DIFFERENTIAL ELEMENTS

- **Cartesian Coordinate System الاحداثيات الكارتيزية**

1- Differential displacements (dl)

dl=*dx* ***ax*** +*dy* ***ay*** +*dz* ***az***

or

dl=*dx* ***ax***

dl=*dy* ***ay***

dl=*dz* ***az***

2- Differential area (ds)

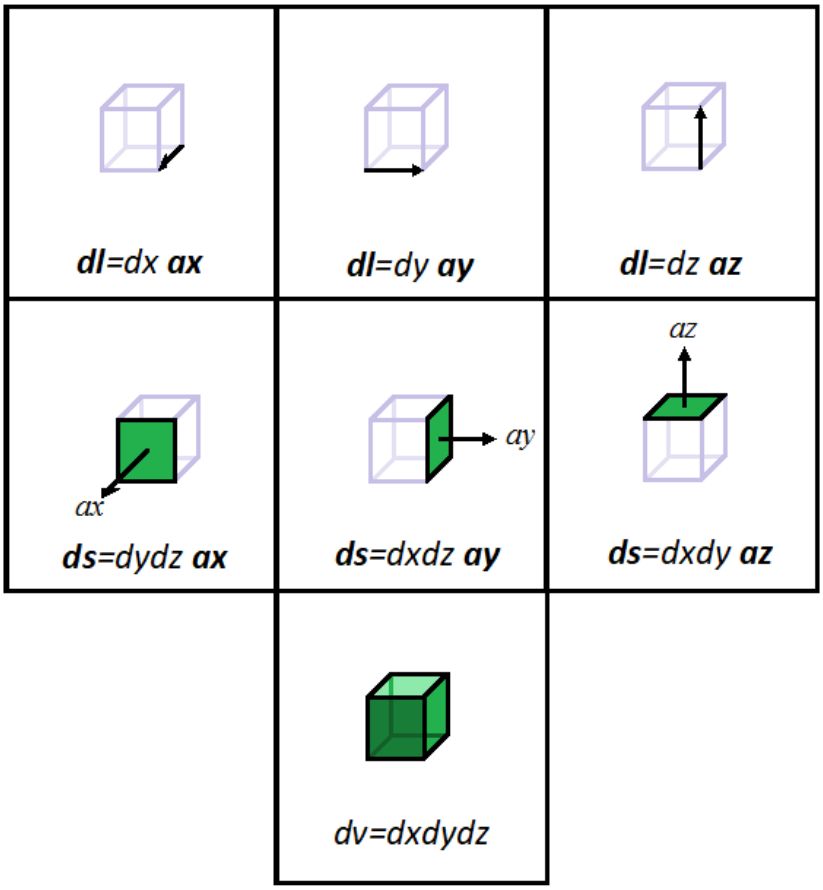
ds=*dydz* ***ax***

ds=*dxdz* ***ay***

ds=*dxdy* ***az***

3- Differential volume (dv)

dv=dxdydz



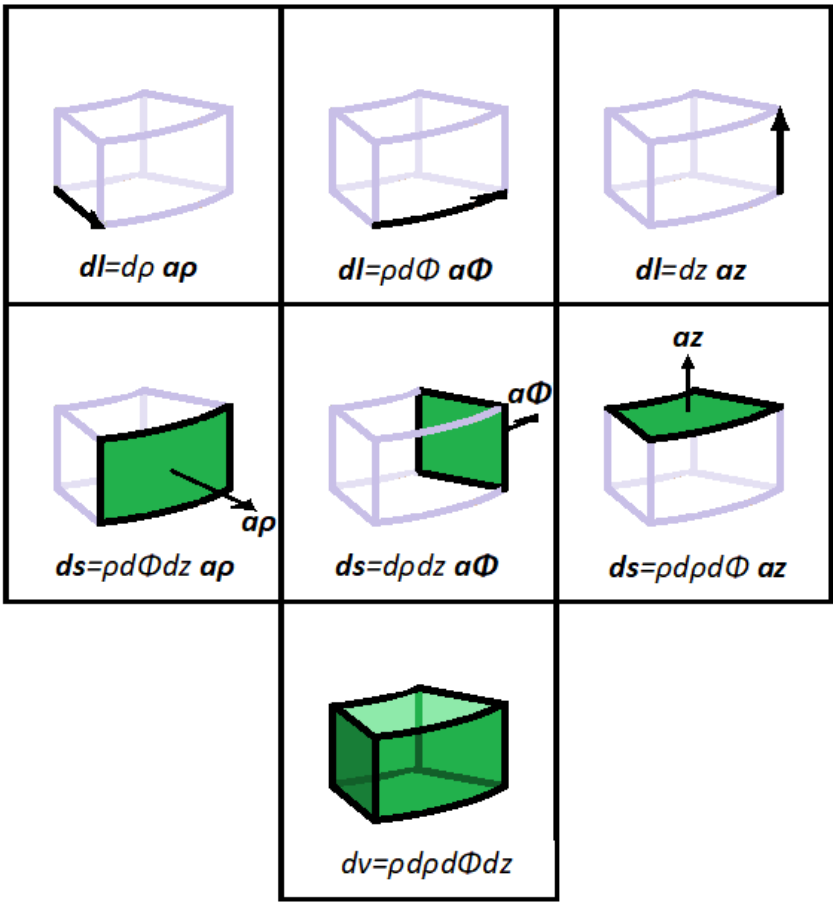
- **Cylindrical Coordinate System الاحداثيات الاسطوانية**

1- Differential displacement (dl)

$\boldsymbol{dl} = d\rho\ \boldsymbol{a\rho}$

$\boldsymbol{dl} = \rho d\Phi\ \boldsymbol{a\Phi}$

$\boldsymbol{dl} = dz\ \boldsymbol{az}$



2- Differential area (ds)

$\boldsymbol{ds} = \rho d\Phi dz\ \boldsymbol{a\rho}$

$\boldsymbol{ds} = d\rho dz\ \boldsymbol{a\Phi}$

$\boldsymbol{ds} = \rho d\rho d\Phi\ \boldsymbol{az}$

3-Differential volume (dv)

$dv = \rho d\rho d\Phi dz$

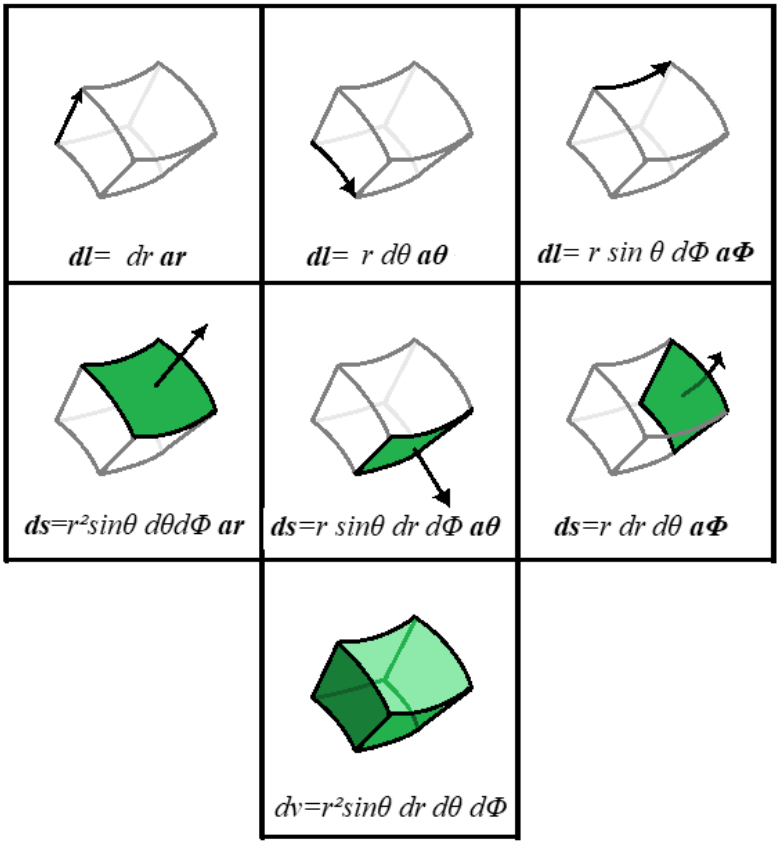
- **Spherical Coordinate System الاحداثيات الكروية**

1-Differential displacement (dl)

dl= dr **ar**

dl=r dθ **aθ**

dl=r sin θ dΦ **aΦ**



2- Differential area (ds)

ds=r²sinθ dθdΦ **ar**

ds=r sinθ dr dΦ **aθ**

ds=r dr dθ **aΦ**

3-Differential volume (dv)

dv=r²sinθ dr dθ dΦ

جدول عام يوضح (differential elements) لانظمة الاحداثيات الكارتيزي والاسطواني والكروي

	Differential elements	Cartesian	Cylindrical	Spherical
1	Differential displacement **(dl)**	dx **ax** dy **ay** dz **az**	dρ **aρ** ρdΦ **aΦ** dz **az**	dr **ar** r dθ **aθ** r sin θ dΦ **aΦ**
2	Differential area **(ds)**	dy dz **ax** dx dz **ay** dx dy **az**	ρdΦdz **aρ** dρdz **aΦ** ρdρdΦ **az**	r^2sinθ dθdΦ **ar** r sinθ dr dΦ **aθ** r dr dθ **aΦ**
3	Differential volume (dv)	dx dy dz	ρdρdΦdz	r^2sinθ dr dθ dΦ

Table(1): *The differential elements of the three coordinate systems*