

1. Use continuity to show the limit exists or prove the limit does not exist.

(a) $\lim_{(x,y) \rightarrow (0,0)} \frac{x + e^y}{e^x - e^y}$

(b) $\lim_{(x,y) \rightarrow (0,0)} \frac{xy}{x^2 - e^y + 1}$

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

(d) $\lim_{(x,y) \rightarrow (0,0)} \frac{4x + 3y}{x^2 - 3y + 1}$

(e) $\lim_{(x,y) \rightarrow (0,0)} \ln(x^2 + y^2 + 4) - \sqrt{xy + 1}$

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

2. Let $f(x, y) = \sin(xy) + \sqrt{x}$

(a) Find f_x

(b) Find f_y

3. Let $f(x, y) = x^3 - 4xy + e^{xy}$

(a) Find f_x

(b) Find f_y

4. Let $f(x, y) = xe^{xy} + \cos(x + y)$

(a) Find f_x

(b) Find f_y

(c) Find f_{xx}

(d) Find f_{yy}

(e) Find f_{xy}

(f) Find f_{yx}

5. Let $\ln(z) = xy + e^{x+y}$

(a) Find $\frac{\partial z}{\partial x}$

(b) Find $\frac{\partial z}{\partial y}$