<u>Notes</u>

Discussion

☆ Course / Unit 2: Geometry of Derivati... / Recitation 7: Practice with directional derivati...

<u>Course</u>

<u>Dates</u>

<u>Help</u>

sandipan_dey ~

<u>Calendar</u>

()

Next >

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

End My Exam

Previous

43:46:15





Progress

☐ Bookmark this page

Recitation due Aug 18, 2021 20:30 IST Completed



Practice

1.

1/1 point (graded)

Imagine a mountain landscape where the height at a point (x, y) is $h(x, y) = x^2 + x + y^4$. There are two trails in this landscape starting at (1, 1). One trail goes in a straight line to (1, 2) and one trail goes in a straight line to (2, 2). Near (1, 1), which trail is steeper?

- \bigcirc The trail from (1,1) to (1,2) is steeper.
- igcirc The trail from (1,1) to (2,2) is steeper.



Solution:

The first trail points in the direction (0,1) and the second points in the direction (1,1). Computing the directional derivative at (1,1) in each of these directions, we find:

$$egin{array}{ll}
abla h\left(x,y
ight) &= \langle 2x+1,4y^3
angle \
abla h\left(1,1
ight) &= \langle 3,4
angle \ D_{\langle 0,1
angle} h\left(1,1
ight) &=
abla h\left(1,1
ight) \cdot \langle 0,1
angle &= 4 \ D_{\langle 1,1
angle} h\left(1,1
ight) &=
abla h\left(1,1
ight) \cdot \langle rac{1}{\sqrt{2}},rac{1}{\sqrt{2}}
angle &= rac{7}{\sqrt{2}} \end{array}$$

Since $7/\sqrt{2}>4$, we conclude that the slope is steeper in the direction $\langle 1,1 \rangle$.

Submit

You have used 1 of 1 attempt

1 Answers are displayed within the problem

Could not format HTML for problem. Contact course staff in the discussion forum for assistance.

3.

3.0/3 points (graded)

As above let $h\left(x,y
ight) =x^{2}+x+y^{4}$.

Let c be the curve defined by $h\left(x,y
ight)=3$. (Notice that (1,1) is on the curve c.)

a.) Find a unit vector which is normal to $m{c}$ at (1,1).

[3/5,4/5] **Answer:** [0.6,0.8]

b.) Find a unit vector \hat{u} which is tangent to c at (1,1).

[-4/5,3/5]

✓ Answer: [0.8,-0.6]





c.) Compute $D_{\hat{u}}h\left(1,1
ight)$ (where \hat{u} is the vector you found in part (b).)

0 **✓ Answer:** 0

d.) (Self reflection.) Can you explain why you got the answer that you did?

Solution:

- a) We learned that the gradient $\nabla h\left(1,1\right)$ points perpendicular to the level curve of $h\left(x,y\right)$ that passes through (1,1). Since the question asked for a unit vector, we rescale $\nabla h\left(1,1\right)=\langle 3,4\rangle$ to have unit length, giving the answer $\langle 3/5,4/5\rangle$.
- b) Since we already have a unit vector that is normal to the curve, rotating this vector by 90 degrees (clockwise or counter-clockwise) gives a vector that is tangent to the curve. Rotating a vector $\langle a,b\rangle$ 90 degrees clockwise gives the vector $\langle b,-a\rangle$. Therefore, the answer is $\langle 4/5,-3/5\rangle$, or its negative.
- c) $D_{\langle 4/5,-3/5
 angle} h\left(1,1
 ight) = \langle 3,4
 angle \cdot \langle 4/5,-3/5
 angle = 0.$
- d) Since the vector we found in part (b) is perpendicular to the gradient, the dot product between the two will be zero.

Submit

You have used 1 of 5 attempts

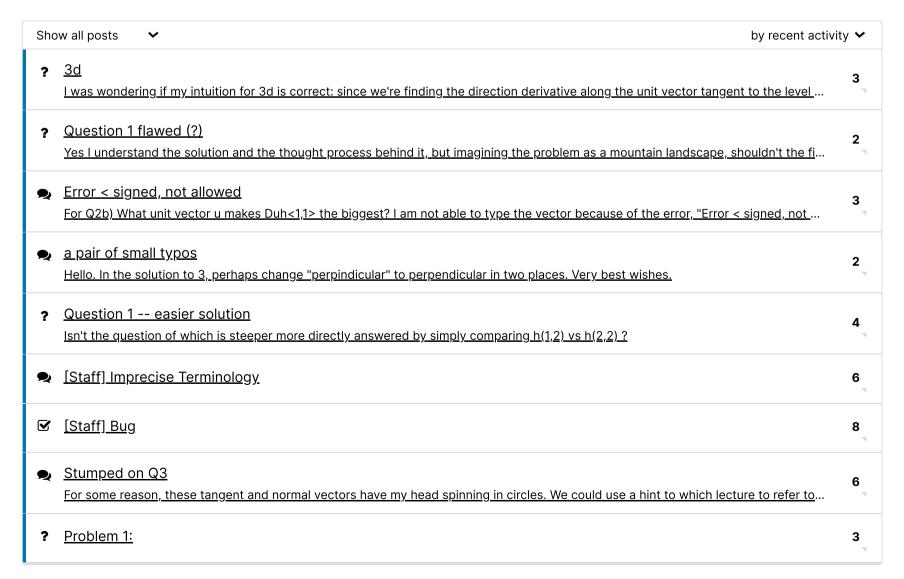
1 Answers are displayed within the problem

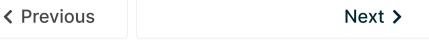
1. Directional Derivatives

Hide Discussion

Topic: Unit 2: Geometry of Derivatives / 1. Directional Derivatives

Add a Post





© All Rights Reserved



edX

About

Affiliates

edX for Business

Open edX

Careers

News

Legal

Terms of Service & Honor Code

Privacy Policy

Accessibility Policy

Trademark Policy

<u>Sitemap</u>

Connect

<u>Blog</u>

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>

