

For each of the following functions, compute $f_x, f_y, f_{xx}, f_{yy}, f_{xy}$, and f_{yx} . Verify that $f_{xy} = f_{yx}$.

1 $f(x, y) = 4x + 3y - 6$

2 $f(x, y) = (x - y)^2$

3 $f(x, y) = \frac{y}{x}$

4 $f(x, y) = x^4 + y^3$

5 $f(x, y) = e^{xy}$

6 $f(x, y) = x \ln(y) + y \ln(x)$

7 $f(x, y) = \ln(y^x x^y)$

$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	7
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	6
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	5
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	4
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	3
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	2
$\frac{\partial}{\partial x} (x \ln y + y \ln x) = \ln y + \frac{y}{x}$	1
Answers:	

For each of the following functions, compute f_x , f_y , and f_z .

8 $f(x, y, z) = \ln(x^2 + y^2 + z^2)$

9 $f(x, y, z) = x^2y + y^2z + z^2x$

10 $f(x, y, z) = y \ln(xz) - z \ln(xy)$

For each of the following functions, find all points where both $f_x = 0$ and $f_y = 0$. At this point, compute f_{xx} and $D = f_{xx}f_{yy} - f_{xy}^2$.

11 $f(x, y) = x^2 + 4y^2 - 2xy$

12 $f(x, y) = x^2 + 2xy + 2y^2 - 8y + 12$

13 $f(x, y) = 6x^3 + y^2 + 6xy + 7$

14 $f(x, y) = x^2 - 2y^2 + xy - 4$

Answers:

8 $f_x = \frac{2x}{x^2+y^2+z^2}, f_y = \frac{2y}{x^2+y^2+z^2}, f_z = \frac{2z}{x^2+y^2+z^2}$

9 $f_x = 2xy, f_y = x^2 + 2z, f_z = 2y + z^2$

10 $f_x = \frac{y}{xz}, f_y = \frac{x}{z} - \frac{x}{y}, f_z = \frac{y}{z} - \frac{x}{y}$

11 $(x, y) = (0, 0), (4, 4), (-4, 4)$, where $f_{xx} = 2$ and $D = 4$

12 $(x, y) = (0, 0)$, where $f_{xx} = 0$ and $D = -6$ and $(x, y) = (1, -3)$, where $f_{xx} = 36$ and $D = 24$

13 $(x, y) = (0, 0)$, where $f_{xx} = 0$ and $D = -6$ and $(x, y) = (1, 1)$, where $f_{xx} = 18$ and $D = 12$

14 $(x, y) = (0, 0)$, where $f_{xx} = 2$ and $D = 12$

14 $(x, y) = (0, 0)$, where $f_{xx} = 2$ and $D = 12$