# ECE 2300J
# Recitation Class 2

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# Pre-class

- Quiz this Thursday! (Usually start around 8:00pm)
  - Content: Chap.2
  - Format: 2~3 questions with simple calculation!
  - Online quiz regulations:
    - At least one camara on showing both computer screen and yourself!
    - Have extra 5 mins to submit. No need to rush.
    - I will be supervising the entire process and to help you set up!

Good luck on the first quiz!

# 2.1 Recap-Useful Vector theorems

- Divergence Theorem:

# 2.1 Recap-Useful Vector theorems

- Stokes Theorem:

# 2.1 Recap-Useful Vector theorems

- Null identities:

# Ex.1 Theorems application

- (HW1-5) For vector function $\mathbf{A} = \mathbf{a_r} r^2 + \mathbf{a_z} 2z$, verify the divergence theorem for the circular cylindrical region enclosed by $r = 5$, $z = 0$, and $z = 4$.

# Ex.1 Theorems application Cont.

# 2.2 Electrostatics

- Key Requirements:

- Field density:

# 2.2 Electrostatics

- Strength-Colomb’ s Law

# 2.2.1 Maxwell’s Description

- Gauss’s Law:

# 2.2.1 Maxwell’s Description

- Conservativeness:

# Ex.2 Electrostatics

A total charge $Q$ is put on a thin spherical shell of radius $b$. Determine the electric field intensity at an arbitrary point inside the shell

# Ex.2 Electrostatics Cont.

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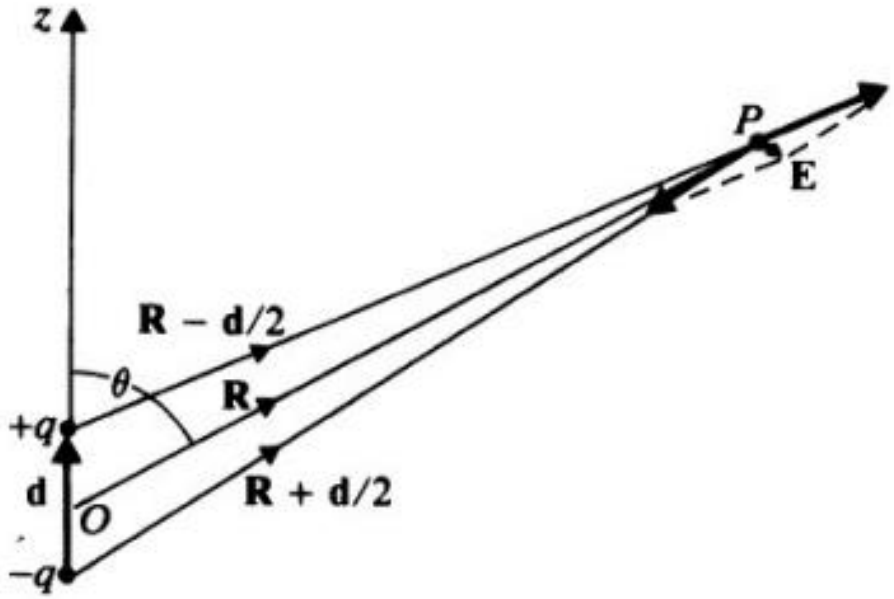
# 2.2.2 Dipole

- Definition:




- E.g.:

# 2.2.2 Dipole

- Field:
  - Vector Form:

  - Spherical coordination:

- Moment:

# 2.2.3 Continuous Distributed Charges

- Differentiated element:

# 2.2.3 Continuous Distributed Charges

- Line:
- Surface:
- Volume:

# 2.2.4 Application of Gauss's Law

- When to use?

- Example:

  Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density $\rho_\ell$ in air.

# Ex.3 Method 1 – Integration

Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density $\rho_\ell$ in air.

# Ex.3 Method 2 – Gauss's Law

Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density $\rho_\ell$ in air.

# 2.2.4 Application of Gauss's Law

- Some Important Results:

| different models | E(magnitude) |
|---|---|
| infinitely long, line charge | $E = \frac{\rho_\ell}{2\pi r \epsilon_0}$ |
| infinite planar charge | $E = \frac{\rho_s}{2\epsilon_0}$ |
| uniform spherical surface charge with radius R | $\begin{cases} E = 0 (r < R) \\ E = \frac{Q}{4\pi r^2 \epsilon_0} (r > R) \end{cases}$ |
| uniform sphere charge with radius R | $\begin{cases} E = \frac{Qr}{4\pi R^3} (r < R) \\ E = \frac{Q}{4\pi r^2 \epsilon_0} (r > R) \end{cases}$ |
| infinitely long, cylindrical charge with radius R | $\begin{cases} E = \frac{\rho_v r}{2\epsilon_0} (r < R) \\ E = \frac{\rho_v R^2}{2r\epsilon_0} (r > R) \end{cases}$ |

# Thank You

Credit to Deng Naihao for this slides & information