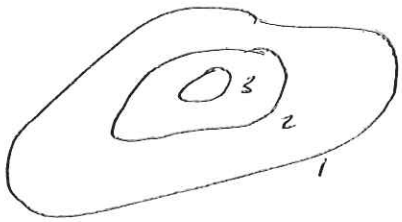
Math needed from Phys 274

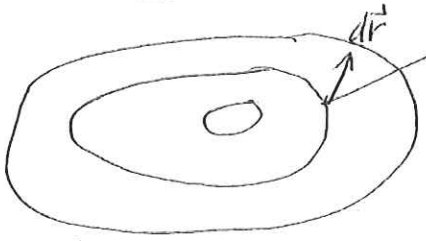
- Perform line integrals $\int_A^B d\vec{r} \cdot \vec{F}(\vec{r})$

- Vector Fields $\vec{F}(\vec{r})$

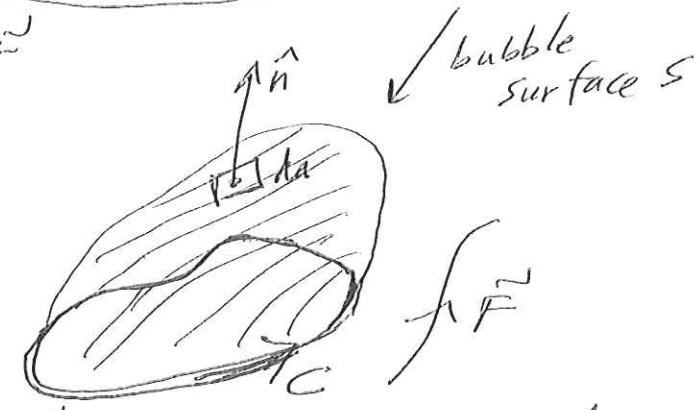
- Scalar field $U(\vec{r})$



- Understand $\vec{\nabla} U$



- Understand $dU = d\vec{r} \cdot \vec{\nabla} U$
  - change in U for $d\vec{r}$
- Perform $\vec{\nabla} \times \vec{F}$
- Stokes Theorem



$\oint_C d\vec{r} \cdot \vec{F} = \int_S da\, \hat{n} \cdot \vec{\nabla} \times \vec{F}$, right hand rule

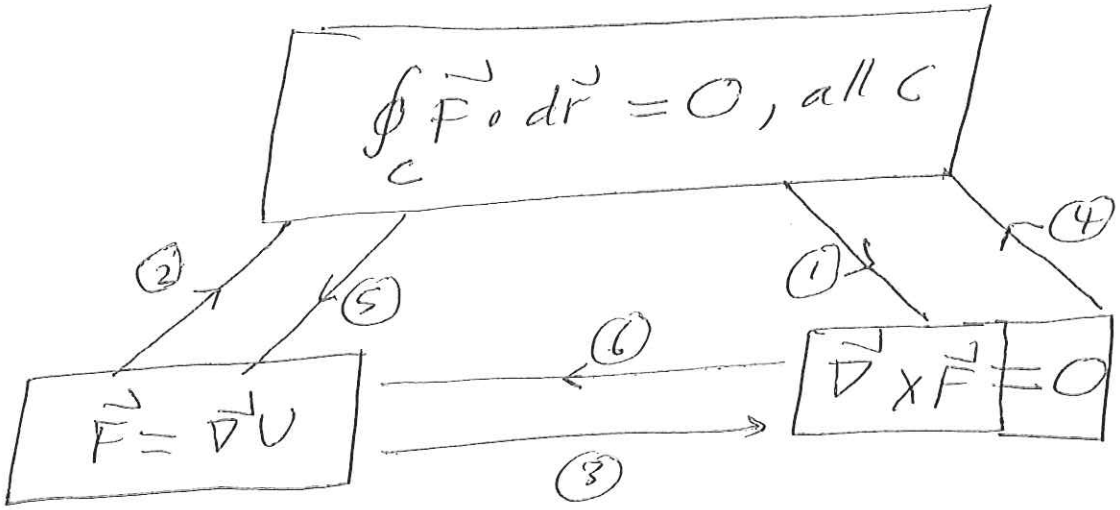
for given C, all bubbles S allowed

- Cartesian, polar, cylindrical, spherical coordinate systems

$\oint_C \vec{F}\cdot d\vec{r}$, $\vec{F}=\vec{\nabla}U$, and $\vec{\nabla}\times\vec{F}$ are related

W7

The below boxes are $\Leftrightarrow$ true



(1) by Stokes' Theorem

(2) by the fact $d\vec{r}\cdot\vec{\nabla}U = dU$

(3) by direct plug in

(4) by Stokes'

(5) $\int_{\vec{r}}^{\vec{r}+d\vec{r}} \vec{F}\cdot d\vec{r} \Rightarrow \vec{F}\cdot d\vec{r} = dU$. But $dU = d\vec{r}\cdot\vec{\nabla}U$
$\Rightarrow \vec{F}=\vec{\nabla}U$

(6) Use (4) and (5)