Announcements

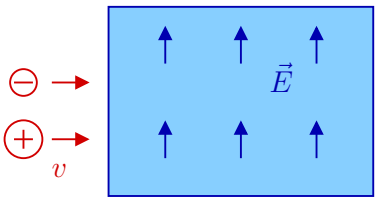
- Exams will be given in the evenings from 7:00-9:00 PM on the following dates (all Thursdays): February 12, March 19, and April 16. There will be no morning lecture on exam dates.
- Interested in declaring a physics major? Information session on Monday, January 26 from 4:00-5:00 pm in Olin 264.

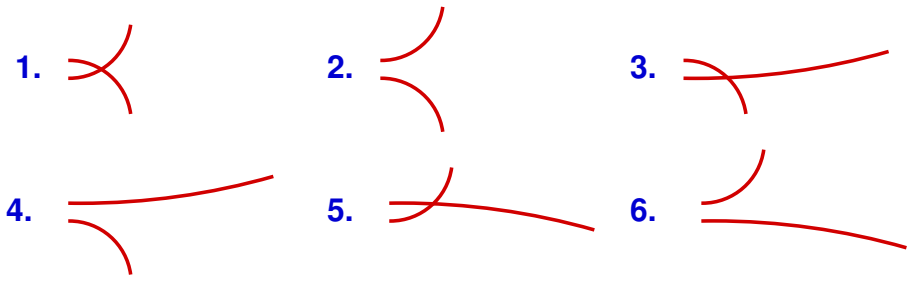
Where can you go to get help?

- Pooled office hours!
- Drop-in help sessions Wednesday & Sunday from 8-10 PM in Olin 264
- TLC study groups: my.bucknell.edu/StudyGroups
- TLC Tutoring: bucknell.edu/bookTLCtutoring

Lecture 2 — Concept Test 1

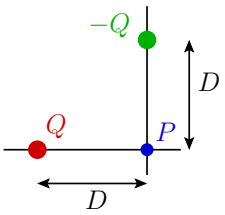
An electron and a proton enter a region of uniform electric field pointing upward, both traveling with the same initial speed. Which of the following sketches best shows the paths of the two particles? (Neglect any electrical attraction between the two particles.)





Lecture 2 — Concept Test 2

What is the direction of the electric field at the point P?



1. ↗

2. ↖

3. ↙

4. ↘

5. $E = 0$ at P

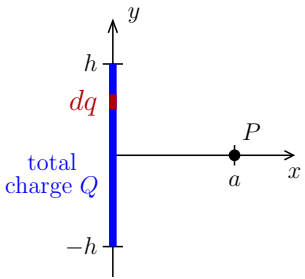
6. none of these are correct

Approach for E-field Integrals

1. Draw a sketch, choose integration variable (x, y, or θ)
2. Pick a tiny piece of charge and label it dq
   a. label the size of this tiny piece using dx, dy, or $R\,d\theta$
   b. Draw r (distance between dq and P) on the sketch
   c. Draw an arrow for $d\vec{E}$ at P due to dq
3. Find dE magnitude in terms of integration variable:
   a. Find dq. Line: $dq = \lambda\,dx$ or $dq = \lambda\,dy$. Arc: $dq = \lambda\,R d\theta$
   b. Find r (use Pythagoras)
   c. Plug dq and r into $dE = k\,dq/r^2$
4. Determine the components $dE_x = dE\,\cos\theta$ and $dE_y = dE\,\sin\theta$. You may need to use similar triangles.
5. Determine the limits of integration (where is the charge?)
6. Put it together and solve for $E_x = \int dE_x$ and $E_y = \int dE_y$.

Lecture 2 — Concept Test 3

Which of the following is the correct expression for dq for this rod?



1. $dq = Q\,dx$

2. $dq = Q\,dy$

3. $dq = \dfrac{Q}{a}\,dx$

4. $dq = \dfrac{Q}{a}\,dy$

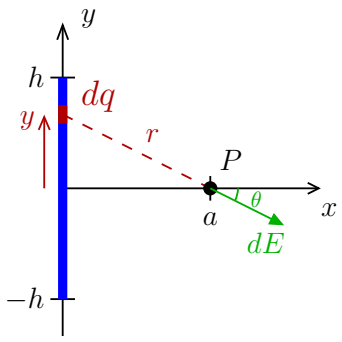
5. $dq = \dfrac{Q}{2h}\,dx$

6. $dq = \dfrac{Q}{2h}\,dy$

Lecture 2 — Concept Test 4

Which of the following is the correct expression for $\cos\theta$ for this rod?

1. $\dfrac{a}{\sqrt{a^2+y^2}}$
2. $\dfrac{h}{\sqrt{a^2+y^2}}$
3. $\dfrac{y}{\sqrt{a^2+y^2}}$
4. $\dfrac{a}{\sqrt{a^2+h^2}}$
5. $\dfrac{h}{\sqrt{a^2+h^2}}$
6. $\dfrac{y}{\sqrt{a^2+h^2}}$



Useful Integrals

$$\int \frac{x\,dx}{(a^2+x^2)^{3/2}} = \frac{-1}{\sqrt{a^2+x^2}}$$

$$\int \frac{dx}{(a^2+x^2)^{3/2}} = \frac{x}{a^2\sqrt{a^2+x^2}}$$

$$\int \sin^2(ax)\,dx = \frac{x}{2} - \frac{1}{4a}\sin(2ax)$$

$$\int x\sin^2(ax)\,dx = \frac{x^2}{4} - \frac{x}{4a}\sin(2ax) - \frac{1}{8a^2}\cos(2ax)$$

$$\int e^{-bx}\,dx = -\frac{1}{b}e^{-bx}$$

$$\int xe^{-bx}\,dx = -\left(\frac{x}{b} + \frac{1}{b^2}\right)e^{-bx}$$

$$\int x^2e^{-bx}\,dx = -\left(\frac{x^2}{b} + \frac{2x}{b^2} + \frac{2}{b^3}\right)e^{-bx}$$