Congratulations! You passed!

Grade received 100%

To pass 80% or higher

Go to next item

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

1 / 1 point

For the function $f(x, y) = x^3y + x + 2y$, calculate the Hessian matrix

$$H = \begin{bmatrix} \partial_{x,x}f & \partial_{x,y}f \\ \partial_{y,x}f & \partial_{y,y}f \end{bmatrix}$$

$H = [\begin{smallmatrix} \partial_{x,x}f & \partial_{x,y}f \\ \partial_{y,x}f & \partial_{y,y}f \end{smallmatrix}]$

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

$H = [\begin{smallmatrix} 0 & -3x^2 \\ -3x^2 & 6xy \end{smallmatrix}]$

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

$H = [\begin{smallmatrix} 0 & 3x^2 \\ 3x^2 & 6xy \end{smallmatrix}]$

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

$H = [\begin{smallmatrix} 6xy & -3x^2 \\ -3x^2 & 0 \end{smallmatrix}]$

◉

$$\begin{bmatrix} 6xy & 3x^2 \\ 3x^2 & 0 \end{bmatrix}$$

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

Correct
Well done!

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

1 / 1 point

◉

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

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

○

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

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

○

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

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

○

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

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

Correct
Well done!

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

1 / 1 point

Notice something interesting when you calculate

$$\begin{bmatrix} x \\ y \end{bmatrix}$$

$\frac{1}{2}[x, y]H\begin{bmatrix} x \\ y \end{bmatrix}$!

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

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

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

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

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.

4. For the function $f(x,y,z) = x^2 e^{-y} cos(z)$, calculate the Hessian matrix

1 / 1 point

$$\begin{bmatrix} \partial_{x,x}f & \partial_{x,y}f & \partial_{x,z}f \\ \partial_{y,x}f & \partial_{y,y}f & \partial_{y,z}f \\ \partial_{z,x}f & \partial_{z,y}f & \partial_{z,z}f \end{bmatrix}$$

$$H = \begin{bmatrix} \partial_{x,x}f & \partial_{x,y}f & \partial_{x,z}f \\ \partial_{y,x}f & \partial_{y,y}f & \partial_{y,z}f \\ \partial_{z,x}f & \partial_{z,y}f & \partial_{z,z}f \end{bmatrix}$$

- (selected)

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

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

-

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

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

-

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

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

-

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

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

Correct

Well done!

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

1 / 1 point

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

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

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

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

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

Correct

Well done!