

Homework -exercises 18.-19.1.2024

To get points from these exercises do them at home before the second exercise session of the week and at the beginning of the class mark them on the list.

1. Specify the function

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

limit value at the origin $(x, y) = (0, 0)$ along each line $y = kx$, $k = \text{constant}$. Is there a

$$\lim_{(x,y) \rightarrow (0,0)} f(x, y)?$$

2. Let's look at the functions

$$f(x, y) = \frac{x^2 - 4y^2}{x + 2y} \quad \text{and} \quad g(x, y) = \frac{y^2}{\sqrt{x^2 + y^2}}.$$

Find the domains of both of the functions? Do the functions have a limit at the origin $(x, y) = (0, 0)$?

3. Calculate all (first-order) partial derivatives of the following functions at $(x, y) = (1, 0)$:

$$f(x, y) = x^3y - y^3x, \quad g(x, y) = y \sin(xy^2), \quad h(x, y) = \frac{x - 2y}{3x + 4y}.$$