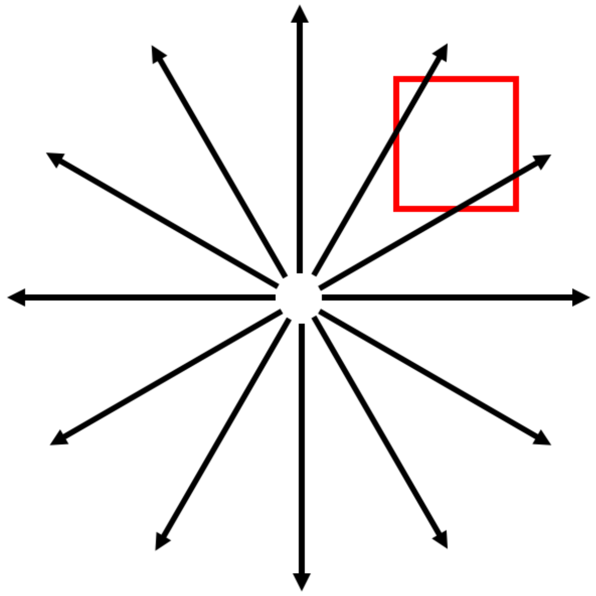


This picture represents the field lines of a single positive point charge.

What is the divergence in the boxed region? What is the divergence of the whole field?

A. Boxed region is zero; whole field is zero
B. Boxed region is non-zero; whole field is zero
C. Boxed region is zero; whole field is non-zero
D. Boxed region is non-zero; whole field is non-zero
E. ???

NOTES FROM HW 2 (FROM BRYAN)

To get full credit:

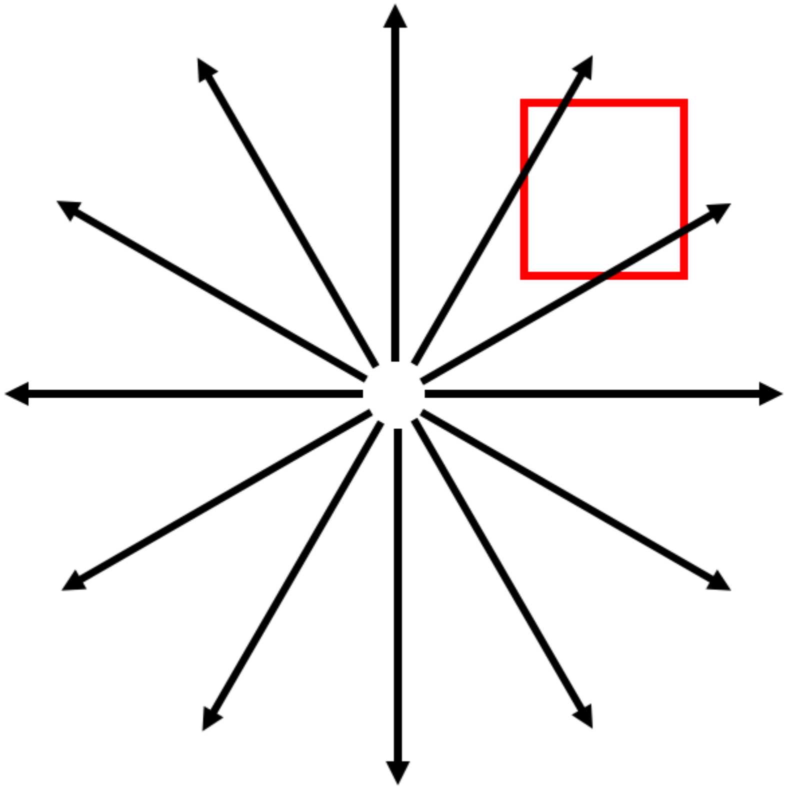
- Make sure to explain your answers when asked
- For graphs, make sure to annotate them well
- Remember that approximations are not what value but how it gets there

Activity: For a the electric field of a point charge, $\mathbf{E}(\mathbf{r}) = \dfrac{1}{4\pi\varepsilon_0}\dfrac{q}{r^2}\hat{r}$, compute $\nabla \cdot \mathbf{E}$.

Hint: The front fly leaf of Griffiths suggests that the we take:

$$\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 E_r\right)$$

Remember this?



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

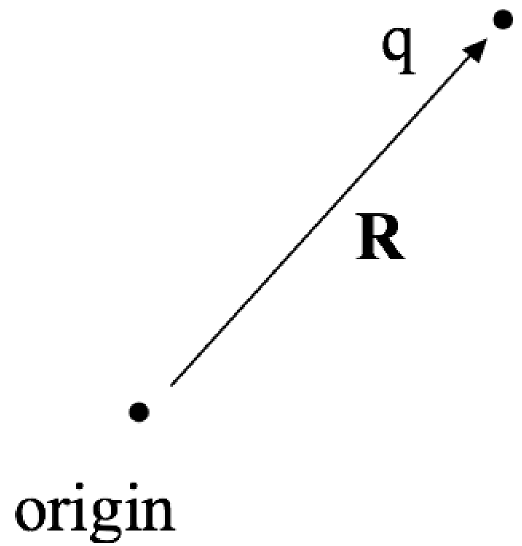
C. 25/27

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?

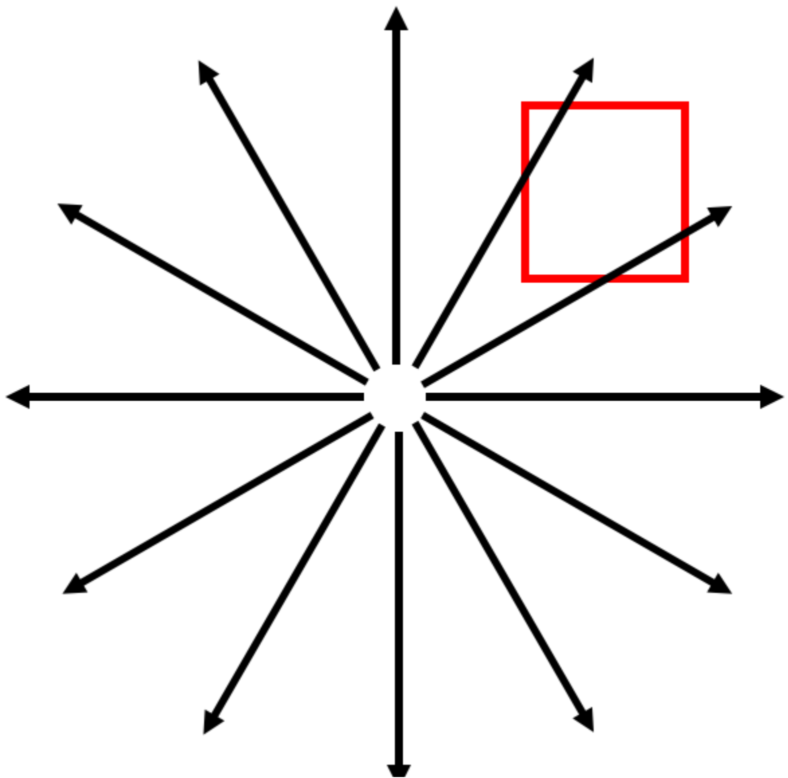
A. $\delta(x)$ is dimension less ('no units')
B. $[\mathrm{m}]$: Unit of length
C. $[\mathrm{m}^2]$: Unit of length squared
D. $[\mathrm{m}^{-1}]$: 1 / (unit of length)
E. $[\mathrm{m}^{-2}]$: 1 / (unit of length squared)

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. ???



We have shown twice that $\nabla \cdot \mathbf{E} = 0$ using what seem to be appropriate vector identities. But physically, $\nabla \cdot \mathbf{E} = \rho/\varepsilon_0$. What is going on?!

A. We broke physics - let's call it a day
B. There's some trick to get out of this and that makes me uncomfortable
C. I can see what we need to do
D. ???