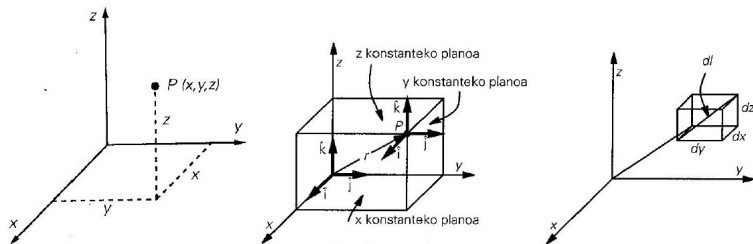


KOORDENATU SISTEMAK

- **OSAGAI KARTESIARRAK** (x, y, z)

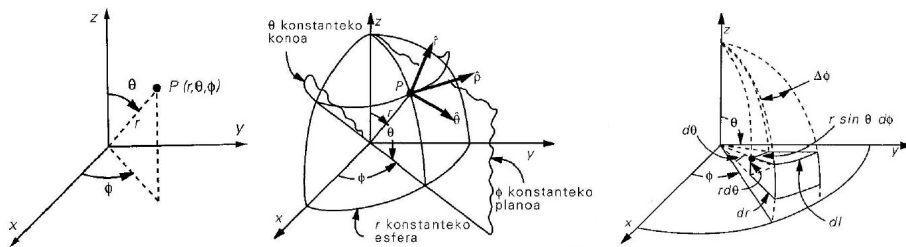
Bektore unitarioak $\hat{i}, \hat{j}, \hat{k}$, posizio bektorea $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.



Bektore diferentziala $d\vec{l} = dx\hat{i} + dy\hat{j} + dz\hat{k}$,
 Gainazal elementuak $dS_x = dydz$, $dS_y = dx dz$, $dS_z = dx dy$
 Bolumen elementuak $dV = dx dy dz$

- **OSAGAI ESFERIKOAK** (r, θ, ϕ)

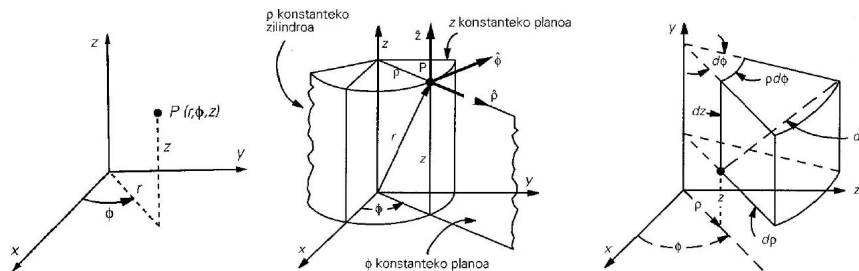
Bektore unitarioak $\hat{r}, \hat{\theta}, \hat{\phi}$, posizio bektorea $\vec{r} = r\hat{i} + \theta\hat{j} + \phi\hat{k}$.



Bektore diferentziala $d\vec{l} = dr\hat{r} + r d\theta\hat{\theta} + r \sin\theta d\phi\hat{\phi}$,
 Gainazal elementuak $dS_r = r^2 \sin\theta d\theta d\phi$, $dS_\theta = r \sin\theta dr d\phi$, $dS_\phi = r dr d\theta$
 Bolumen elementuak $dV = r^2 \sin\theta dr d\theta d\phi$

- **OSAGAI ZILINDRIKOAK** (ρ, ϕ, z)

Bektore unitarioak $\hat{\rho}, \hat{\phi}, \hat{k}$, posizio bektorea $\vec{r} = \rho\hat{\rho} + z\hat{k}$.



Bektore diferentziala $d\vec{l} = d\rho\hat{\rho} + \rho d\phi\hat{\phi} + dz\hat{k}$,
 Gainazal elementuak $dS_\rho = \rho d\phi dz$, $dS_\phi = \rho dz$, $dS_z = \rho d\rho d\phi$
 Bolumen elementuak $dV = \rho d\phi dz$