Calculating Hessians

Practice Quiz, 5 questions

5/5 points (100.00%)

✓ Congratulations! You passed!

Next Item

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1 / 1 point

1. In this quiz, you will calculate the Hessian for some functions of 2 variables and functions of 3 variables.

For the function $f(x, y) = x^3y + x + 2y$, calculate the Hessian matrix $H = \begin{bmatrix} \partial_{x,x}f & \partial_{x,y}f \\ \partial_{y,x}f & \partial_{y,y}f \end{bmatrix}$

- ○ $H = \begin{bmatrix} 0 & -3x^2 \\ -3x^2 & 6xy \end{bmatrix}$
- ◉ $H = \begin{bmatrix} 6xy & 3x^2 \\ 3x^2 & 0 \end{bmatrix}$

Correct
Well done!

- ○ $H = \begin{bmatrix} 6xy & -3x^2 \\ -3x^2 & 0 \end{bmatrix}$
- ○ $H = \begin{bmatrix} 0 & 3x^2 \\ 3x^2 & 6xy \end{bmatrix}$

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1 / 1 point

2. For the function $f(x, y) = e^x cos(y)$, calculate the Hessian matrix.

- ◉ $H = \begin{bmatrix} e^x cos(y) & -e^x sin(y) \\ -e^x sin(y) & -e^x cos(y) \end{bmatrix}$

Correct
Well done!

- ○ $H = \begin{bmatrix} -e^x cos(y) & -e^x sin(y) \\ -e^x sin(y) & e^x cos(y) \end{bmatrix}$
- ○ $H = \begin{bmatrix} -e^x cos(y) & e^x sin(y) \\ -e^x sin(y) & -e^x cos(y) \end{bmatrix}$
- ○ $H = \begin{bmatrix} -e^x cos(y) & -e^x sin(y) \\ e^x sin(y) & -e^x cos(y) \end{bmatrix}$

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1 / 1 point

3. For the function $f(x, y) = \frac{x^2}{2} + xy + \frac{y^2}{2}$, calculate the Hessian matrix.

Notice something interesting when you calculate $\frac{1}{2}[x, y]H\begin{bmatrix} x \\ y \end{bmatrix}$!

- ◉ $H = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

Correct
Well done! Not unlike a previous question with the Jacobian of linear functions, the Hessian can be used to succinctly write a quadratic equation in multiple variables.

- ○ $H = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$
- ○ $H = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- ○ $H = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$

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1 / 1 point

4. For the function $f(x, y, z) = x^2e^{-y}cos(z)$, calculate the Hessian matrix $H = \begin{bmatrix} \partial_{x,x}f & \partial_{x,y}f & \partial_{x,z}f \\ \partial_{y,x}f & \partial_{y,y}f & \partial_{y,z}f \\ \partial_{z,x}f & \partial_{z,y}f & \partial_{z,z}f \end{bmatrix}$

- ○ $H = \begin{bmatrix} 2xe^{-y}cos(z) & -2e^{-y}cos(z) & -2e^{-y}sin(z) \\ -2e^{-y}cos(z) & x^2e^{-y}cos(z) & x^2e^{-y}sin(z) \\ -2x^2e^{-y}sin(z) & x^2e^{-y}sin(z) & -2xe^{-y}cos(z) \end{bmatrix}$
- ◉ $H = \begin{bmatrix} 2e^{-y}cos(z) & -2xe^{-y}cos(z) & -2xe^{-y}sin(z) \\ -2xe^{-y}cos(z) & x^2e^{-y}cos(z) & x^2e^{-y}sin(z) \\ -2xe^{-y}sin(z) & x^2e^{-y}sin(z) & -x^2e^{-y}cos(z) \end{bmatrix}$

Correct
Well done!

- ○ $H = \begin{bmatrix} 2xe^{-y}cos(z) & x^2e^{-y}cos(z) & 2xe^{-y}sin(z) \\ 2xe^{-y}cos(z) & x^2e^{-y}cos(z) & x^2xe^{-y}sin(z) \end{bmatrix}$

$2xe^{-y}sin(z) \quad 2xe^{-y}sin(z) \quad 2xe^{-y}cos(z)$

$$H = \begin{bmatrix} 2e^{-y}cos(z) & 2xe^{-y}cos(z) & 2xe^{-y}sin(z) \\ 2xe^{-y}cos(z) & x^2e^{-y}cos(z) & x^2e^{-y}sin(z) \\ 2xe^{-y}sin(z) & x^2e^{-y}sin(z) & x^2e^{-y}cos(z) \end{bmatrix}$$

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1 / 1 point

5. For the function $f(x, y, z) = xe^y + y^2cos(z)$, calculate the Hessian matrix.

$$H = \begin{bmatrix} 0 & e^y & 0 \\ e^y & xe^y + 2sin(z) & -2ycos(z) \\ 0 & -2ycos(z) & -y^2sin(z) \end{bmatrix}$$

$$H = \begin{bmatrix} 0 & e^y & 0 \\ e^y & xe^y + 2cos(z) & 2ysin(z) \\ 0 & 2ysin(z) & y^2cos(z) \end{bmatrix}$$

$$H = \begin{bmatrix} 0 & e^y & 0 \\ e^y & xe^y + 2sin(z) & 2ycos(z) \\ 0 & 2ycos(z) & y^2sin(z) \end{bmatrix}$$

$$H = \begin{bmatrix} 0 & e^y & 0 \\ e^y & xe^y + 2cos(z) & -2ysin(z) \\ 0 & -2ysin(z) & -y^2cos(z) \end{bmatrix}$$

Correct

Well done!