Consider a cube of constant charge density centered at the origin.

True or False: I can use Gauss' Law to find the electric directly above the center of the cube.

A. True and I can argue how we'd do it.
B. True. I'm sure we can, but I don't see how to just yet.
C. False. I'm pretty sure we can't, but I can't say exactly why.
D. False and I can argue why we can't do it.

ANNOUNCEMENTS

- First week for clickers is this week
  - I will drop the 3 lowest clicker grades
- Homework 2 (due Wed.)
  - No need to do Problem 5 (will be problem 1 on HW 4)
  - BTW, I will drop your lowest homework grade

What is the value of:

$$\int_{-\infty}^{\infty} x^2 \delta(x-2) dx$$

A. 0

B. 2

C. 4

D. ∞

E. Something else

Activity: Compute the following integrals. Note anything special you had to do.

- Row 1-2: $\int_{-\infty}^{\infty} xe^x \delta(x-1)dx$
- Row 3-4: $\int_{\infty}^{-\infty} \log(x)\delta(x-2)dx$
- Row 5-6: $\int_{-\infty}^{0} xe^x \delta(x-1)dx$
- Row 6+: $\int_{-\infty}^{\infty} (x+1)^2 \delta(4x)dx$

Compute:

$$\int_{-\infty}^{\infty} x^2 \delta(3x + 5)dx$$

A. $25/3$

B. $-5/3$

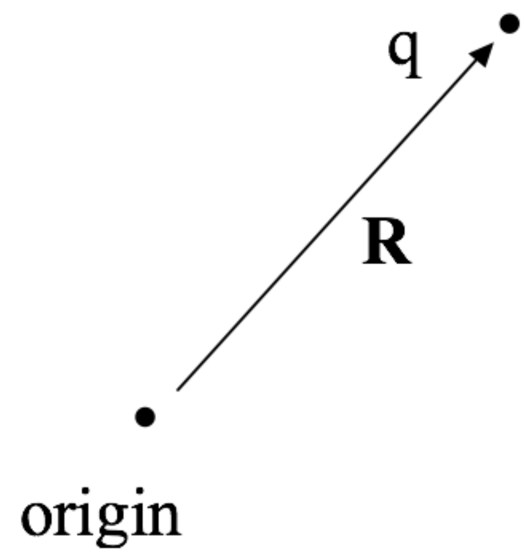
C. $25/27$

D. $25/9$

E. Something else

A point charge (q) is located at position $\mathbf{R}$, as shown. What is $\rho(\mathbf{r})$, the charge density in all space?

A. $\rho(\mathbf{r}) = q\delta^3(\mathbf{R})$
B. $\rho(\mathbf{r}) = q\delta^3(\mathbf{r})$
C. $\rho(\mathbf{r}) = q\delta^3(\mathbf{R} - \mathbf{r})$
D. $\rho(\mathbf{r}) = q\delta^3(\mathbf{r} - \mathbf{R})$
E. Something else??



What are the units of $\delta(x)$ if x is measured in meters?

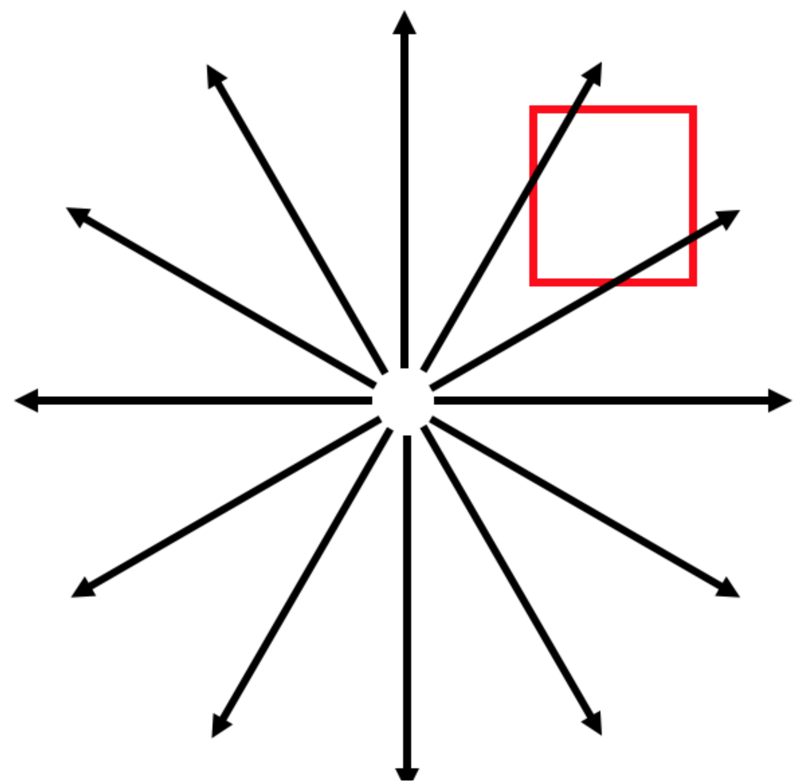
A. $\delta(x)$ is dimension less (‘no units’)
B. $[\mathrm{m}]$: Unit of length
C. $[\mathrm{m}^2]$: Unit of length squared
D. $[\mathrm{m}^{-1}]$: 1 / (unit of length)
E. $[\mathrm{m}^{-2}]$: 1 / (unit of length squared)

What are the units of $\delta^3(\mathbf{r})$ if the components of $\mathbf{r}$ are measured in meters?

A. $[\mathrm{m}]$: Unit of length
B. $[\mathrm{m}^2]$: Unit of length squared
C. $[\mathrm{m}^{-1}]$: 1 / (unit of length)
D. $[\mathrm{m}^{-2}]$: 1 / (unit of length squared)
E. None of these.

What is the divergence in the boxed region?

A. Zero
B. Not zero
C. ???

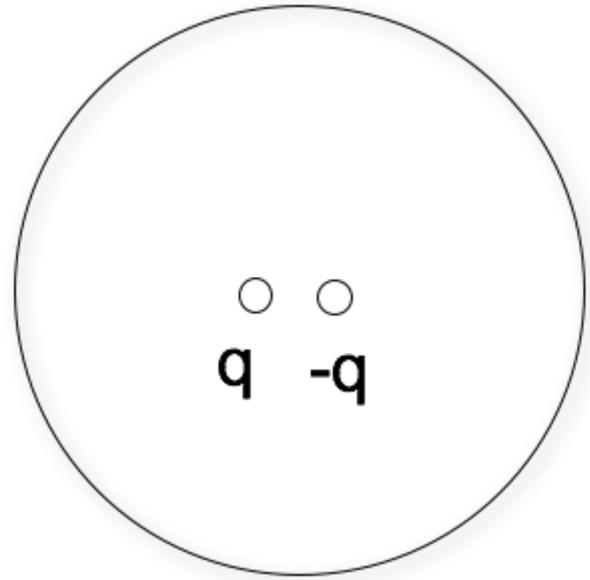


A Gaussian surface which is *not* a sphere has a single charge (q) inside it, *not* at the center. There are more charges outside. What can we say about total electric flux through this surface $\oint_S \mathbf{E} \cdot d\mathbf{A}$?

A. It is q/ε_0.
B. We know what it is, but it is NOT q/ε_0.
C. Need more info/details to figure it out.

An electric dipole ($+q$ and $-q$, small distance d apart) sits centered in a Gaussian sphere.

What can you say about the flux of $\mathbf{E}$ through the sphere, and $|\mathbf{E}|$ on the sphere?



A. Flux = 0, E = 0 everywhere on sphere surface
B. Flux = 0, E need not be zero *everywhere* on sphere
C. Flux is not zero, E = 0 everywhere on sphere
D. Flux is not zero, E need not be zero...

Tutorial follow-up:

Does the charge σ on the beam line affect the particles being accelerated inside it?

A. Yes
B. No
C. ???

Think: Why? Or why not?

Tutorial follow-up:

Could the charge σ affect the electronic equipment outside the tunnel?

A. Yes
B. No
C. ???

Think: Why? Or why not?