Bigger Jacobians!

TOTAL POINTS 5

1.Question 1

In this quiz, you will calculate the Jacobian matrix for some vector valued functions.

For the function u(x,y) = x^2 - y^2 and v(x,y) = 2xy, calculate the Jacobian matrix J =

[[∂u/∂x ∂u∂y], [∂v∂x ∂v∂y]].

1 / 1 point

- ○ J =[[2x 2y], [2y 2x]]
- ◉ J =[[2x -2y], [2y2x]]
- ○ J =[2x−2y−2y2x]
- ○ J =[2x−2y2y2x]

2.Question 2

For the function u(x,y,z) = 2x + 3y, v(x, y, z) = cos(x)sin(z) and w(x,y,z) = e^xe^ye^z, calculate the Jacobian matrix J =

⎡⎣⎢⎢⎢⎢⎢⎢⎢ ∂u∂x∂v∂x∂w∂x∂u∂y∂v∂y∂w∂y∂u∂z∂v∂z∂w∂z⎤⎦⎥⎥⎥⎥⎥⎥⎥

1 / 1 point

- ◉ J =[[2 3 0], [−sin(x)sin(z) 0 cos(x)cos(z)], [exeyez exeyez exeyez]]
- ○ J =⎡⎣2sin(x)sin(z)exeyez30exeyez0−cos(x)cos(z)exeyez⎤⎦
- ○ J =⎡⎣2−cos(x)sin(z)exeyez30exeyez0−sin(x)cos(z)exeyez⎤⎦
- ○ J =⎡⎣2cos(x)sin(z)exeyez30exeyez0−sin(x)cos(z)exeyez⎤⎦

3.Question 3

Consider the pair of linear equations u(x,y) = ax + byu(x,y)=ax+by and v(x,y) = cx + dyv(x,y)=cx+dy, where a, b, ca,b,c and dd are all constants. Calculate the Jacobian, and notice something kind of interesting!

1 / 1 point

- ○ J =[a c], [b d]
- ◉ J = [a b], [c d]
- ○ J =[bdca]
- ○ J =[bacd]

4.Question 4

For the function u(x,y,z) = 9x^2y^2 + ze^x, v(x, y, z) = xy + x^2y^3 + 2z and w(x,y,z) = cos(x)sin(z)e^y, calculate the Jacobian matrix and evaluate at the point (0,0,0).

1 / 1 point

- (selected) J = [[0 0 1], [0 0 2], [0 01]]
- J =⎡⎣001002001⎤⎦
- J =⎡⎣000000111⎤
- J =⎡⎣001001001⎤⎦

5.Question 5

In the lecture, we calculated the Jacobian of the transformation from Polar co-ordinates to Cartesian co-ordinates in 2D. In this question, we will do the same, but with Spherical co-ordinates to 3D.

For the functions $x(r,\theta,\phi)=rcos(\theta)sin(\phi)$, $y(r,\theta,\phi)=rsin(\theta)sin(\phi)$ and $z(r,\theta,\phi)=rcos(\phi)$, calculate the Jacobian matrix.

1 / 1 point

- J = ⎡⎣$rcos(\theta)sin(\phi)rsin(\theta)sin(\phi)cos(\phi)-rsin(\theta)sin(\phi)r2cos(\theta)sin(\phi)-1rcos(\theta)cos(\phi)sin(\theta)cos(\phi)-rsin(\phi)$⎤⎦⎥
- J = ⎡⎣$r2cos(\theta)sin(\phi)rsin(\theta)sin(\phi)cos(\phi)-sin(\theta)sin(\phi)rcos(\theta)sin(\phi)1cos(\theta)cos(\phi)rsin(\theta)cos(\phi)rsin(\phi)$⎤⎦⎥
- (selected) J=[[$cos(\theta)sin(\phi)$ $-rsin(\theta)sin(\phi)$ $rcos(\theta)cos(\phi)$], [$sin(\theta)sin(\phi)$ $rcos(\theta)sin(\phi)$ $rsin(\theta)cos(\phi)$], [$cos(\phi)$ 0 $-rsin(\phi)$]]
- J = ⎡⎣$rcos(\theta)sin(\phi)rsin(\theta)sin(\phi)rcos(\phi)-sin(\theta)sin(\phi)cos(\theta)sin(\phi)0cos(\theta)cos(\phi)sin(\theta)cos(\phi)-sin(\phi)$⎤⎦⎥