

MATH 2153 - Calculus III – Recitation 9

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- 1. Comparing two masses.** Two different tetrahedrons fill the region in the first octant bounded by the coordinate planes and the plane $x + y + z = 4$. Both solids have densities that vary in the z -direction between $\rho = 4$ and $\rho = 8$, according to the functions $\rho_1 = 8 - z$ and $\rho_2 = 4 + z$. Find (1) the mass, and (2) the center of mass, of each solid. (*Hint:* Draw the solid and decide the best order of integration.)
2. Find the volume of the solid bounded by the plane $z = 0$ and the hyperboloid $z = \sqrt{17} - \sqrt{1 + x^2 + y^2}$. (*Hint:* Draw the solid and use appropriate coordinates.)
3. Find the solid in the first octant bounded by the cylinder over the unit circle (in the xy -plane) and the planes $z = x$ and $z = 0$. (*Hint:* Draw the solid and use appropriate coordinates.)
4. For $0 \leq r \leq 1$, the solid D_1 bounded by the cone $z = 4 - 4r$, and the solid D_2 bounded by the paraboloid $z = 4 - 4r^2$ have the same base in the xy -plane and the same height (4). Decide which of these solids has greater mass if the density of both objects is $\rho(r, \theta, z) = 10 - 2z$.
5. Find the centroid of the following objects:
 - (a) the solid cone with height h , base radius R and constant density;
 - (b) the plate in the shape of bounded plane region enclosed by the functions $y = x^2 - 1$ and $y = \frac{3x^2}{4} - \frac{7}{16}$ with constant density function.