

$$= 4ab \int_0^{\pi/2} \sin \theta d\theta = 2ab \int_0^{\pi/2} d\theta - 2ab \int_0^{\pi/2} \cos 2\theta d\theta$$

$$Ch = 6 = \pi ab$$

The two sets becomes identical iff the curvilinear coordinate system is orthogonal

2) If the coordinate curves intersect at right angles the curvilinear coordinate system is called orthogonal

2) u_1, u_2, u_3 coordinate curve of an orthogonal curvilinear system
 x, y, z coordinate axis of a Rectangular Cartesian system

$$\Rightarrow E_1 = \frac{\nabla u_1}{|\nabla u_1|}, E_2 = \frac{\nabla u_2}{|\nabla u_2|}, E_3 = \frac{\nabla u_3}{|\nabla u_3|}$$

are unit vector

on curvilinear coordinate system the unit vector $\hat{e}_1, \hat{e}_2, \hat{e}_3$ are mutually orthogonal

$$\Rightarrow \hat{e}_1 \cdot \hat{e}_2 = \hat{e}_2 \cdot \hat{e}_3 = \hat{e}_3 \cdot \hat{e}_1 = 0$$

$$\Rightarrow \hat{e}_1 \cdot \hat{e}_1 = \hat{e}_2 \cdot \hat{e}_2 = \hat{e}_3 \cdot \hat{e}_3 = 1$$

unit vector

$$A = A_1 \hat{e}_1 + A_2 \hat{e}_2 + A_3 \hat{e}_3, \text{ where } A_1, A_2, A_3 \text{ are component of } A$$

$\Rightarrow$ The three coordinate curve are generally no straight line then a coordinate