Math 2233 Practice Midterm 2 Solutions

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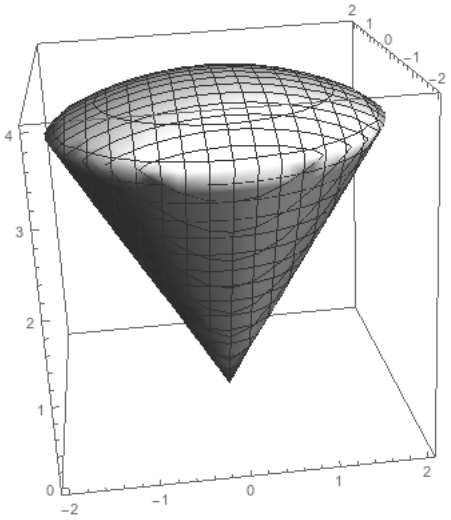
Problem 1 (M3)**.** (a) Find and classify the critical points of $f(x, y) = 2x^3 + 6xy + 3y^2$.

(b) Find the maximum and minimum values of $f(x, y) = 20 - 4x^2 - y^2$ on the disk $x^2 + y^2 \leq 4$.

Problem 2 (M4)**.** Let R be the spherical wedge bounded by a sphere of radius 4 centered at the origin, and the cone given by $z = \sqrt{3x^2 + 3y^2}$ (as shown below). Let $f(x, y, z) = z$.

(a) Set up integrals to compute $\int_R f\, dV$ in cartesian, cylindrical, and spherical coordinates.

(b) Choose one of these integrals and evaluate it.



(c) Compute the integral of the function $f(x) = x + 3y$ over the region bounded by $x + 3y = 0, x + 3y = 3, x - 3y = 0, x - 3y = 2$.

Problem 3 (S4)**.** Let R be the disk of radius 2 centered at the origin, with density $\rho(x, y) = x^2 + y^2 - 2x - 4y + 5$. What is the center of mass of R?