

Preliminary Homework  
Assigned Monday, October 29

Note: Preliminary homework is always graded credit or no credit. **You get full credit for completing the assignment, whether or not your answers are correct, as long as your work shows you have thought about the problem.** The purpose of preliminary homework is to start you thinking about the topic of the next class.

You may use your preliminary homework for in-class activities with your classmates. You should be sure to think about these questions so you will be prepared.

Preliminary homework is always due at the *beginning* of the next class.

**Assignment:** Consider the functions

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

The domains of these functions are the entire plane  $\mathbb{R}^2$  except for the origin.

If we fix  $y = 0$  we get an ordinary function from  $\mathbb{R}$  to  $\mathbb{R}$ , given by  $f(x, 0)$ .

- (1.) Find  $\lim_{x \rightarrow 0} f(x, 0)$  and  $\lim_{y \rightarrow 0} f(0, y)$ . What do you conclude about  $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ ?
- (2.) Find  $\lim_{x \rightarrow 0} g(x, 0)$  and  $\lim_{y \rightarrow 0} g(0, y)$ . What do you conclude about  $\lim_{(x,y) \rightarrow (0,0)} g(x, y)$ ?
- (3.) Find  $\lim_{a \rightarrow 0} g(a, a)$ . Does this change your answer to question (2)?