REVIEW of 3310 (E&M I)

Do you have an Iclicker to use for this term?

A) Yes, I do!

B) Not yet

- Press & HOLD power (blue light *flashes)*
- Key in <u>AC</u> (or whatever OUR room code says, all term)
- Brief green Status flash confirms! (Blue light steady)

(You can do this only *while I'm collecting votes)*

Have you looked at the 3320 course web page yet?

A) Yes
B) Not yet

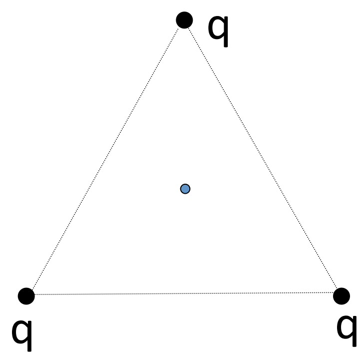
Can you make it to evening exams Thurs Oct 2, 7:30-9:30 PM *and* Thurs Nov 13, 7:30-9:30 PM

A) Yes
B) No possibility

r8

3 equal charges, q, are arranged in an equilateral triangle pattern, as shown.

What is the E field at the center?



A) Zero

B) Non-zero

C) Really need trig and a calculator to decide for sure

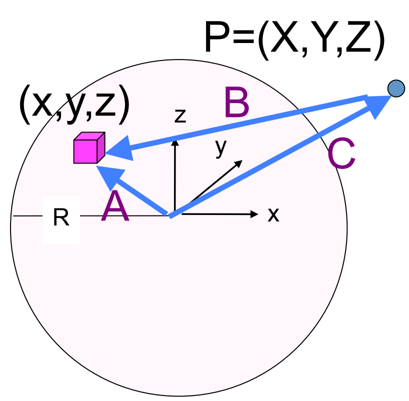
To find **E** at P from a <u>negatively</u> charged sphere

r9

(radius R, volume charge density ρ),

$$\vec{\mathbf{E}} = \frac{1}{4\pi\varepsilon_0}\iiint \frac{\hat{\mathscr{r}}}{\mathscr{r}^2}\,\rho\, d\tau'$$

What is $\vec{\mathscr{r}}$ (given the small volume element shown)?



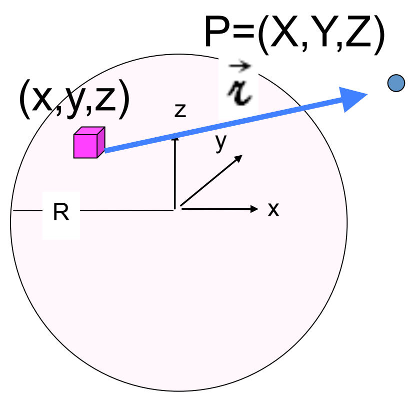
D) None of these

E) Answer is ambiguous

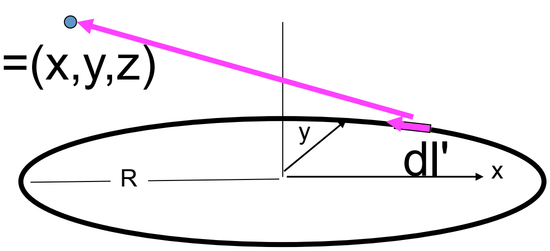
r10

To find **E** at P from a negatively charged sphere (radius R, volume charge density ρ),

$$\vec{\mathbf{E}} = \frac{1}{4\pi\varepsilon_0}\iiint \frac{\hat{\mathscr{r}}}{\mathscr{r}^2}\ \rho\, d\tau'$$



To find E at P from a thin ring (radius R, charge density λ), which is the correct formula for the x-component of $\vec{\Re}$?

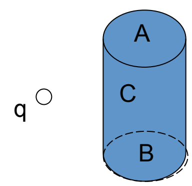


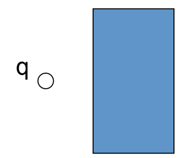
A) x-x'
B) (x-x')/R
C) (x-R cos ϕ') (cylindrical coordinates)
D) (x – x')/Sqrt[(x-x')^2+(y-y')^2+(z-z')^2]
E) More than one of the above is correct!

A positive point charge +q is placed outside a closed (empty) cylindrical surface as shown.
The closed surface consists of the flat end caps (labeled A and B) and the curved side surface (C). What is the sign of the (outward) electric flux through surface C?

(A) positive (B) negative (C) zero

(D) To be sure, this requires calculating!





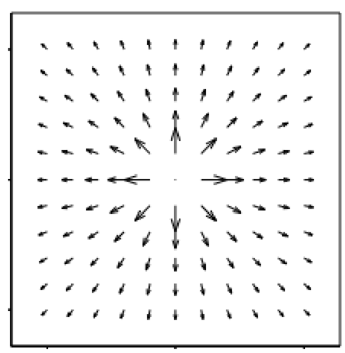
(Side View)

Can you think of more than one argument?

Consider the 3D vector field

$$\vec{V}(\vec{r}) = c\left(\frac{\hat{r}}{r^2}\right)$$

in spherical coordinates,
where c = constant .

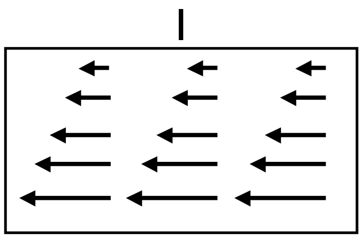


The divergence of this vector field is:

A) Zero everywhere except at the origin
B) Zero everywhere including the origin
C) Non-zero everywhere, including the origin.
D) Non-zero everywhere, except at origin (zero at origin)
E) Not quite sure how to get this (without computing from the front flyleaf of Griffiths!)

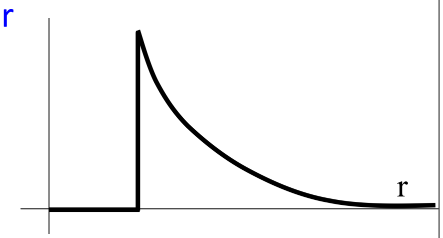
Which of the following could be a (physical) electrostic field in the region shown?

Why?



A) Both
B) Only I
C) Only II
D) Neither
E) ??

Could this be a plot of |E|(r)? Or V(r)?
(for SOME physical situation?)



A) Could be E(r), or V(r)

B) Could be E(r), but can't be V(r)

C) Can't be E(r), could be V(r)

D) Can't be either

E) ???

Given a thin spherical *shell* with uniform *surface charge* density σ (and no other charges anywhere else) what can you say about the potential V *inside* this sphere? (Assume V(∞)=0)

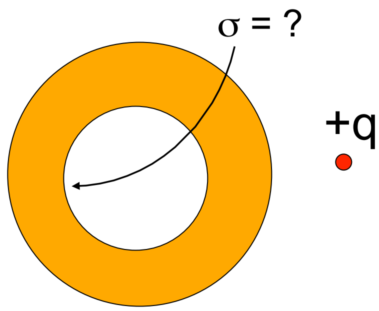
A) V=0 everywhere inside
B) V = non-zero constant everywhere inside
C) V must vary with position, but 0 at the center.
D) None of these/something else/not sure.

Choose all of the following statements that are implied by $\oiint \vec{B} \cdot d\vec{a} = 0$
(for any/all closed surface you like)

(I) $\vec{\nabla} \cdot \vec{B} = 0$
(II) $B^{//}_{above} = B^{//}_{below}$
(III) $B^{\perp}_{above} = B^{\perp}_{below}$

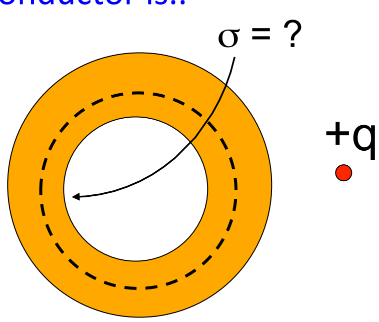
A) (II) only
B) (III) only
C) (I) and (II) only
D) (I) and (III) only
E) All of the above

A point charge +q is near a neutral copper sphere with a hollow interior space. In equilibrium, the surface charge density σ on the interior wall of the hollow conductor is..



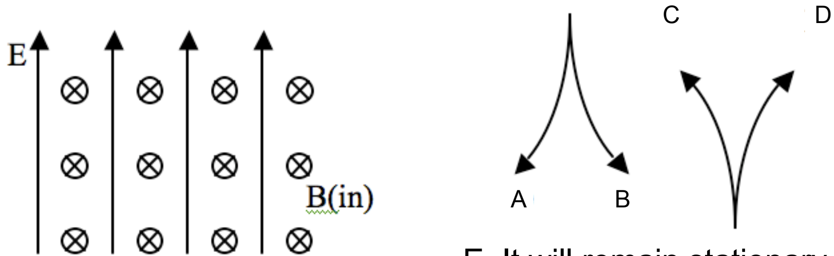
A) Zero everywhere
B) Non-zero, but with zero net total charge on interior surface
C) Non-zero, with non-zero net total charge on interior surface.

A point charge +q is near a neutral copper sphere with a hollow interior space. In equilibrium, the surface charge density σ on the interior wall of the hollow conductor is..



A) Zero everywhere
B) Non-zero, but with zero net total charge on interior surface
C) Non-zero, with non-zero net total charge on interior surface.

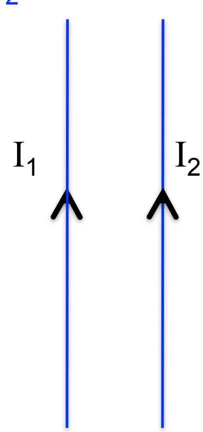
A proton (q=+e) is released from rest in a uniform **E** and uniform **B** (as shown).
E points up, **B** points into the page.
Which of the paths will the proton initially follow?



E. It will remain stationary

(To think about: what happens after longer times?)

I have two very long, parallel wires each carrying a current I_1 and I_2, respectively. In which direction is the force on the wire with the current I_2?



A) Up
B) Down
C) Right
D) Left
E) Into or out of the page

(How would your answer change if you would reverse the direction of the currents?)

Static fields satisfy the partial diff. eqs:

$$\vec{\nabla}\bullet\vec{E}=\frac{\rho}{\varepsilon_0} \qquad \vec{\nabla}\bullet\vec{B}=0 \qquad \vec{\nabla}\times\vec{E}=0 \qquad \vec{\nabla}\times\vec{B}=\mu_0\vec{J}$$

In the presence of macroscopic matter:

A) The equations are unchanged.
B) You must replace E with D and B with H, because of the response of the matter.
C) You must replace ρ and J with free charge density and free currents, because *bound* charges and currents don't contribute
D) None of the above/something else!!

5.7 Current I flows down a wire (length L) with a square cross section (side *a)*
If it is uniformly distributed over the entire wire area, what is the magnitude of the volume current density?

A) $J=I/a^2$
B) $J=I/a$
C) $J=I/(a^2L)$
D) $J=I/a^3$
E) None of the above!

Current I flows down a wire (length L) with a square cross section (side *a)*
If it is uniformly distributed over the outer surfaces only, what is the magnitude of the surface current density *K*?

A) $K = I/a^2$

B) $K = I/a$

C) $K = I/(4a)$

D) $K = I/(a^2 L)$

E) None of the above

To think about: does it seem physically correct to you that charges WOULD distribute evenly over the outer surface?

5.14

What is B at the point shown?

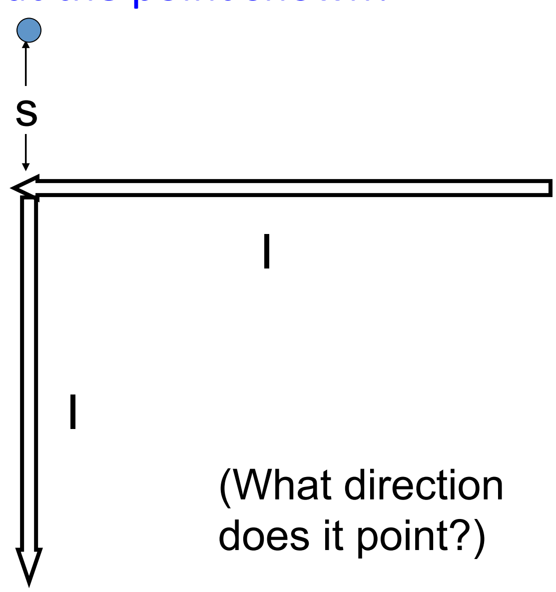
A) $\frac{\mu_0}{\pi s} I$

B) $\frac{\mu_0}{2\pi s} I$

C) $\frac{\mu_0}{4\pi s} I$

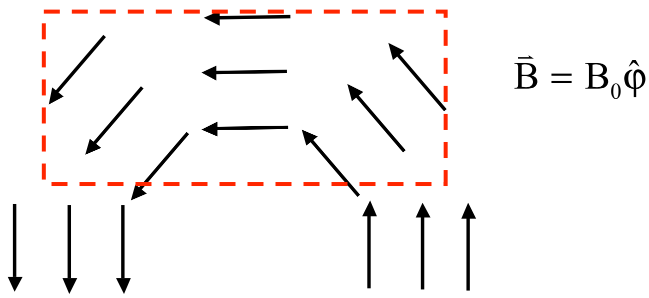
D) $\frac{\mu_0}{8\pi s} I$

E) None of these



(What direction does it point?)

If the arrows represent a B field (note that |B| is the same everywhere), is there a nonzero **J** (perpendicular to the page) in the dashed region?

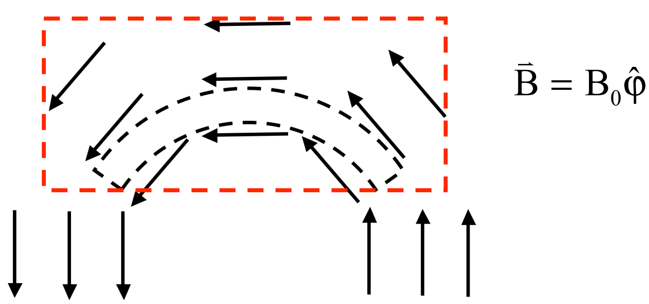


A. Yes

B. No

C. Need more information to decide

If the arrows represent a B field (note that |B| is the same everywhere), is there a nonzero **J** (perpendicular to the page) in the dashed region?



A. Yes

B. No

C. Need more information to decide

Can we use Ampere's Law to simply compute the B-field *at the center* of a circular current-carrying loop of wire?

A) Yes
B) No
C) Not sure/ maybe if you are really good at math/???