

1. For each of the following, sketch four level sets.

(a) $xyz = 1$

(b) $x + y + z^2 = 1$

(c) $x^2 + y^2 + z^2 = 25$

2. For a function $f(x, y)$, is it possible for the level sets corresponding to two different values of c to intersect? Explain your answer. Does this contradict your answers to (b) and (c) in the previous problem?

3. (a) Find f_x and f_y for $f(x, y) = \ln(x^2 + y^2)$.

(b) Find f_x and f_y for $f(x, y) = e^{y^2} \cos(2xy)$.

(c) Find f_x and f_y for $f(x, y) = x^2y^3e^{xy} + 5x + 1$.

(d) Find f_x and f_y for $f(x, y) = \frac{e^{xy}}{x^2 + x}$.

(e) Find f_x , f_y , and f_z for $f(x, y, z) = \frac{1}{xyz}$.

(f) Find f_x , f_y , and f_z for $f(x, y, z) = yze^{2x^2 - y}$.

(g) Let $f(x, y, z) = \frac{1}{\sqrt{x^2 + y^2 + z^2}}$ and let $g = f_x$. Find g_x .

4. Consider the function $f(x, y, z) = xe^z + (\ln y)(\sin z) - y$.

(a) Find the linear approximation for f at the point $(2, 1, 0)$.

(b) Use the approximation you found above to estimate $f(2.01, 0.9, 0.1)$. (*This should be done WITHOUT a calculator.*)

(c) With the aid of your calculator, estimate $f(2.01, 0.9, 0.1)$ by plugging the values directly into the function $f(x, y, z)$. Compare this with the estimate you found in (b). How big is the difference?