

Preliminary Homework  
Assigned Wednesday, October 30

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.

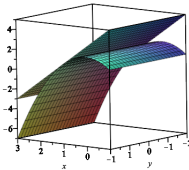
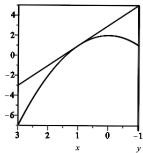
You may use your preliminary homework for in-class activities with your classmates. You should be sure to think about these questions so you will be prepared.

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

**Assignment:** Let  $f(x) = 2 - x^2$  and  $g(x, y) = 2 - x^2$ . (This is not a typo.)

(1.) Show that the line  $z = 3 - 2x$  is tangent to the graph of  $f$  at the point  $x = 1, z = 1$  in  $\mathbb{R}^2$ , where the two axes are labeled  $x$  and  $z$  instead of  $x$  and  $y$ .

(2.) Explain why the plane  $z = 3 - 2x$  should be tangent to the graph of  $g$  at the point  $x = 1, y = 0, z = 1$  in  $\mathbb{R}^3$ .



(3.) Explain why

$$\lim_{(\Delta x, \Delta y) \rightarrow (0, 0)} \frac{g((1, 0) + (\Delta x, \Delta y)) - g((1, 0))}{(\Delta x, \Delta y)}$$

could not possibly give us the slope of the graph of  $g$  when  $x = 1$  and  $y = 0$ .

(To answer this question, you do not need to know what “slope” means for the graph of a function  $g(x, y)$ . We will see that a graph like this does not have just one slope. However, again, you do not need to know that to answer this question, or the next one.)

(4.) Might it be that

$$\lim_{(\Delta x, \Delta y) \rightarrow (0, 0)} \frac{g((1, 0) + (\Delta x, \Delta y)) - g((1, 0))}{|(\Delta x, \Delta y)|}$$

gives us the slope of the graph of  $g$  when  $x = 1$  and  $y = 0$ ?

Hint: First try to find the limit.