

## MATH 104: WORKSHEET 8

### 1. Concepts

(1) Limit and continuity

If  $f(x, y) \rightarrow L_1$  as  $(x, y) \rightarrow (a, b)$  along a path  $C_1$  and  $f(x, y) \rightarrow L_2$  as  $(x, y) \rightarrow (a, b)$  along a path  $C_2$ , where  $L_1 \neq L_2$ , then

$\lim_{(x,y) \rightarrow (a,b)} f(x, y)$  does not exist.

### 2. Discussions

*Question 1.* Do the limits below exist?

(1)

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

(2)

$$\frac{xy}{x^2 + y^2}$$

(3)

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