.

- $\bigcirc \langle \Delta x, \Delta y \rangle$ is almost perpendicular to $\langle 4, 5 \rangle$.
- $igorplus \langle \Delta x, \Delta y
 angle$ is almost parallel to $\langle 4, 5
 angle$.
- $\bigcirc \langle 1 + \Delta x, 1 + \Delta y \rangle$ is almost perpendicular to $\langle 4, 5 \rangle$.
- $\bigcirc \langle 1+\Delta x, 1+\Delta y
 angle$ is almost parallel to $\langle 4,5
 angle$.
- None of the above.



Solution:

The closest point will be in the direction of steepest increase, i.e. along the gradient. Thus the correct option is almost parallel to the gradient vector $\langle 4, 5 \rangle$.

Submit

You have used 1 of 1 attempt

1 Answers are displayed within the problem

2A-11(b)

2/2 points (graded)

Use the linear approximation to find a good approximation of $\langle \Delta x, \Delta y
angle$ based on the answer above.

(Give answer approximate up to 5 decimal places.)

Solution:

We look for a solution of the form $\langle \Delta x, \Delta y \rangle = a \langle 4, 5 \rangle$. Plugging into the formula for the linear approximation we get:

$$f\left(1+\Delta x,1+\Delta y\right) \approx f\left(1,1\right)+f_{x}\left(1,1\right)\Delta x+f_{y}\left(1,1\right)\Delta y$$
 (3.132)

$$3.01 \approx 3 + 4\Delta x + 5\Delta y \tag{3.133}$$

 $4\Delta x + 5\Delta y \approx 0.01$

 $\Lambda(\Lambda_0) \perp 5(5_0) \sim 0.01$



Hide Notes

Problem Set 2A | Unit 2: Geometry of Derivatives | Multivariable Calculus 1: Vectors and Derivatives | edX

 $16a + 25a \approx 0.01 \tag{3.135}$

 $a \approx 0.01/41 \approx 0.00024$ (3.137)

Therefore

 $\Delta x \approx 0.00098 \tag{3.138}$

 $\Delta y \approx 0.00122 \tag{3.139}$

Plugging in 1.00098 for x and 1.00122 for y into our formula for f does give 3.01003... which has an error of 0.001%.

Submit

You have used 1 of 5 attempts

1 Answers are displayed within the problem

9. Gradients and steepest increase

Hide Discussion

Topic: Unit 2: Geometry of Derivatives / 9. Gradients and steepest increase

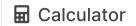
Add a Post



© All Rights Reserved









Affiliates

edX for Business

Open edX

Careers

News

Legal

Terms of Service & Honor Code

Privacy Policy

Accessibility Policy

Trademark Policy

<u>Sitemap</u>

Connect

Blog

Contact Us

Help Center

Media Kit

Donate















© 2021 edX Inc. All rights reserved.

深圳市恒宇博科技有限公司 <u>粤ICP备17044299号-2</u>