

# Math 2233 Practice Midterm 2 Solutions

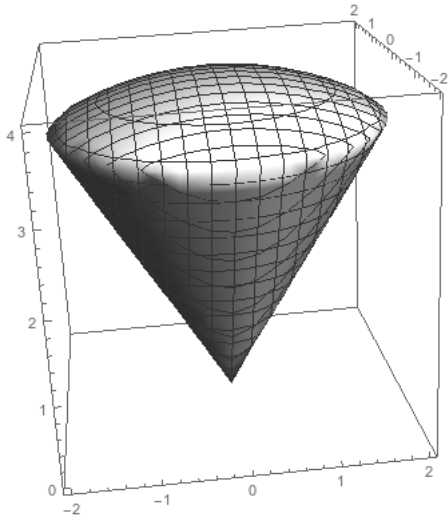
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**Problem 1 (M3).** (a) Find and classify the critical points of  $f(x, y) = 2x^3 + 6xy + 3y^2$ .

(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  $R$ ?