

Cylindrical Coordinates Using the first figure below, determine the length $d\ell$ of each of the three segments shown (the three thick lines). Notice that, along any of these three segments, only one coordinate s , ϕ , or z is changing at a time (i.e. along segment 1, $dz \neq 0$, but $d\phi = 0$ and $ds = 0$). Use your results to determine the volume of the region.

Segment 1: $d\ell =$

Segment 2: $d\ell =$

Segment 3: $d\ell =$

$dV =$

Spherical Coordinates Using the second figure below, determine the length $d\ell$ of each of the three segments shown (the three thick lines). Notice that, along any of these three segments, only one coordinate r , θ , or ϕ is changing at a time (i.e. along segment 1, $d\theta \neq 0$, but $dr = 0$ and $d\phi = 0$). Use your results to determine the volume of the region.

(Be careful: One segment is trickier than the others.)

Segment 1: $d\ell =$

Segment 2: $d\ell =$

Segment 3: $d\ell =$

$dV =$

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