Unit 19 homework before session 1

- Read the course introduction. It details the course format and the grading scheme.

Unit 19 homework before session 2

- *Smartphysics*: Watch the "Coulomb's law" pre-lectures and do the checkpoint questions.
- *Smartphysics*: Work homework problems for "Coulomb Law".

Unit 19 homework before session 3

- *Smartphysics*: Watch "Electric Fields" pre-lectures and answer the checkpoint questions.
- *Smartphysics*: Work homework problem for "Electric Fields".

All Unit 19 homework problems and the Unit 19 activity guide are due on the first day of Unit 20

Electric Field from Arc of Charge: Hints

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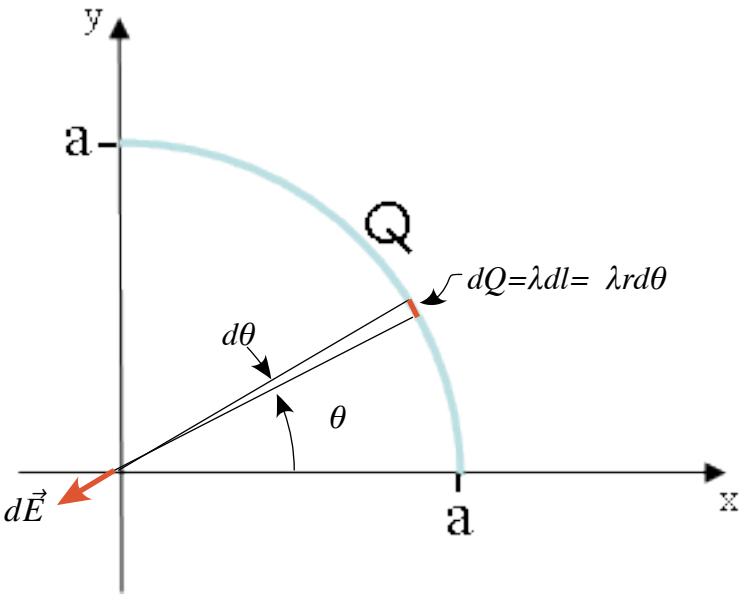

For a small segment of the arc the contribution to the electric field is

$$d\vec{E} = k\frac{dq}{r^2}\hat{r}$$

where r is constant over the arc. λ is the charge per unit length on the arc, so the little red element of charge dQ can be expressed as follows:

$$dq = \lambda d\ell = \lambda r d\theta$$

The unit vector points from the charge element towards the origin, so be careful of the signs.

$$\hat{r} = -\cos\theta\hat{i} - \sin\theta\hat{j}$$

Therefore the x component of $d\vec{E}$ is

$$dE_x = -k\frac{\lambda r d\theta}{r^2}\cos\theta$$

Now just sum up all the little dE_xs by doing an integral over θ from 0 degrees to 90 degrees: 0 to $\pi/2$.

$$E_x = -k\int dE_x = k\int_0^{\pi/2} \frac{\lambda r d\theta}{r^2}\cos\theta$$

$$\begin{aligned} E_x &= -k\frac{\lambda r}{r^2}\int_0^{\pi/2}\cos\theta d\theta \\ &= -k\frac{\lambda}{r}\sin\theta|_0^{\pi/2} \\ &= -k\frac{\lambda}{r}\left[\sin\frac{\pi}{2} - \sin 0\right] \\ &= -k\frac{\lambda}{r} \end{aligned}$$

The y component is done analogously, replacing cosine with sine.