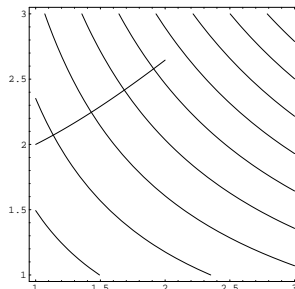


Freshman-Sophomore Contest 2004

Sophomore Version, page 2.

1. Find the average value of $x^2 + y^2 + z^2$ over the interior of the solid ball $x^2 + y^2 + z^2 \leq 1$.
2. A moving point starts at $(1, 2)$ and moves with constant speed, always parallel to the gradient vector of the function $f(x, y) = xy$. When the point crosses the vertical line $x = 2$, what is its y coordinate?



3. A skewed pyramid with horizontal base a square having corners $(1, -1, 0)$, $(1, 1, 0)$, $(3, 1, 0)$, and $(3, -1, 0)$, and tip at $(-1, 0, 1)$, is cut by the plane containing the y and z axes. What is the area of the resulting cross section?