



3. Set up an iterated integral **in cylindrical coordinates** for the volume of the region between the paraboloids  $z = 3x^2 + 3y^2$  and  $z = 4 - x^2 - y^2$ .

4. Set up an iterated integral for the volume of the region inside both the cylinder  $x^2 + y^2 = 1$  and the cylinder  $y^2 + z^2 = 4$ .

5. Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_{-\sqrt{1-x^2-y^2}}^{\sqrt{1-x^2-y^2}} 1 dz dy dx$ .

6. Set up iterated integral(s) for the  $z$ -coordinate of the center of mass of the first-octant solid between  $x^2 + y^2 + z^2 = 1$  and  $x^2 + y^2 + z^2 = 4$  [Note: For full credit, your final answer should be entirely in terms of a single coordinate system].

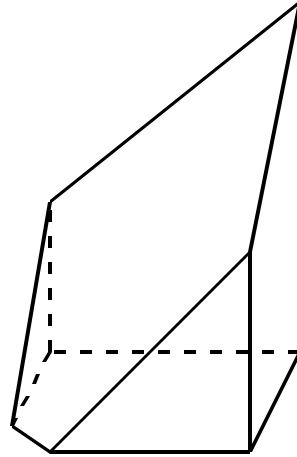
7. Biff is a Calc 3 student at Enormous State University, and he's having some trouble. Biff says "Okay, dude, this is insane. Our calc professor just keeps saying these things like 'You should understand...' stuff, like we're supposed to be able to figure something out for ourselves or something. It's totally unfair. He said we should be able to understand why this one formula from Calc 2 was, like the one for  $\bar{y} = \frac{1}{A} \int_a^b \frac{1}{2} [f(x)]^2 dx$ . But that's obviously a total crock, right, 'cause it's that way in the book. It's not like you figure out calculus yourself or anything, geez!"

Explain clearly to Biff how to formula he mentions can be obtained from our Calc 3 approach.

8. Find the volume of the ellipsoid  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$  using the transformation  $x = au, y = bv, z = cw$ .

9. Set up an iterated integral for the area of one leaf of the rose  $r = \cos n\theta$  where  $n$  is an integer greater than or equal to 2.

10. Consider the solid created by diagonally slicing a box with a square base of side length 4 with a plane that cuts off one corner of the base as shown, so that the length cut off from the base edges is exactly 1 unit. If the long vertical edge is 7 units and the two short vertical edges are 3 units, set up iterated integral(s) for the volume of this solid.



Extra Credit (5 points possible):

Find the average value of the function  $f(x) = \int_x^1 \sin(t^2) dt$  on the interval  $0 \leq x \leq 1$ .