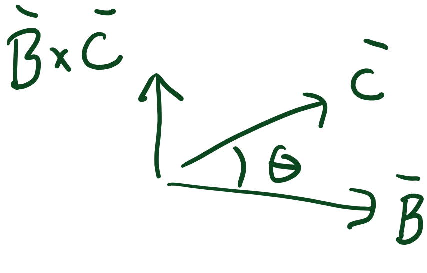
$$\bar{B}\cdot\bar{B} = |\bar{B}|^2 = B^2$$

$$\frac{\bar{B}}{|\bar{B}|} = \frac{\bar{B}}{\sqrt{\bar{B}\cdot\bar{B}}} = \bar{a}_B$$



$$|\bar{B}\times\bar{C}| = |\bar{B}|\,|\bar{C}|\sin\theta$$

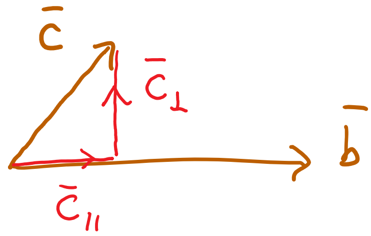
$$\bar{C}\times\bar{B} = -\bar{B}\times\bar{C}$$

$$\bar{A}\cdot\bar{B}\times\bar{C} = \bar{A}\times\bar{B}\cdot\bar{C} = \bar{C}\cdot\bar{A}\times\bar{B}$$

$$\bar{A}\times(\bar{B}\times\bar{C}) = \bar{B}(\bar{A}\cdot\bar{C}) - \bar{C}(\bar{A}\cdot\bar{B})$$

$$(\bar{A}\times\bar{B})\times\bar{C} = \bar{B}(\bar{A}\cdot\bar{C}) - \bar{A}(\bar{B}\cdot\bar{C})$$

$\bar{b}\ ,\ \bar{c}$



$$\bar{c} = \bar{c}_\parallel + \bar{c}_\perp$$

$$= \alpha\, \bar{b} + \beta\, (\bar{b}\times\bar{c})\times\bar{b}$$

$$\bar{b}\cdot\bar{c} = \alpha\, \bar{b}\cdot\bar{b} + \beta \underbrace{\left[(\bar{b}\times\bar{c})\times\bar{b}\right]\cdot\bar{b}}_{(\bar{b}\times\bar{c})\cdot\underbrace{\bar{b}\times\bar{b}}_{=0}} = \alpha\, \bar{b}\cdot\bar{b} \Rightarrow \alpha = \frac{\bar{b}\cdot\bar{c}}{\bar{b}\cdot\bar{b}}$$

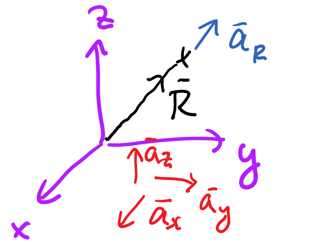
$$\bar{b}\times\bar{c} = \alpha \underbrace{\bar{b}\times\bar{b}}_{0} + \beta\, \bar{b}\times\left[(\bar{b}\times\bar{c})\times\bar{b}\right] = \beta\left[(\bar{b}\times\bar{c})\,\bar{b}\cdot\bar{b} - \bar{b}\,\underbrace{(\bar{b}\cdot\bar{b}\times\bar{c})}_{0}\right]$$

$$= \underbrace{\beta\, \bar{b}\cdot\bar{b}}_{1}\ \bar{b}\times\bar{c}$$

$$\bar{c} = \frac{\bar{b}\cdot\bar{c}}{\bar{b}\cdot\bar{b}}\,\bar{b} + \frac{(\bar{b}\times\bar{c})\times\bar{b}}{\bar{b}\cdot\bar{b}}$$

!

CARTESIAN COORDINATE SYSTEM



$$\bar{R} = x\,\bar{a}_x + y\,\bar{a}_y + z\,\bar{a}_z$$

$$|\bar{R}| = \sqrt{\bar{R}\cdot\bar{R}} = \sqrt{x^2+y^2+z^2}$$

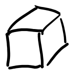
(x, y, z)

$$\bar{a}_R = \frac{\bar{R}}{|\bar{R}|}$$

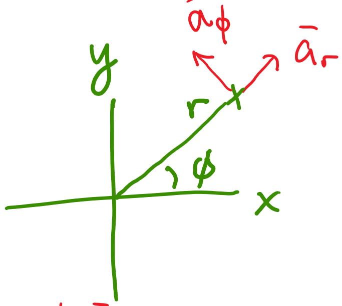
$\bar{a}_x \cdot \bar{a}_x = 1$

$\bar{a}_x \cdot \bar{a}_y = 0$

$$d\bar{l} = dx\,\bar{a}_x + dy\,\bar{a}_y + dz\,\bar{a}_z$$



$$dV = dx\,dy\,dz$$



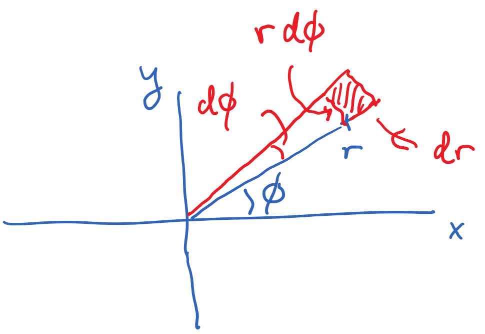
CYLINDRICAL C. SYSTEM

(r, ϕ, z)

$\bar{a}_r \quad \bar{a}_\phi \quad \bar{a}_z$

$$\bar{a}_r = \cos\phi\,\bar{a}_x + \sin\phi\,\bar{a}_y$$

$$\bar{a}_\phi = \cos\phi\,\bar{a}_y - \sin\phi\,\bar{a}_x$$



$r = \sqrt{x^2+y^2}$

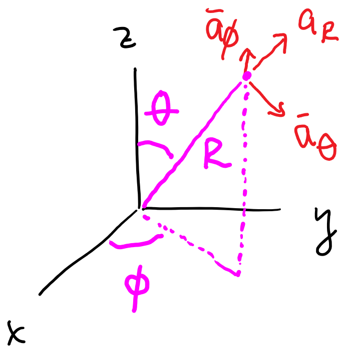
$\tan\phi = y/x$

$$dS = r\,d\phi\,dr$$

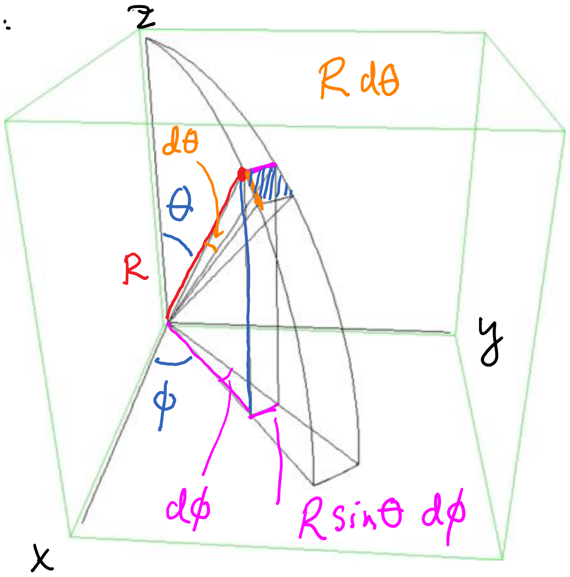
$$dV = dS\,dz$$

SPHERICAL C. SYSTEM

(R, θ, ϕ)



$\bar{a}_R \cdot \bar{a}_R = 1$



$\bar{a}_R \cdot \bar{a}_\theta = 0$

$\bar{a}_R \times \bar{a}_\theta = \bar{a}_\phi$ ...

$$dS = R\,d\theta \;\; R\sin\theta\,d\phi$$

$$= \sin\theta \; R^2 \; d\theta \; d\phi$$

$$dV = dR \cdot dS$$