Cylindrical Coordinates:

Find the general form for $d\vec{r}$ in cylindrical coordinates by determining $d\vec{r}$ along the specific paths below.

- Path 1 from (s, ϕ, z) to $(s + ds, \phi, z)$:

  $d\vec{r} =$

- Path 2 from (s, ϕ, z) to $(s, \phi, z + dz)$:

  $d\vec{r} =$

- Path 3 from (s, ϕ, z) to $(s, \phi + d\phi, z)$:

  $d\vec{r} =$

If all three coordinates are allowed to change simultaneously, by an infinitesimal amount, we could write this $d\vec{r}$ for any path as:

$d\vec{r} =$

This is the general line element in cylindrical coordinates.

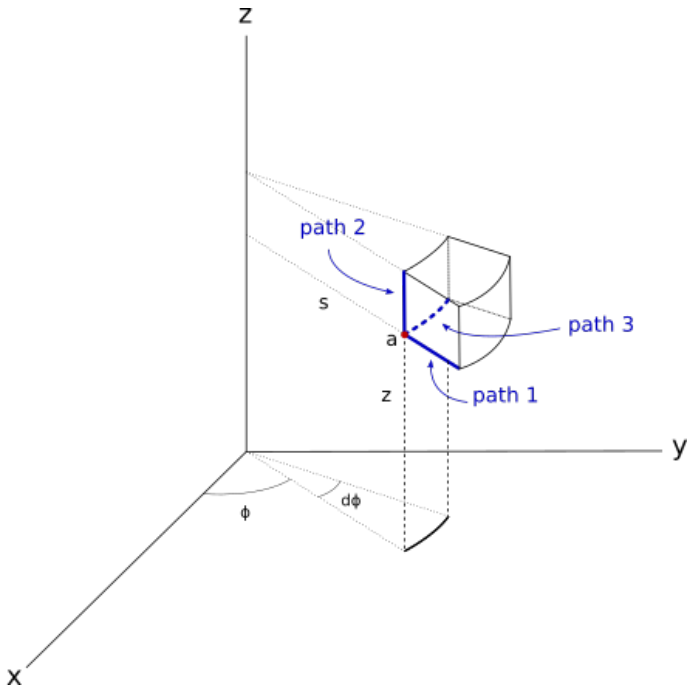


Figure 1: Figure 1: $d\vec{r}$ in cylindrical coordinates

Spherical Coordinates:

Find the general form for $d\vec{r}$ in spherical coordinates by determining $d\vec{r}$ along the specific paths below.

- Path 1 from (r, θ, ϕ) to $(r + dr, \theta, \phi)$:

  $d\vec{r} =$

- Path 2 from (r, θ, ϕ) to $(r, \theta + d\theta, \phi)$:

  $d\vec{r} =$

- Path 3 from (r, θ, ϕ) to $(r, \theta, \phi + d\phi)$: (Be careful, this is a tricky one!)

  $d\vec{r} =$

If all three coordinates are allowed to change simultaneously, by an infinitesimal amount, we could write this $d\vec{r}$ for any path as:

$d\vec{r} =$

This is the general line element in spherical coordinates.

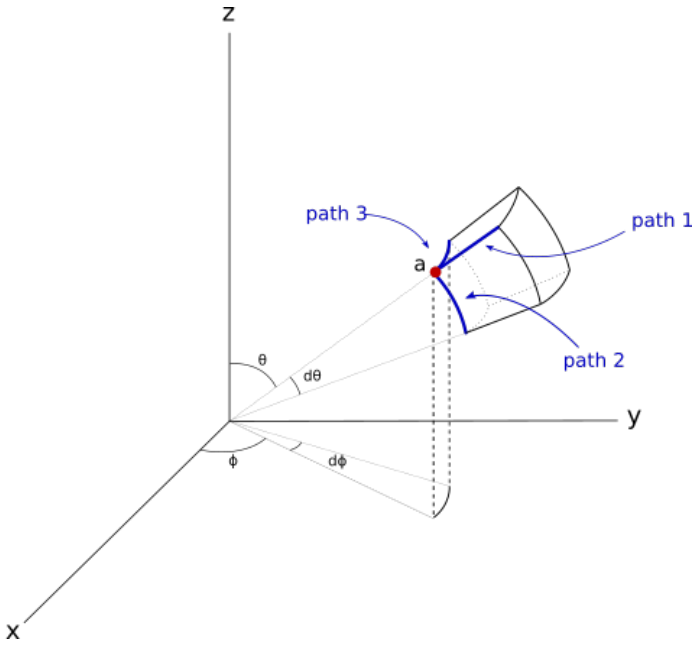


Figure 2: Figure 2: $d\vec{r}$ in spherical coordinates