

## Quiz 2: Multivariable functions and limits

Name:

Section:

1. Consider the function

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

- (a) (5 points) Compute the partial derivative of  $f(x, y)$  with respect to  $x$
- (b) (5 points) sketch the level curves of  $f(x, y)$ . That is, plot the values of  $(x, y)$  such that  $f(x, y) = c$  for  $c = -1, 0, 1$ .
- (c) (5 points) Does the limit as  $(x, y) \rightarrow (0, 0)$  exist? (Hint: Consider the limit along the path  $(x(t), y(t)) = (t, mt)$  for different  $m$ ).

2. (5 points) Recall that a multivariate function is *Continuous* at a point  $\vec{a}$  if  $\lim_{(x,y) \rightarrow \vec{a}} f(x,y)$  exists, and its value equals  $f(\vec{a})$ . Give an example of a function where  $\lim_{(x,y) \rightarrow \vec{0}} f(x,y)$  exists, but  $f(x,y)$  is not continuous at zero.