

Math 210 (Lesieutre)
12.8: Maxima and minima
February 20, 2017

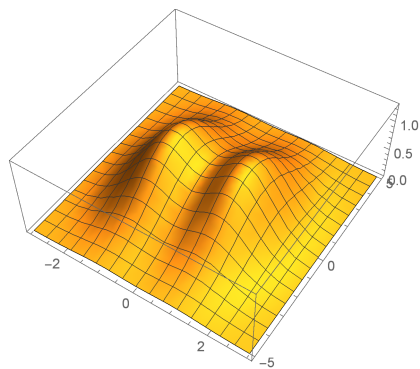
Problem 1. A cylinder has radius 2 and height 3.

a) Suppose that the radius and height each increase by 0.1. Approximately how much will the volume change?

b) Give a formula for the linear approximation to $V(r, h)$ near $(r, h) = (2, 3)$.

Problem 2. Here is a graph of the function.

$$f(x, y) = e^{-(x-1)^2 - (y/3)^2} + e^{-(x+1)^2 - (y/3)^2}.$$



How many critical points can you identify on the graph? Are they maxima, minima, or saddle points?

Problem 3. For each of the following functions, compute all four second derivatives. Check that each function has a critical point at $(0, 0)$, and classify it as a maximum, a minimum, or a saddle point.

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

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

c) $f(x, y) = -x^2 - 2y^2$

d) $f(x, y) = x^2 + xy + y^2$

Problem 4. For each of the following functions, find the critical points. Pick one, and determine whether it is a maximum, minimum, or saddle point.

a) $x^4 + y^4 - 16xy$

b) $f(x, y) = x^2 - 2x + y^2 - 4y + xy + 5$

c) $g(x, y) = x^2ye^{-x^2-y^2}$.