Consider a spherical Gaussian surface. What is the $d\mathbf{A}$ in $\int\int \mathbf{E} \cdot d\mathbf{A}$?

A. $rd\theta d\phi\hat{r}$
B. $r^2 d\theta d\phi\hat{r}$
C. $r\sin\theta d\theta d\phi\hat{r}$
D. $r^2\sin\theta d\theta d\phi\hat{r}$
E. Something else

*Tutorial follow-up*:

Does the charge $\sigma$ 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 $\sigma$ affect the electronic equipment outside the tunnel?

A. Yes

B. No

C. ???

*Think: Why? Or why not?*

We derived that the electric field due to an infinite sheet with charge density $\sigma$ was as follows:

$$\mathbf{E}(z) = \begin{cases} \dfrac{\sigma}{2\varepsilon_0}\hat{k} & \text{if} \quad z > 0 \\ \dfrac{-\sigma}{2\varepsilon_0}\hat{k} & \text{if} \quad z < 0 \end{cases}$$

What does that tell you about the difference in the field when we cross the sheet, $\mathbf{E}(+z) - \mathbf{E}(-z)$?

A. it's zero

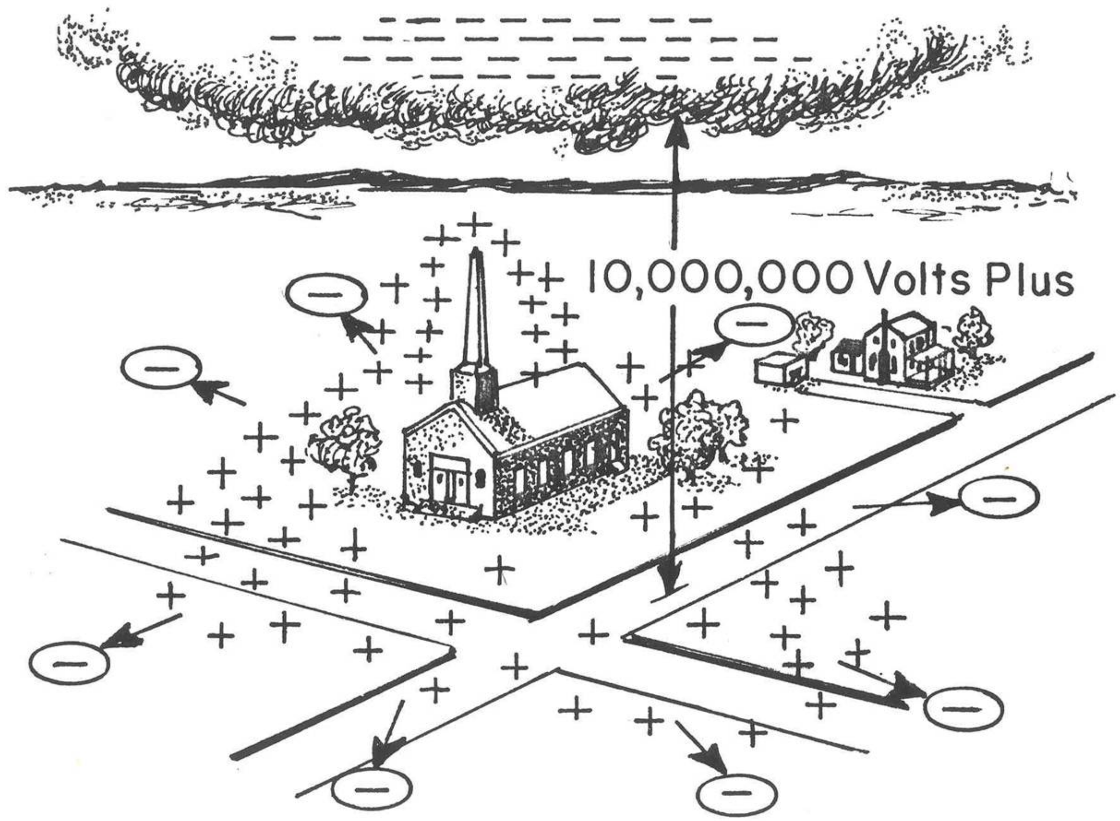
B. it's $\frac{\sigma}{\varepsilon_0}$

C. it's -$\frac{\sigma}{\varepsilon_0}$

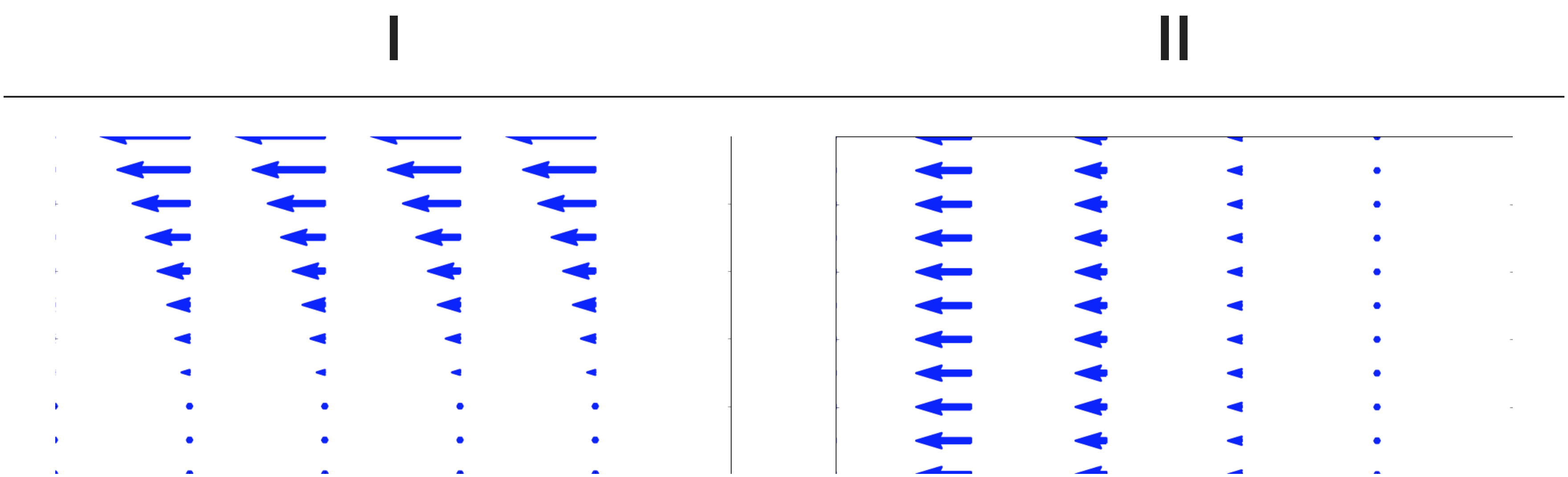
D. it's +$\frac{\sigma}{\varepsilon_0}\hat{k}$

E. it's -$\frac{\sigma}{\varepsilon_0}\hat{k}$

# ELECTRIC POTENTIAL



Which of the following two fields has zero curl?




A. Both do.

B. Only I is zero

C. Only II is zero

D. Neither is zero

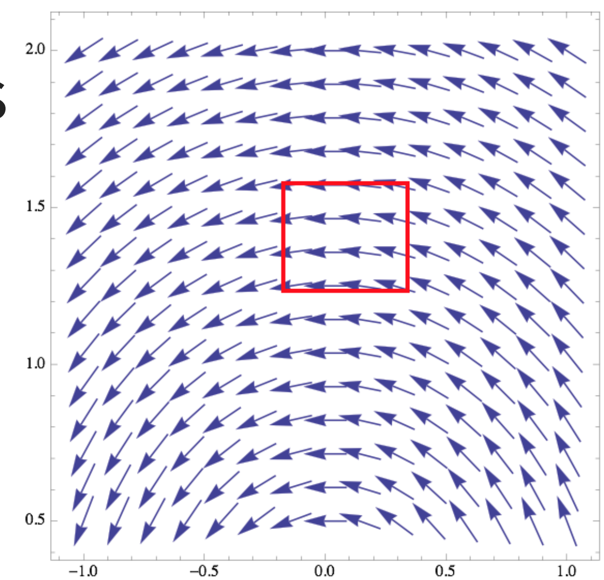
E. ???

What is the curl of the vector field, $\mathbf{v} = c\hat{\phi}$, in the region shown below?

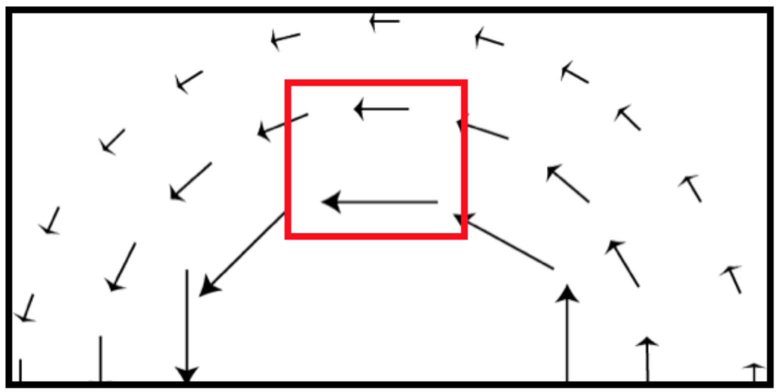
A. non-zero everywhere

B. zero at some points, non-zero at others

C. zero curl everywhere

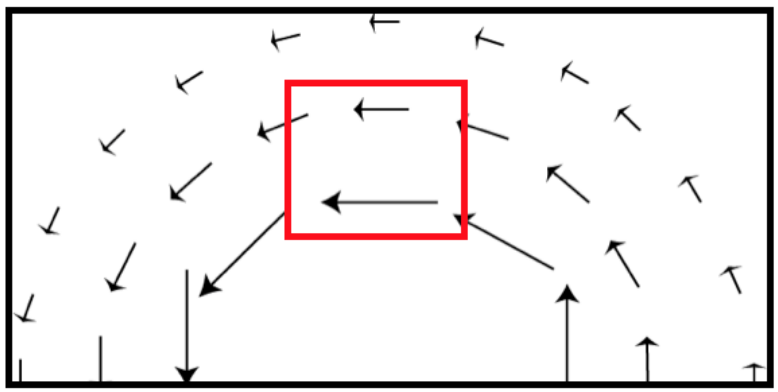


What is the curl of this vector field, in the red region shown below?



A. non-zero everywhere in the box
B. non-zero at a limited set of points
C. zero curl everywhere shown
D. we need a formula to decide

What is the curl of this vector field, $\mathbf{v} = \frac{c}{s}\hat{\phi}$, in the red region shown below?



A. non-zero everywhere in the box

B. non-zero at a limited set of points

C. zero curl everywhere shown

Is it mathematically ok to do this?

$$\mathbf{E} = \frac{1}{4\pi\varepsilon_0}\int_V \rho(\mathbf{r}')d\tau' \left(-\nabla\frac{1}{\mathfrak{R}}\right)$$

$$\longrightarrow \mathbf{E} = -\nabla\left(\frac{1}{4\pi\varepsilon_0}\int_V \rho(\mathbf{r}')d\tau' \frac{1}{\mathfrak{R}}\right)$$

A. Yes

B. No

C. ???

If $\nabla \times \mathbf{E} = 0$, then $\oint_C \mathbf{E} \cdot d\mathbf{l} =$

A. 0

B. something finite

C. $\infty$

D. Can't tell without knowing $C$

Can superposition be applied to electric potential, $V$?

$$V_{tot} \stackrel{?}{=} \sum_i V_i = V_1 + V_2 + V_3 + \ldots$$

A. Yes
B. No
C. Sometimes