

(1) Do the following limits exist?

(i) $\lim_{(x,y) \rightarrow (0,0)} \frac{xy^2}{x^2 + y^4}$

(ii) $\lim_{(x,y) \rightarrow (0,0)} \frac{3x^2y}{x^2 + y^2}$

(2) Use the definition of partial derivatives as limits to find f_x and f_y for

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

(ii) $f(x, y) = \frac{x}{x + y^2}$

(3) Use implicit differentiation to find $\partial z / \partial x$ and $\partial z / \partial y$ for

(i) $yz = \ln(x + z)$

(ii) $x - z = \arctan(yz)$.

(4) Verify Clairaut's Theorem for the following functions.

(i) $f(x, y) = x \sin(x + 2y)$

(ii) $f(x, y) = x^4y^2 - 2xy^5$.

(5) Find all second partial derivatives.

(i) $f(x, y) = \ln(3x + 5y)$

(ii) $z = \frac{x}{x+y}$.

(6) Find the indicated partial derivatives.

(i) $f(x, t) = x^2e^{-ct}; f_{ttt}, f_{txx}$

(ii) $f(x, y, z) = \cos(4x + 3y + 2z); f_{xyz}, f_{zyx}$.

(7) The ellipsoid $4x^2 + 2y^2 + z^2 = 16$ intersects the plane $y = 2$ in an ellipse. Find the equation of the tangent line to the ellipse at the point $(1, 2, 2)$.