Consider a vector field defined as the gradient of some well-behaved scalar function:

$$\mathbf{v}(x, y, z) = \nabla T(x, y, z).$$

What is the value of $\oint_C \mathbf{v} \cdot d\mathbf{l}$?

A. Zero

B. Non-zero, but finite

C. Can't tell without a function for T

ANNOUNCEMENTS

- Homework 1 solutions posted immediately after class
- Graded Homework 1 returned next Friday
- Homework 2 posted (due next Wednesday)

LET THE SHAMING BEGIN

REGISTER YOUR CLICKER!

- Agrawal, Prakash
- Bloomfield, Brandon
- Campbell, Megan
- Everett, Nathan
- Klebba, Jared
- Prince, Alex
- Spencer, Spence
- Verleye, Erick
- Wu, Madeleine
- Xu, Fu

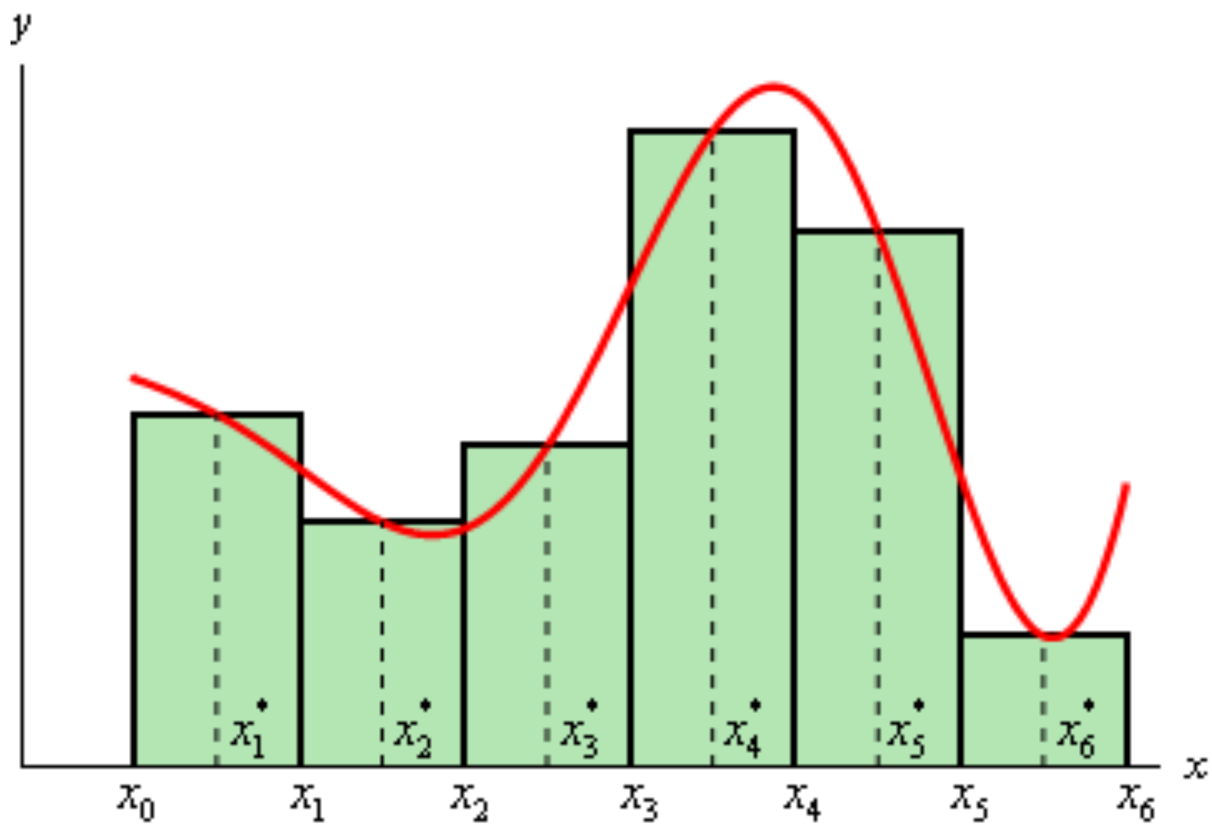
For me, the first homework was ...

A. entirely a review.
B. mostly a review, but it had a few new things in it.
C. somewhat of a review, but it had quite a few new things in it.
D. completely new for me.

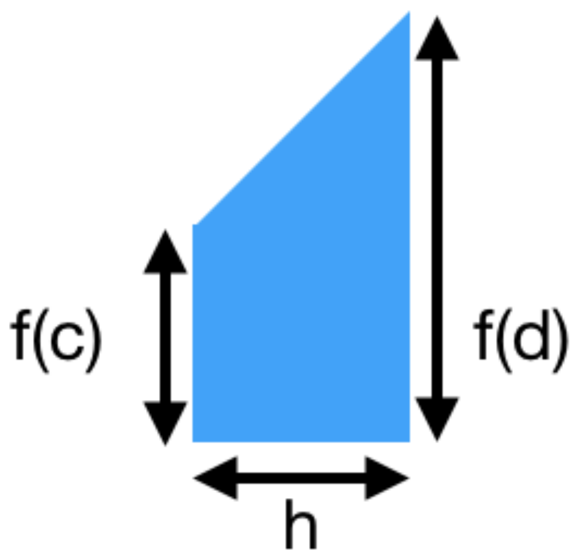
I spent ... hours on the first homework.

A. 1-2
B. 3-4
C. 5-6
D. 7-8
E. More than 9

NUMERICAL INTEGRATION



Consider this trapezoid



What is the area of this trapezoid?

A. $f(c)h$
B. $f(d)h$
C. $f(c)h + \frac{1}{2}f(d)h$
D. $\frac{1}{2}f(c)h + \frac{1}{2}f(d)h$
E. Something else

The trapezoidal rule for a function $f(x)$ gives the area of the k th slice of width h to be,

$$A_k = \frac{1}{2}h\left(f(a + (k-1)h) + f(a + kh)\right)$$

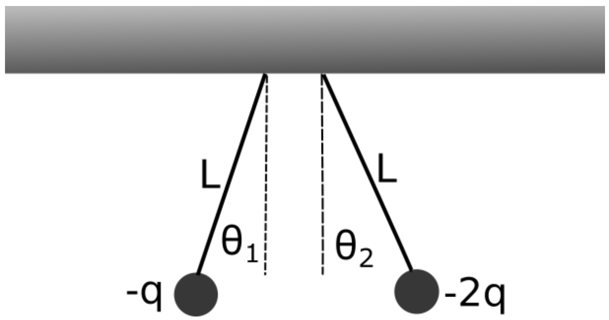
What is the approximate integral, $I(a,b) = \int_a^b f(x)dx$,

$I(a,b) \approx$

A. $\sum_{k=1}^{N} \frac{1}{2}h\left(f(a + (k-1)h) + f(a + kh)\right)$
B. $h\left(\frac{1}{2}f(a) + \frac{1}{2}f(b) + \frac{1}{2}\sum_{k=1}^{N-1} f(a + kh)\right)$
C. $h\left(\frac{1}{2}f(a) + \frac{1}{2}f(b) + \sum_{k=1}^{N-1} f(a + kh)\right)$
D. None of these is correct.
E. More than one is correct.

The trapezoidal rule takes into account the value and slope of the function. The next "best" approximation will also take into account:

A. Concavity of the function
B. Curvature of the function
C. Unequally spaced intervals
D. More than one of these
E. Something else entirely

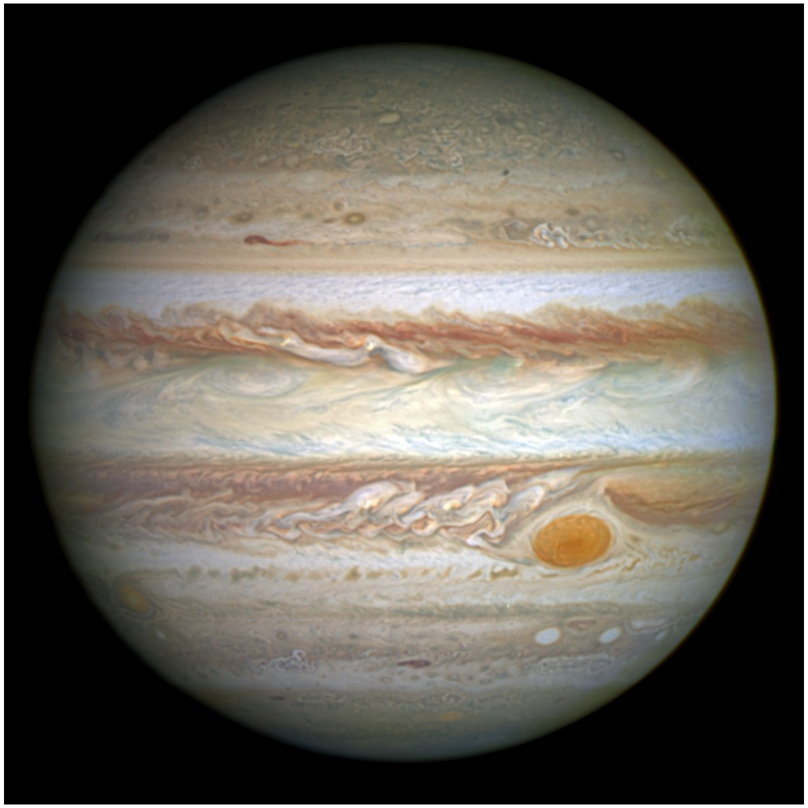


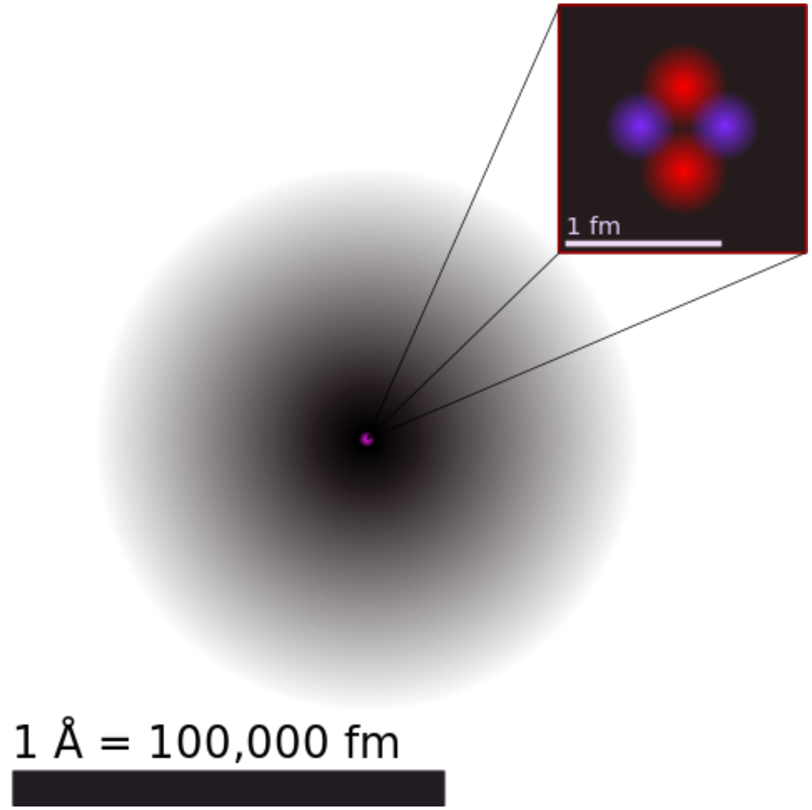
Two small spheres (mass, m) are attached to insulating strings (length, L) and hung from the ceiling as shown.

How does the angle (with respect ot the vertical) that the string attached to the $-q$ charge (θ_1) compare to that of the $-2q$ charge (θ_2)?

A. $\theta_1 > \theta_2$
B. $\theta_1 = \theta_2$
C. $\theta_1 > \theta_2$
D. ????

CLASSICAL ELECTROMAGNETISM

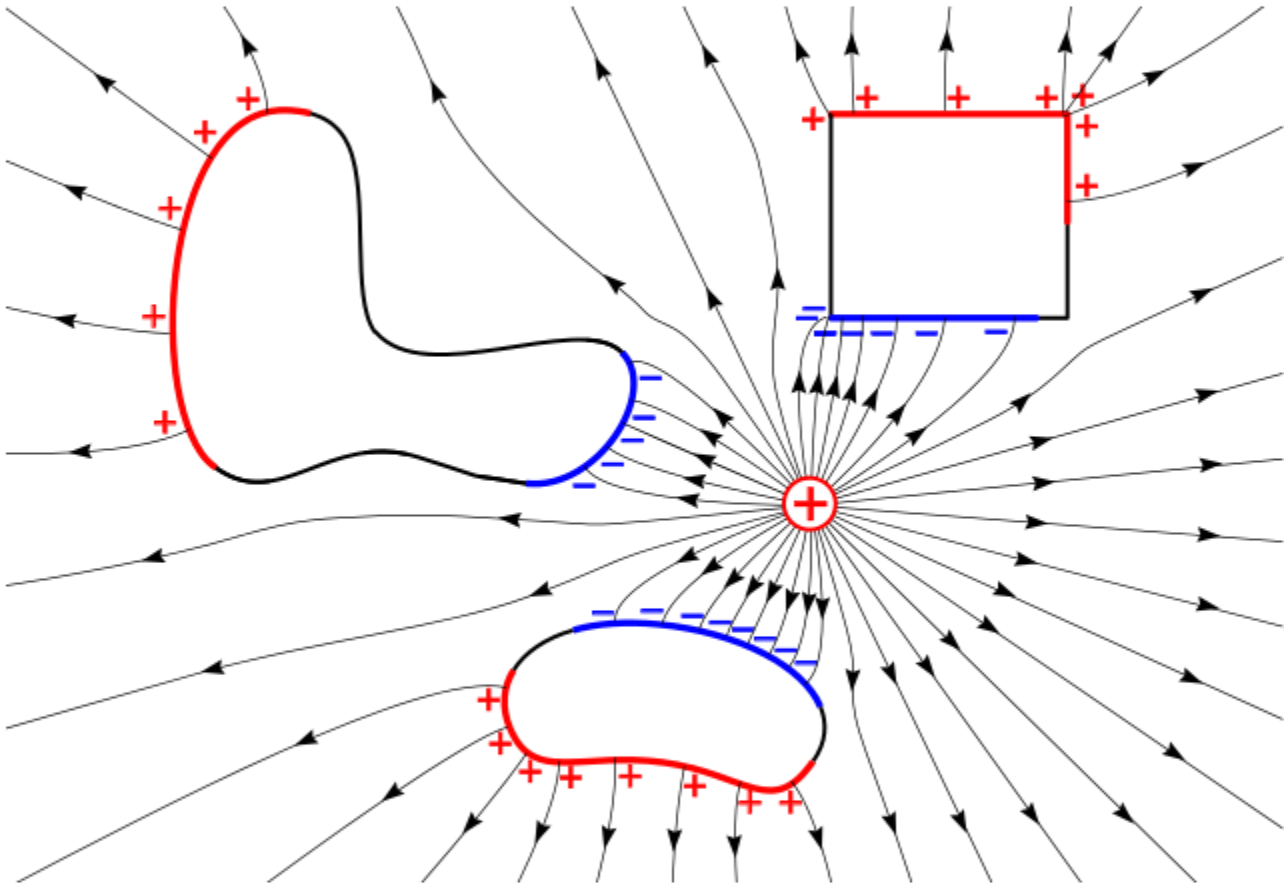




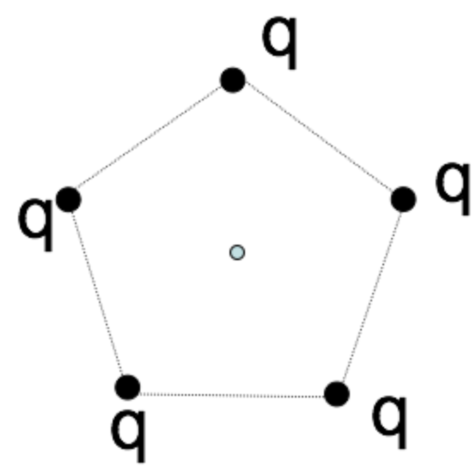
$$\sim 10^8\text{m} \longrightarrow\longrightarrow\longrightarrow\longrightarrow\longrightarrow\longrightarrow \sim 10^{-16}\text{m}$$

24 orders of magnitude

ELECTROSTATICS



5 charges, q, are arranged in a regular pentagon, as shown. What is the E field at the center?

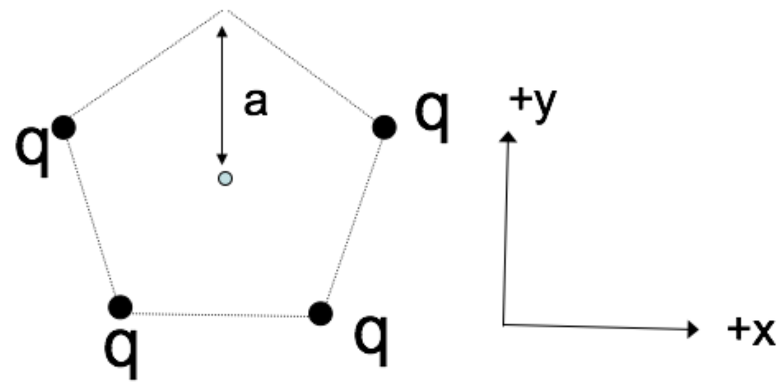


A. Zero

B. Non-zero

C. Really need trig and a calculator to decide

1 of the 5 charges has been removed, as shown. What’s the E field at the center?



A. $+(kq/a^2)\hat{y}$

B. $-(kq/a^2)\hat{y}$

C. 0

D. Something entirely different!

E. This is a nasty problem which I need more time to solve

If all the charges live on a line (1-D), use:

$$\lambda \equiv \frac{\text{charge}}{\text{length}}$$

Draw your own picture. What's $\mathbf{E}(\mathbf{r})$?

To find the E-field at P from a thin line (uniform charge density λ):

$$\mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\varepsilon_0}\int \frac{\lambda dl'}{\mathfrak{R}^2}\hat{\mathfrak{R}}$$

What is $\mathfrak{R}$?

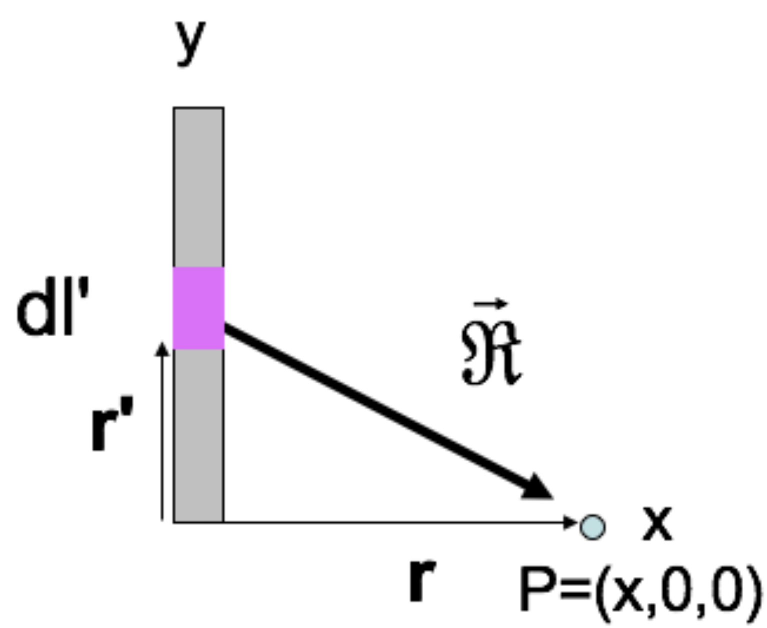
A. x

B. y'

C. $\sqrt{dl'^2 + x^2}$

D. $\sqrt{x^2 + y'^2}$

E. Something else



$$\mathbf{E}(\mathbf{r}) = \int \frac{\lambda dl'}{4\pi\varepsilon_0 \mathfrak{R}^3}\vec{\mathfrak{R}}, \text{ so: } E_x(x,0,0) = \frac{\lambda}{4\pi\varepsilon_0}\int \ldots$$

A. $\int \frac{dy' x}{x^3}$

B. $\int \frac{dy' x}{(x^2+y'^2)^{3/2}}$

C. $\int \frac{dy' y'}{x^3}$

D. $\int \frac{dy' y'}{(x^2+y'^2)^{3/2}}$

E. Something else