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For a surface **S**, there are two free variables. This means:

$$\mathrm{d}\mathbf{S} = \left(\frac{\partial \mathbf{r}}{\partial x}\,\mathrm{d}x\right) \times \left(\frac{\partial \mathbf{S}}{\partial y}\,\mathrm{d}y\right)$$

$$\mathrm{d}\mathbf{S} = \left(\frac{\partial \mathbf{r}}{\partial \theta}\,\mathrm{d}\theta\right) \times \left(\frac{\partial \mathbf{S}}{\partial \phi}\,\mathrm{d}\phi\right)$$

Over the surface of a **sphere**:

$$\mathrm{d}S = a^2 \sin\theta \,\mathrm{d}\theta \,\mathrm{d}\phi$$

Where a is the radius of the sphere.
The volume is:

$$\mathrm{d}V = r^2 \sin\theta \,\mathrm{d}r \,\mathrm{d}\theta \,\mathrm{d}\phi$$

Divergence Theorem:

$$\oint \mathbf{F} \cdot \mathrm{d}\mathbf{S} = \oint \nabla \times \mathbf{F} \,\mathrm{d}\mathbf{V}$$

Curl of a potential field is zero:

$$\forall \phi . \nabla \times \nabla \phi = 0$$