

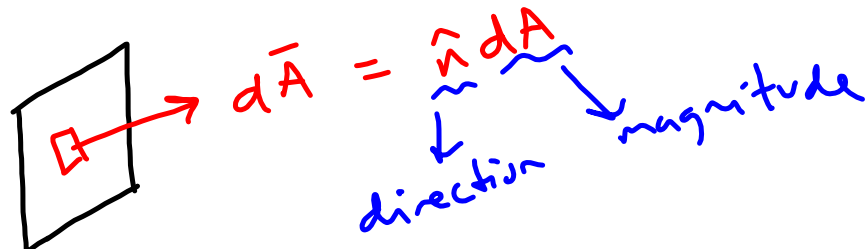
## PATTERNS OF FIELDS (M&I ch. 21)

$\oint$   $\rightarrow$  closed loop integral

- Gauss' Law

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$$

- Electric Flux

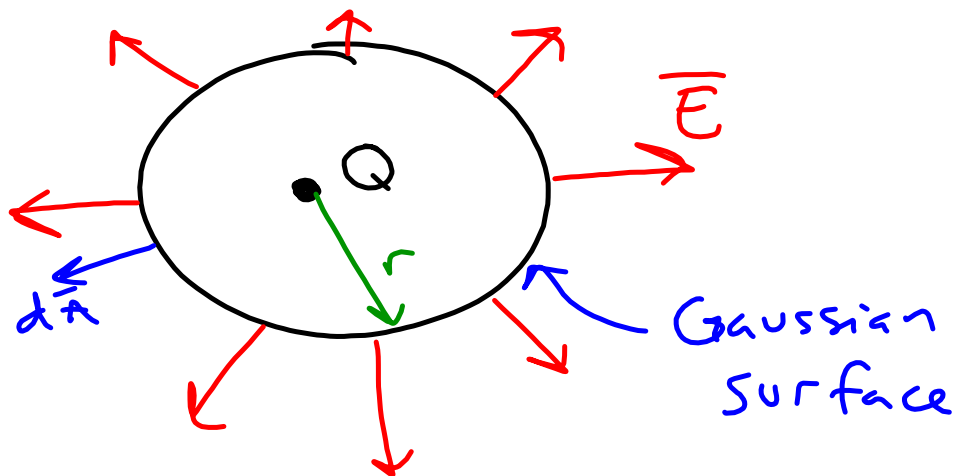


- Maximum flux ( $\Phi_E$ ) when  $\bar{E}$  and  $d\bar{A}$  are parallel or antiparallel [ $\bar{E} \cdot d\bar{A}$ ]

- minimum ( $\emptyset$ ) when  $\bar{E}$  is perpendicular to  $d\bar{A}$

- $\Phi_e = \oint \bar{E} \cdot d\bar{A}$

- Usually use spheres:  
Surface area =  $4\pi r^2$



$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$$

$$\oint \vec{E} \cdot d\vec{A} = \left( \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2} \right) (4\pi r^2) = \frac{Q}{\epsilon_0}$$

- Examples
  - p. 876
  - p. 877
  - p. 878

- Problems
  - P 7
  - P 9