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Recitation due Aug 18, 2021 20:30 IST Completed

Practice

4.

3.0/3 points (graded)

Calculate the gradient of the function $x^3 + 2y^3$ at the point $(1, 1)$.

(Enter vector surrounded by square brackets; e.g. type `[1,-1]` for the vector $\hat{i} - \hat{j}$.)

[3,6] ✔ **Answer:** [3,6]

Calculate the unit vector $\hat{u}$ pointing in the direction of $\hat{i} - \hat{j}$.

(Enter vector surrounded by square brackets; e.g. type `[1,-1]` for the vector $\hat{i} - \hat{j}$.)

[1/sqrt(2),-1/sqrt(2)] ✔ **Answer:** (1/sqrt(2))*[1,-1]

Find the directional derivative $D_{\hat{u}} f$ at the point $(1, 1)$.

-3/sqrt(2) ✔ **Answer:** -3/sqrt(2)

? INPUT HELP

Solution:

The gradient is $\nabla f = \langle 3x^2, 6y^2 \rangle$. At the point $(1, 1)$ this is the vector $\langle 3, 6 \rangle$.

The vector $\vec{v}$ has direction

$$\frac{\langle 1, -1 \rangle}{|\langle 1, -1 \rangle|} = \frac{1}{\sqrt{2}} \langle 1, -1 \rangle.$$

Thus the directional derivative is

$$\nabla f\,(1, 1) \cdot \frac{1}{\sqrt{2}} \langle 1, -1 \rangle = \langle 3, 6 \rangle \cdot \frac{1}{\sqrt{2}} \langle 1, -1 \rangle = \frac{-3}{\sqrt{2}}.$$

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Answers are displayed within the problem

5.

3/3 points (graded)

In each of the following, a function f, a point P, and a vector $\vec{v}$ are given.

Calculate the directional derivative $D_{\vec{v}} f$ at the point P

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Calculate the directional derivative $D_{\vec{v}} f$ at the point P.

	Function $f(x,y)$	Point P	Vector $\vec{v}$	Answers	
a)	$z = \dfrac{x}{y}$	(2,-1)	$\hat{i} + 2\hat{j}$	-sqrt(5)	✔ **Answer:** -sqrt(5)
b)	$z = x \sin y + y \cos x;$	$(0, \pi/2)$	$-3\hat{i} + 4\hat{j}$	1/5	✔ **Answer:** 1/5
c)	$f(t,u) = \ln(2t + 3u)$	(-1,1)	$4\hat{i} - 3\hat{j}$	-1/5	✔ **Answer:** -1/5

Solution:

a) The gradient is $\nabla f = \langle 1/y, -x/y^2 \rangle$. At the point $(2, -1)$ this is the vector $\langle -1, -2 \rangle$.

The vector $\vec{v}$ has direction

$$\frac{\langle 1, 2 \rangle}{|\langle 1, 2 \rangle|} = \frac{1}{\sqrt{5}} \langle 1, 2 \rangle.$$

Thus the directional derivative is

$$\nabla f(1,1) \cdot \frac{1}{\sqrt{5}} \langle 1, 2 \rangle = \langle -1, -2 \rangle \cdot \frac{1}{\sqrt{5}} \langle 1, 2 \rangle = \frac{-5}{\sqrt{5}} = -\sqrt{5}.$$

b) The gradient is $\nabla f = \langle \sin y - y \sin x, x \cos y + \cos x \rangle$. At the point $(0, \pi/2)$ this is the vector $\langle 1, 1 \rangle$.

The vector $\vec{v}$ has direction

$$\frac{\langle -3, 4 \rangle}{|\langle -3, 4 \rangle|} = \frac{1}{5} \langle -3, 4 \rangle.$$

Thus the directional derivative is

$$\nabla f(0, \pi/2) \cdot \frac{1}{5} \langle -3, 4 \rangle = \langle 1, 1 \rangle \cdot \frac{1}{5} \langle -3, 4 \rangle = \frac{1}{5}$$

c) The gradient is $\nabla f = \langle \dfrac{2}{2t + 3u}, \dfrac{3}{2t + 3u} \rangle$. At the point $(-1, 1)$ this is the vector $\langle 2, 3 \rangle$.

The vector $\vec{v}$ has direction

$$\frac{\langle 4, -3 \rangle}{|\langle 4, -3 \rangle|} = \frac{1}{5} \langle 4, -3 \rangle.$$

Thus the directional derivative is

$$\nabla f(-1, 1) \cdot \frac{1}{5} \langle 4, -3 \rangle = \langle 2, 3 \rangle \cdot \frac{1}{5} \langle 4, -3 \rangle = \frac{-1}{5}$$

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Answers are displayed within the problem

2. More practice

Topic: Unit 2: Geometry of Derivatives / 2. More practice

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- May be I am not understanding Q5 — 4
  I am not sure if there is flaw in my thought process with q5, I keep getting the wrong answer: 1. I calculate the partial derivatives the...
- Clarification — 4
  In the second part of question 4, are you not asking for the unit vector of the gradient calculated in the first part?
- [STAFF} Recitation 7 More Practice #5 Needs clarification — 4
  In 5c it should be stated that the assumptions are that x=t and y=u

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1 min + 10 activities

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