

Class Pace – Equations

How is the pace at which I go through equations in the power point documents?

1. Too Fast
2. Too Slow
3. Okay

Class Pace – Concepts

How is the pace at which I go through concepts during a presentation?

1. Too Fast
2. Too Slow
3. Okay

Class Pace – PRS

Do I spend enough time discussing the correct answers to the PRS questions?

1. Not enough time
2. Too much time
3. Okay

Class Pace – Table Problems

Do you have enough time to do the table based in class problems?

1. Not enough time
2. Too much time
3. Okay

Preparation

Do you read before coming to class?

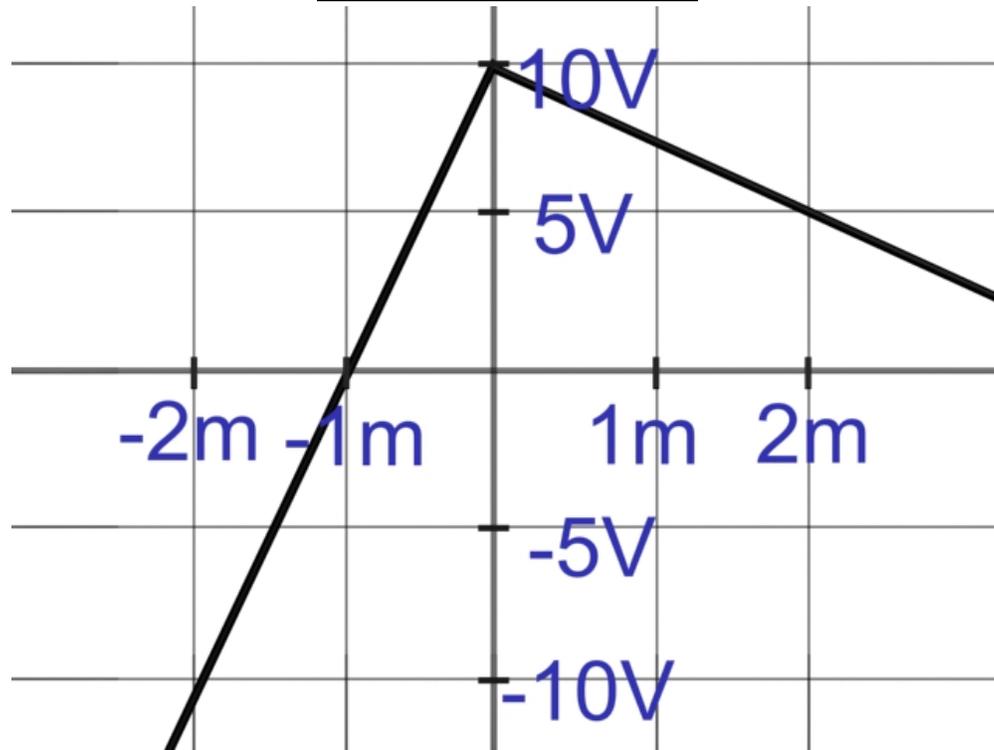
1. Yes, summary & reading
2. Yes, summary only
3. I scan the summary
4. No, not at all

Note Taking

Do you take notes in class?

1. Yes, on lecture print outs
2. Yes, in “traditional” way
3. No

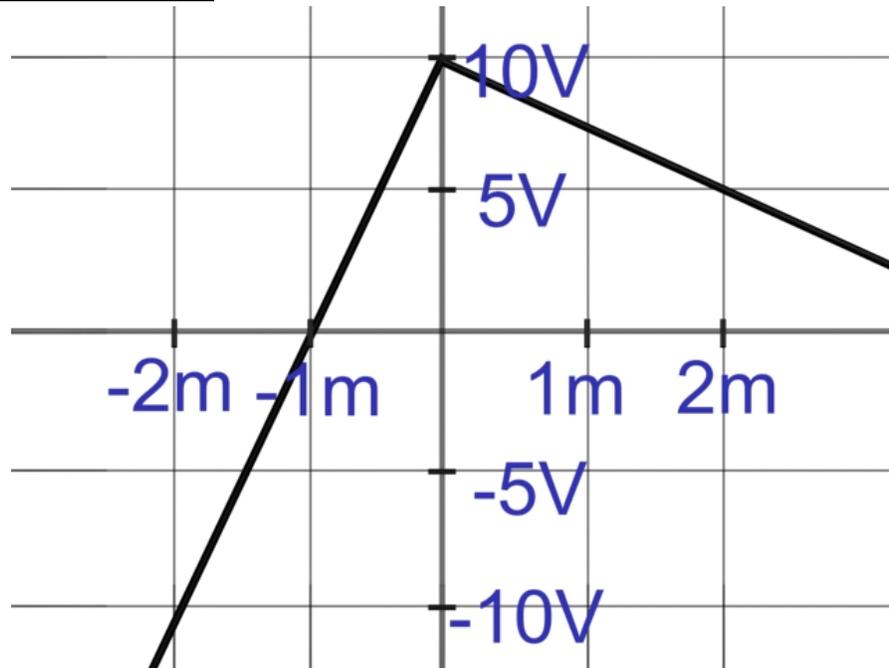
E from V



The graph above shows a potential V as a function of x . The *magnitude* of the electric field for $x > 0$ is

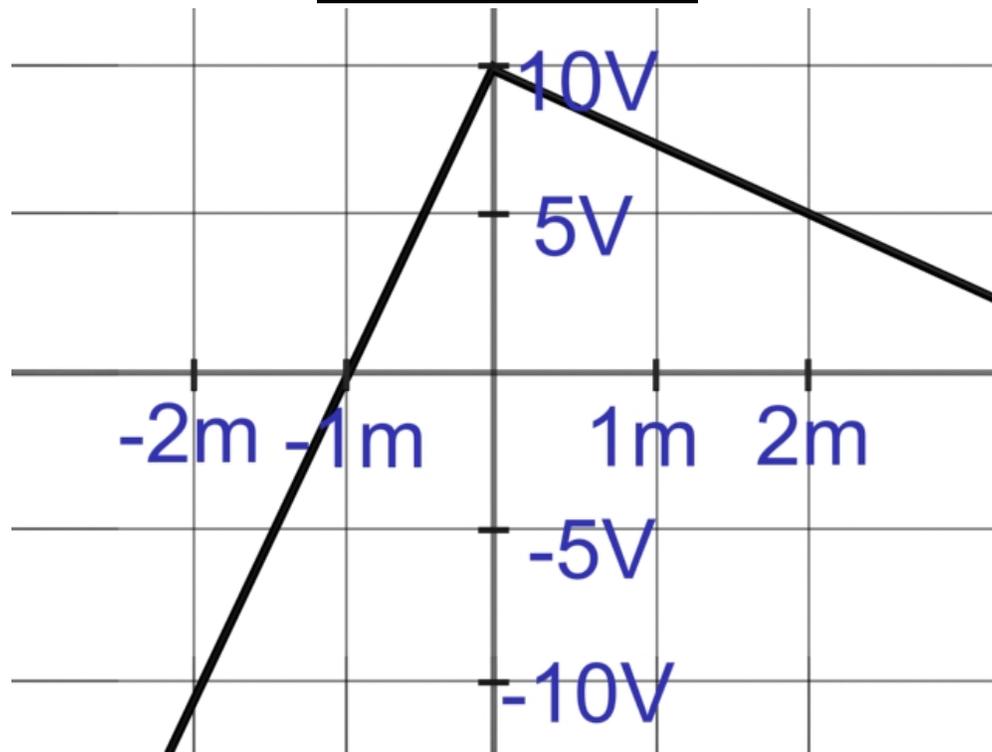
1. larger than that for $x < 0$
2. smaller than that for $x < 0$
3. equal to that for $x < 0$
4. I don't know

E from V



(2) The electric field for $x > 0$ is smaller than that for the electric field for $x < 0$ because the slope of the potential is smaller in the region $x > 0$ as compared to $x < 0$. **Translation:** The hill is steeper on the left than on the right.

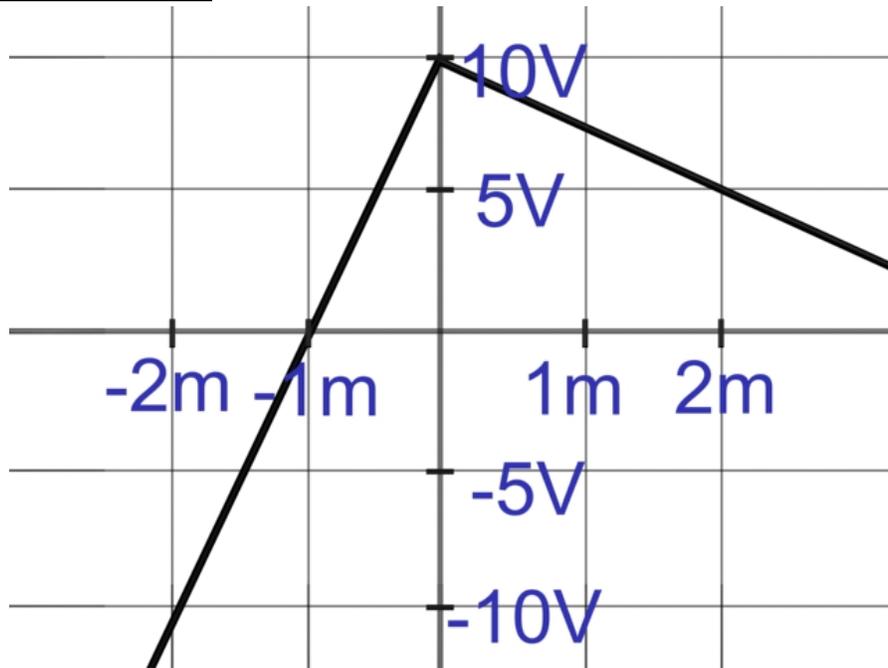
E from V



The graph above shows a potential V as a function of x . Which is true?

1. $E_{x > 0}$ is > 0 and $E_{x < 0}$ is > 0
2. $E_{x > 0}$ is > 0 and $E_{x < 0}$ is < 0
3. $E_{x > 0}$ is < 0 and $E_{x < 0}$ is < 0
4. $E_{x > 0}$ is < 0 and $E_{x < 0}$ is > 0
5. I don't know

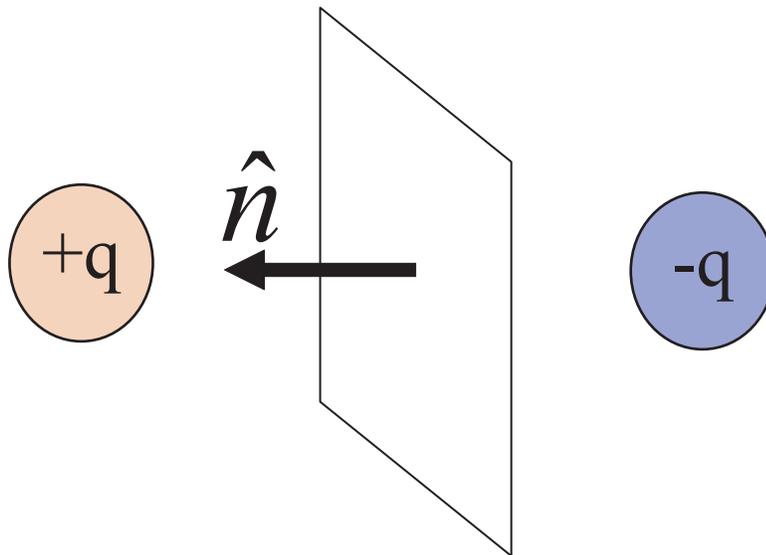
E from V



(2) The electric field for $x > 0$ is in the positive x -direction, because as x decreases for $x > 0$ the potential increases, which can only happen if the electric field opposes movement to smaller x for $x > 0$. **Translation:** “Downhill” is to the left on the left and to the right on the right.

Flux Direction

The flux through the planar surface below (positive unit normal to left)

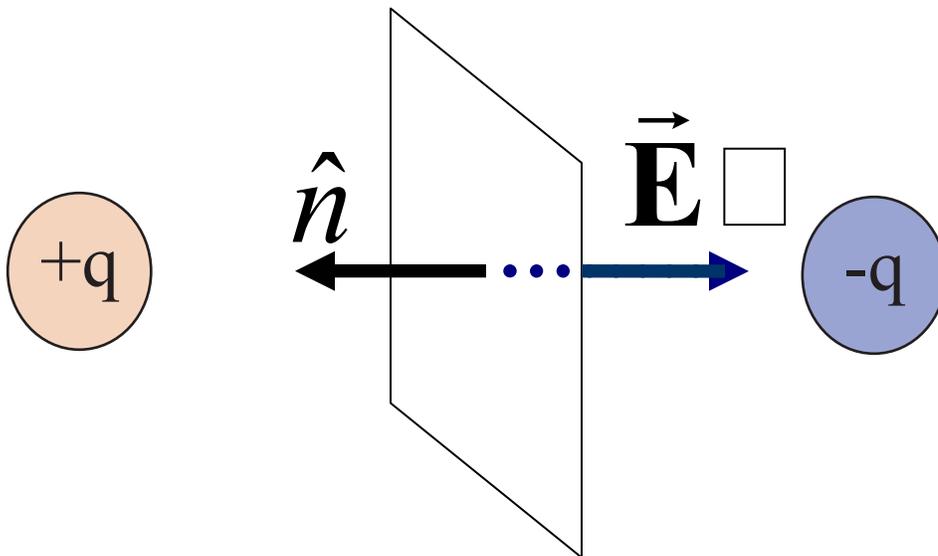


1. is positive.
2. is negative.
3. is zero.
4. I don't know

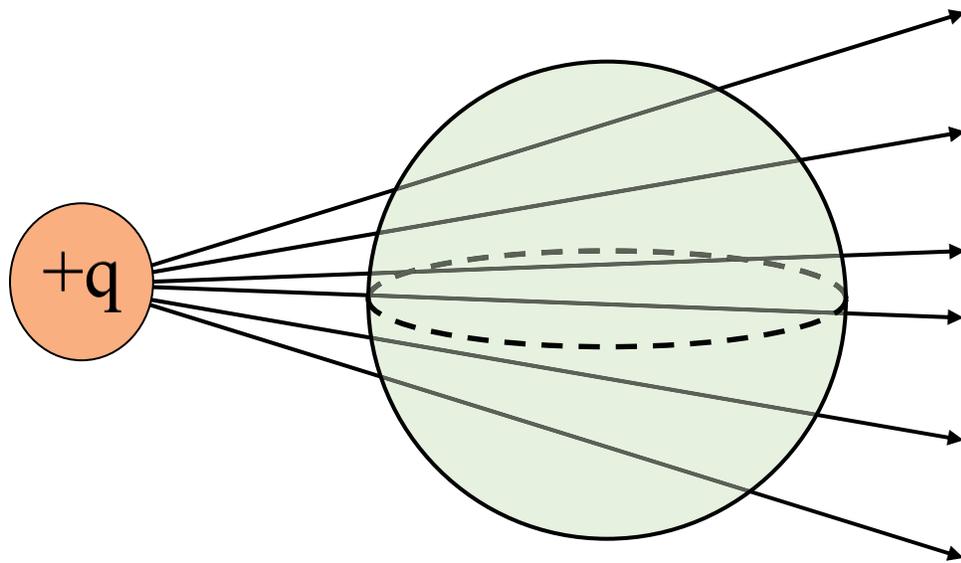
Flux Direction

(2) The flux is negative

The field lines go from left to right, opposite the assigned normal direction. Hence the flux $\vec{E} \cdot d\vec{A}$ is negative.



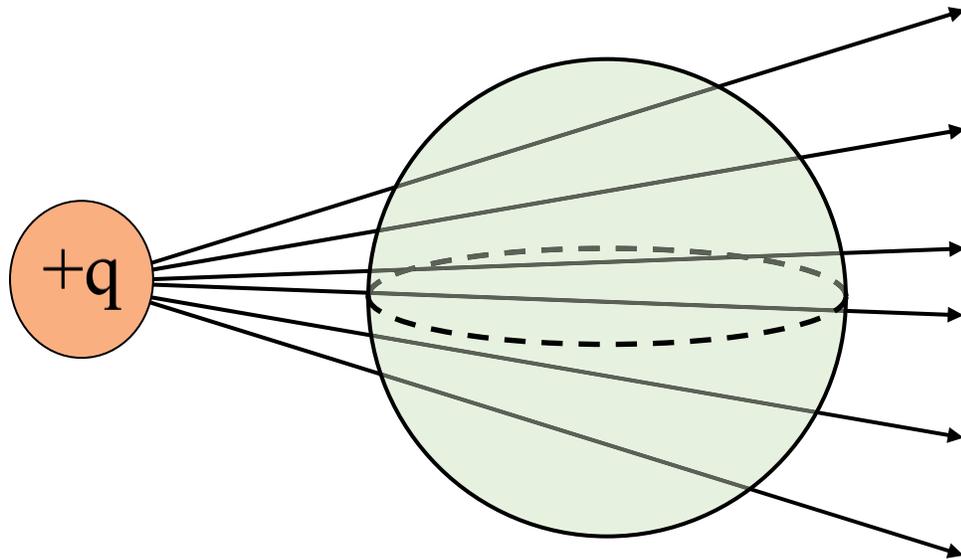
Flux Through Sphere



The total flux through the above spherical surface is

1. positive.
2. negative.
3. zero.
4. I don't know

Flux Through Sphere



(3) The total flux is zero

We know this from Gauss's Law:

$$\Phi_E = \oiint_{\text{closed surface } S} \vec{E} \cdot d\vec{A} = \frac{q_{in}}{\epsilon_0}$$

There is no enclosed charge so no net flux. The flux in on the left is cancelled by the flux out on the right.

Should We Use Gauss' Law?

For which of the following uniform charge distributions can we use Gauss' Law to determine the electric field?

- A. Concentric nested spherical shells
- B. Non-concentric nested spherical shells
- C. Finite line of charge
- D. Infinite line of charge
- E. Thin, infinite, sheet of charge
- F. Thick, infinite, slab of charge

- | | |
|--------------------|--------------------|
| 1. None of them | 2. All of them |
| 3. A, B, C only | 4. D, E, F only |
| 5. A, D, E, F only | 6. C, D only |
| 7. A, D, E only | 8. C, D, E, F only |

Should We Use Gauss' Law?

(5) A, D, E & F

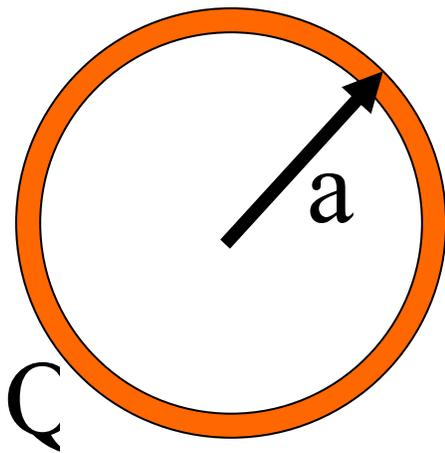
In order to effectively use Gauss' law, the charge distribution must have either spherical, cylindrical or planar symmetry.

- Concentric spheres have spherical symmetry, non-concentric do not
- Infinite lines have cylindrical symmetry, finite do not
- Infinite planes and slabs of charge both exhibit planar symmetry

Spherical Shell

We just saw that in a solid sphere of charge the electric field grows

linearly with distance.



Inside the charged spherical shell at left ($r < a$) what does the electric field do?

1. Constant and Zero
2. Constant but Non-Zero
3. Still grows linearly
4. Some other functional form
(use Gauss' Law to determine)
5. Can't determine with Gauss Law

Spherical Shell

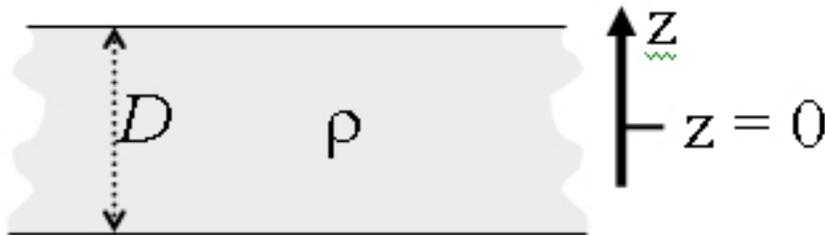
1. Constant and Zero

We have spherical symmetry so we can use Gauss' Law with a spherical surface. Any surface inside the spherical shell will contain no charge and hence have no flux through it. $E = 0!$

E Field from Slab

A positively charged, semi-infinite flat slab has thickness D .

The z -axis is perpendicular to the sheet, with center at $z = 0$.

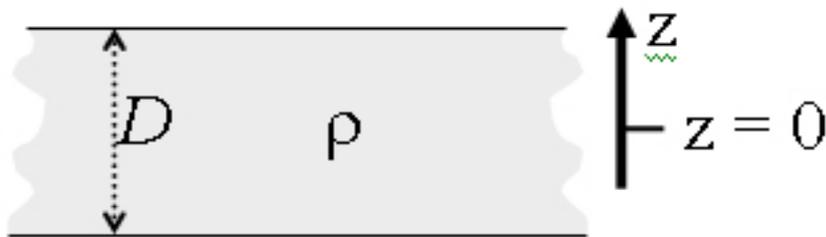


At the plane's center ($z = 0$), $\mathbf{E} \square$

1. points in the positive z -direction
2. points in the negative z -direction
3. is zero
4. I don't know

E Field from Slab

(3) At the center of the slab the electric field is 0.



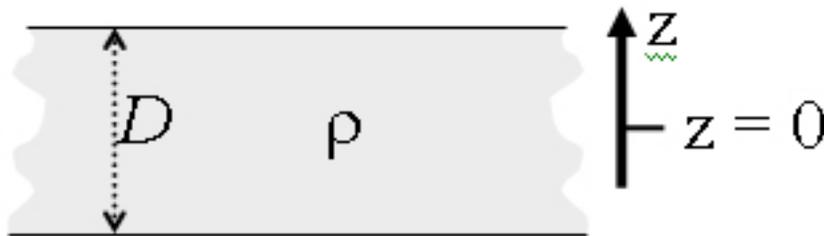
Symmetry tell us this – the amount of charge above and below the center of the plane is equal hence the fields cancel.

Another way of saying this is that since you don't know which way the field would point it must be 0.

E Field from Slab

A positively charged, semi-infinite flat slab has thickness D .

The z -axis is perpendicular to the sheet, with at $z = 0$.



A distance z from its central plane,

1. E is constant

2. $E \propto \frac{1}{z^2}$

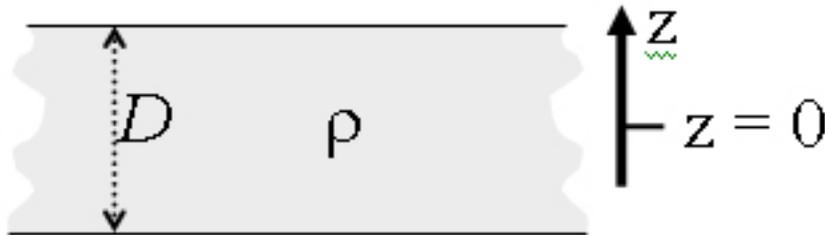
3. $E \propto \frac{1}{z}$

4. $E \propto z$

5. I don't know

E Field from Slab

(4) E is proportional to z inside the slab.



As you move away from the center, an imbalance is generated in the amount of charge below you and the amount above you. This imbalance grows linearly with z , and is what leads to the E field that you see.

Once outside the slab, the imbalance stops changing so the field is constant.