

Region R is bounded by $f(x) = x^2$, $y = 0$, $x = 1$, and $x = 4$.

1. Find the area of R
2. Find the volume generated by revolution of R about the x-axis.
3. Find the volume generated by revolution of R about the line $y = 20$.
4. Find the volume generated by revolution of R about the y-axis.
5. Region R is the base of a solid with cross-sections perpendicular to the x-axis that are all semi-circles. Find the volume of this solid.