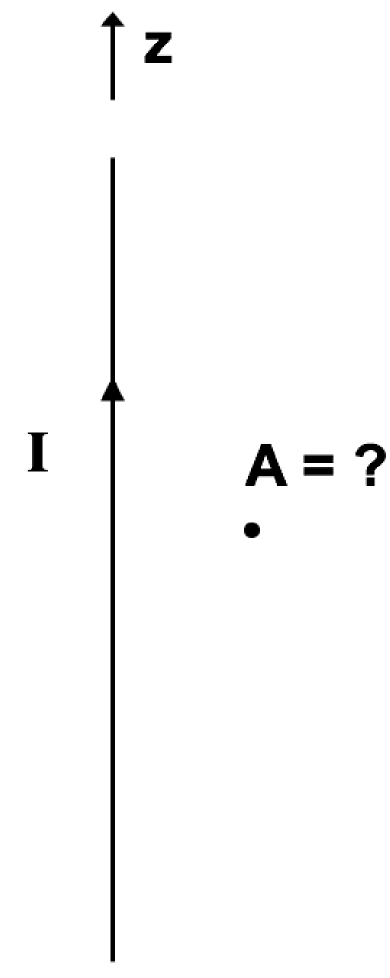
What flexibility do we have in defining the vector potential given the Coulomb gauge ($\nabla \cdot \mathbf{A} = 0$)? That is, what can $\mathbf{A}'$ be that gives us the same $\mathbf{B}$?

A. $\mathbf{A}' = \mathbf{A} + C$
B. $\mathbf{A}' = \mathbf{A} + \mathbf{C}$
C. $\mathbf{A}' = \mathbf{A} + \nabla C$
D. $\mathbf{A}' = \mathbf{A} + \nabla \cdot \mathbf{C}$
E. Something else?

The vector potential A due to a long straight wire with current I along the z-axis is in the direction parallel to:

A. $\hat{z}$
B. $\hat{\phi}$ (azimuthal)
C. $\hat{s}$ (radial)

Assume the Coulomb Gauge



Consider a fat wire with radius a with uniform current I_0 that runs along the $+z$-axis. We can compute the vector potential due to this wire directly. What is $\mathbf{J}$?

A. $I_0/(2\pi)$
B. $I_0/(\pi a^2)$
C. $I_0/(2\pi a)\hat{z}$
D. $I_0/(\pi a^2)\hat{z}$
E. Something else!?

Consider a fat wire with radius a with uniform current I_0 that runs along the $+z$-axis. Given $\mathbf{A}(\mathbf{r}) = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}(\mathbf{r}')}{\mathfrak{R}} d\tau'$, which components of $\mathbf{A}$ need to be computed?

A. All of them
B. Just A_x
C. Just A_y
D. Just A_z
E. Some combination

Consider line of charge with uniform charge density, $\lambda = \rho\pi a^2$. What is the magnitude of the electric field outside of the line charge (at a distance $s > a$)?

A. $E = \lambda/(4\pi\varepsilon_0 s^2)$
B. $E = \lambda/(2\pi\varepsilon_0 s^2)$
C. $E = \lambda/(4\pi\varepsilon_0 s)$
D. $E = \lambda/(2\pi\varepsilon_0 s)$
E. Something else?!

Use Gauss' Law

Consider a shell of charge with surface charge σ that is rotating at angular frequency of ω. Which of the expressions below describe the surface current, $\mathbf{K}$, that is observed in the fixed frame.

A. $\sigma\,\omega$

B. $\sigma\,\dot{\mathbf{r}}$

C. $\sigma\,\mathbf{r}\times\omega$

D. $\sigma\,\omega\times\mathbf{r}$

E. Something else?

What is the physical interpretation of $\oint \mathbf{A} \cdot d\mathbf{l}$?

A. The current density $\mathbf{J}$
B. The magnetic field $\mathbf{B}$
C. The magnetic flux Φ_B
D. It's none of the above, but is something simple and concrete
E. It has no particular physical interpretation at all

Consider a square loop enclosing some amount of magnetic field lines with height H and length L. We intend to compute $\Phi_B = \oint \mathbf{A} \cdot d\mathbf{l}$? What happens to Φ_B as H becomes vanishingly small?

A. Φ_B stays constant
B. Φ_B gets smaller but doesn't vanish
C. $\Phi_B \to 0$

Consider a square loop enclosing some amount of magnetic field lines with height H and length L. If $\Phi_B \to 0$ as $H \to 0$ (or $L \to 0$), what does that say about the continuity of $\mathbf{A}$?

$$\Phi_B = \oint \mathbf{A} \cdot d\mathbf{l}$$

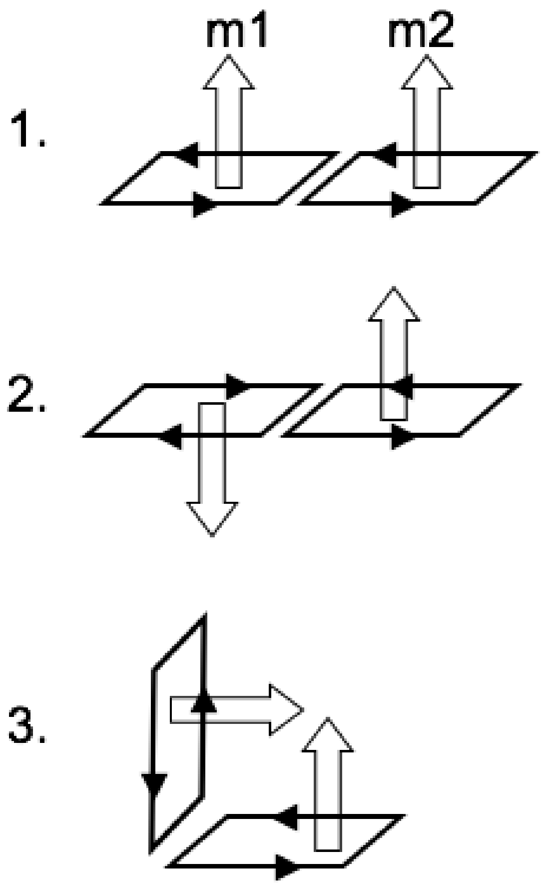
A. $\mathbf{A}$ is continuous at boundaries
B. $\mathbf{A}$ is discontinuous at boundaries
C. ???

The leading term in the vector potential multipole expansion involves:

$$\oint d\mathbf{l}'$$

What is the magnitude of this integral?

A. R
B. $2\pi R$
C. 0
D. Something entirely different/it depends!



Two magnetic dipoles m_1 and m_2 (equal in magnitude) are oriented in three different ways.

Which ways produce a dipole field at large distances?

A. None of these
B. All three
C. 1 only
D. 1 and 2 only
E. 1 and 3 only