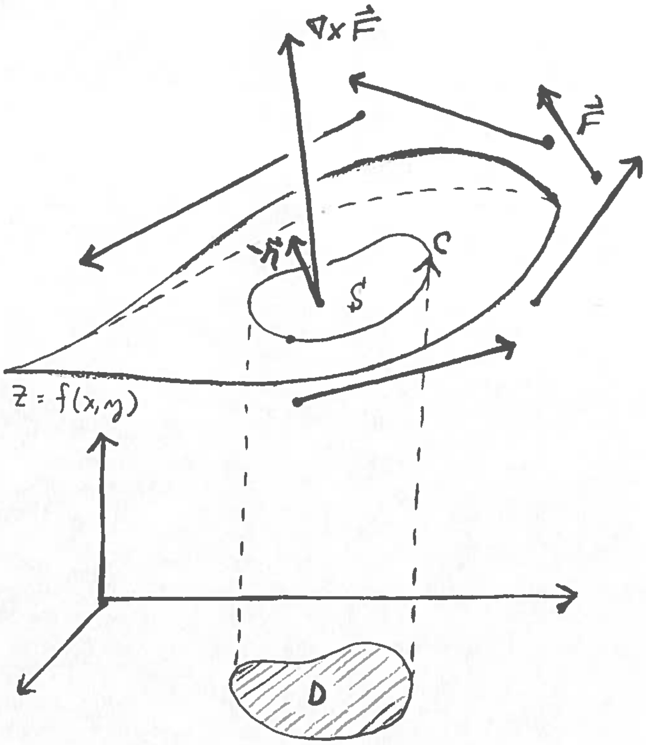

$\int_C \vec{F}\cdot d\vec{r}$	$\nabla\times\vec{F}\neq\vec{0}$	$\nabla\times\vec{F}=\vec{0}$
any C	$\int P\,dx+Q\,dy+R\,dz$ and substitute t $\Rightarrow$ $\Downarrow$	$\left[f_p\right]_{start}^{finish}$ by FTVC $\Downarrow$
C closed	C simple, on surface $\Rightarrow$ $\iint_D (\nabla\times\vec{F})\cdot(-\vec{n})\,dA$ Stokes/Greens	0 by FTVC

$\left(-\vec{n}=\langle -f_x,-f_y,1\rangle\right)$ (f_p = potential)

Scalars

$$V=\iint_D f(x,y)\,dA \quad ; \quad \text{type I} \Rightarrow dy\,dx \quad \text{type II} \Rightarrow dx\,dy$$
$$\text{polar} \Rightarrow r\,dr\,d\theta$$

$$\text{mass}=\iiint_D f(x,y,z)\,dV \quad ; \quad \text{type I} \Rightarrow dz\,dy\,dx$$
$$\text{type II} \Rightarrow dz\,dx\,dy$$

$$V=\iiint_D 1\,dV \quad ; \quad \text{cylindrical} \Rightarrow r\,dz\,dr\,d\theta$$
$$\text{spherical} \Rightarrow \rho^2\sin\phi\,d\rho\,d\theta\,d\phi$$

$$\text{div}(\vec{F})=\nabla\cdot\vec{F}=\partial_x P+\partial_y Q+\partial_z R=P_x+Q_y+R_z$$

Vectors

$$\text{curl}(\vec{F})=\nabla\times\vec{F}=\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ \partial_x & \partial_y & \partial_z\\ P & Q & R\end{vmatrix}=\langle R_y-Q_z,\,-(R_x-P_z),\,Q_x-P_y\rangle$$

If $\nabla\times\vec{F}=\vec{0}$, (smooth & continuous $\vec{F}$), $\vec{F}$ is conservative, gradient, path indep.

then we can find potential $f(x,y,z)$ with $\vec{F}=\nabla f$.

$$\text{flux}=\iint_S \vec{F}\cdot d\vec{S}=\iint_D \vec{F}\cdot(-\vec{n})\,dA$$

Unbounded S surface of 3D volume E $\}$ $\text{flux}=\iiint_E \nabla\cdot\vec{F}\,dV$