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☆ Course / Unit 2: Geometry of Derivatives / Lecture 7: Directional derivatives



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43:50:43





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Lecture due Aug 18, 2021 20:30 IST Completed

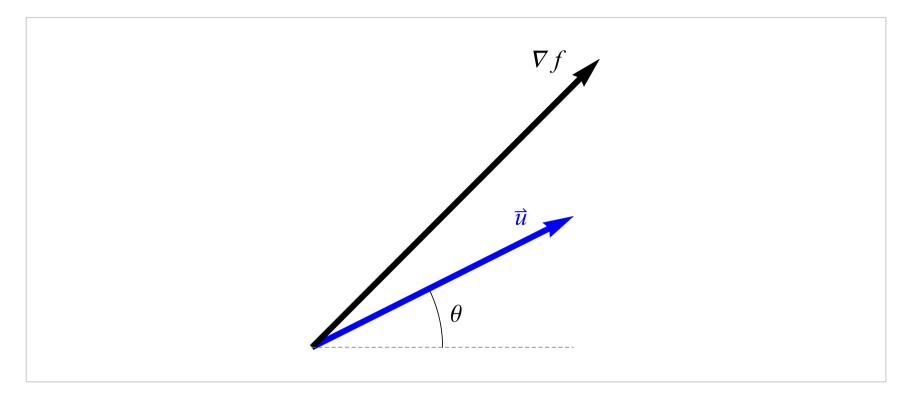


Explore

Unit vector given an angle

2.0/2 points (graded)

Let $\hat{m{u}}$ be a unit vector that makes an angle $m{ heta}$ with the positive $m{x}$ -axis.

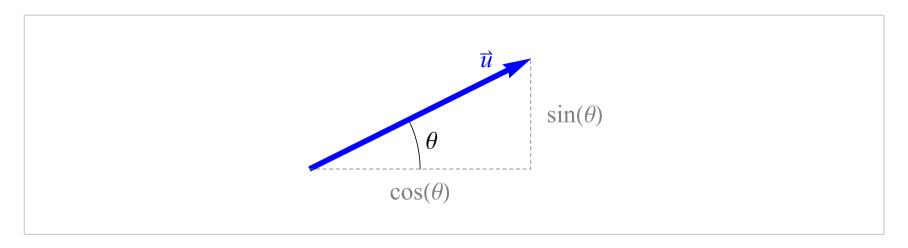


Enter the missing coefficients in terms of $m{ heta}$ that describe the directional derivative in the direction of $\hat{m{u}}$.

Solution:

By drawing a right triangle whose hypotenuse is \hat{u} , we see that the unit vector in the direction of θ is

$$\hat{u} = \langle \cos \theta, \sin \theta \rangle.$$



Then

$$D_{\hat{u}}f\left(x,y
ight)=
abla f\left(x,y
ight)\cdot\hat{u}=\cos heta f_{x}\left(x,y
ight)+\sin heta f_{y}\left(x,y
ight).$$

Submit

You have used 1 of 4 attempts



1 Answers are displayed within the problem

Practice

1/1 point (graded)

Let $f(x,y)=x^2y^3-xe^y$. Find the directional derivative of f at the point (3,0) in the direction $heta=rac{\pi}{6}$.

Solution:

We have

$$f_x = 2xy^3 - e^y ext{ and } f_y = 3x^2y^2 - xe^y.$$

So

$$abla f = \langle 2xy^3 - e^y, 3x^2y^2 - xe^y
angle$$

and

$$abla f(3,0) = \langle -1, -3 \rangle.$$

Then we compute

$$D_{\hat{u}}f\left(3,0
ight)=
abla f\left(3,0
ight)\cdot\hat{u}=\left\langle -1,-3
ight
angle \cdot\left\langle \cos\left(\pi/6
ight),\sin\left(\pi/6
ight)
ight
angle =-rac{\sqrt{3}}{2}-rac{3}{2}.$$

Submit

You have used 1 of 5 attempts

1 Answers are displayed within the problem

5. Directional derivatives given an angle

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