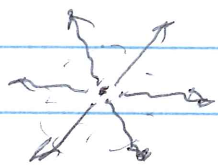
EE 331 - LECT. #21 MAR. 6, 2020

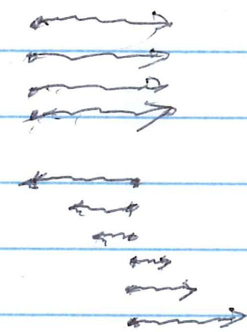
3. divergence of a vector field = scalar field

$$\text{div } \bar{A} = \nabla \cdot \bar{A}$$
$$= \lim_{\Delta V \to 0} \oint \bar{A} \cdot \bar{ds}$$



4. curl of a vector field = vector field

$$\text{curl } \bar{A} = \nabla \times \bar{A}$$



4. laplacian of a scalar or vector field = scalar or vector field

laplacian of $V = \nabla^2 V$

" " $\bar{A} = \nabla^2 \bar{A}$

two important & very useful vector identities
always true

1) $\nabla \times \nabla V = 0$ curl of grad is zero

2) $\nabla \cdot (\nabla \times \bar{A}) = 0$ div of curl is zero

<u>two important theorems for vector fields</u>

div thm: $\oint_S \bar{A}\cdot d\bar{s} = \int_V (\nabla\cdot\bar{A})\, dv$

stokes's thm: $\oint_L \bar{A}\cdot d\bar{l} = \int_S (\nabla\times\bar{A})\cdot d\bar{s}$

div thm: 1) net outward flux of $\bar{A}$ from S = vol integral of div of $\bar{A}$

2) closed double integral = triple integral

stokes's thm: 1) circulation of $\bar{A}$ around L = open surf integral of div of $\bar{A}$

2) closed line integral = open surf integral

ex. #16