

## Math 32 – Workshop #13

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1. For each function, sketch the graph. The sketch some traces and some level curves. Identify which are which.

(a)  $f(x, y) = e^{-x}$

(b)  $f(x, y) = 25 - x^2 - y^2$

(c)  $f(x, y) = \sqrt{25 - x^2 - y^2}$

2. Draw a contour map of the function showing several level curves.

(a)  $f(x, y) = x - y + 2$

(b)  $f(x, y) = x^2 + 4y^2$

(c)  $f(x, y) = xy$

(d)  $f(x, y) = \ln(y - 4x)$

(e)  $f(x, y) = \frac{16}{x^2 + y^2}$

(f)  $f(x, y) = y - \sqrt{x}$

3. Sketch a typical level surface.

(a)  $f(x, y, z) = x^2 + y^2 + z^2$

(b)  $f(x, y, z) = z - x^2 - 4y^2$

4. Let  $f(x, y) = x^2 + y^2$  and  $g(x, y) = \sqrt{x^2 + y^2}$ . Sketch level curves for each function for  $k = 0, 1, 4, 9$ . How are the graphs of  $f$  and  $g$  different?

5. Consider the curve  $C$  given by  $x^2 + y^2 = 1$ . Find a function  $f(x, y)$  and a constant  $k$  so that  $C$  is the level curve of  $f$  with value  $k$ . How many choices of  $f$  and  $k$  are there?