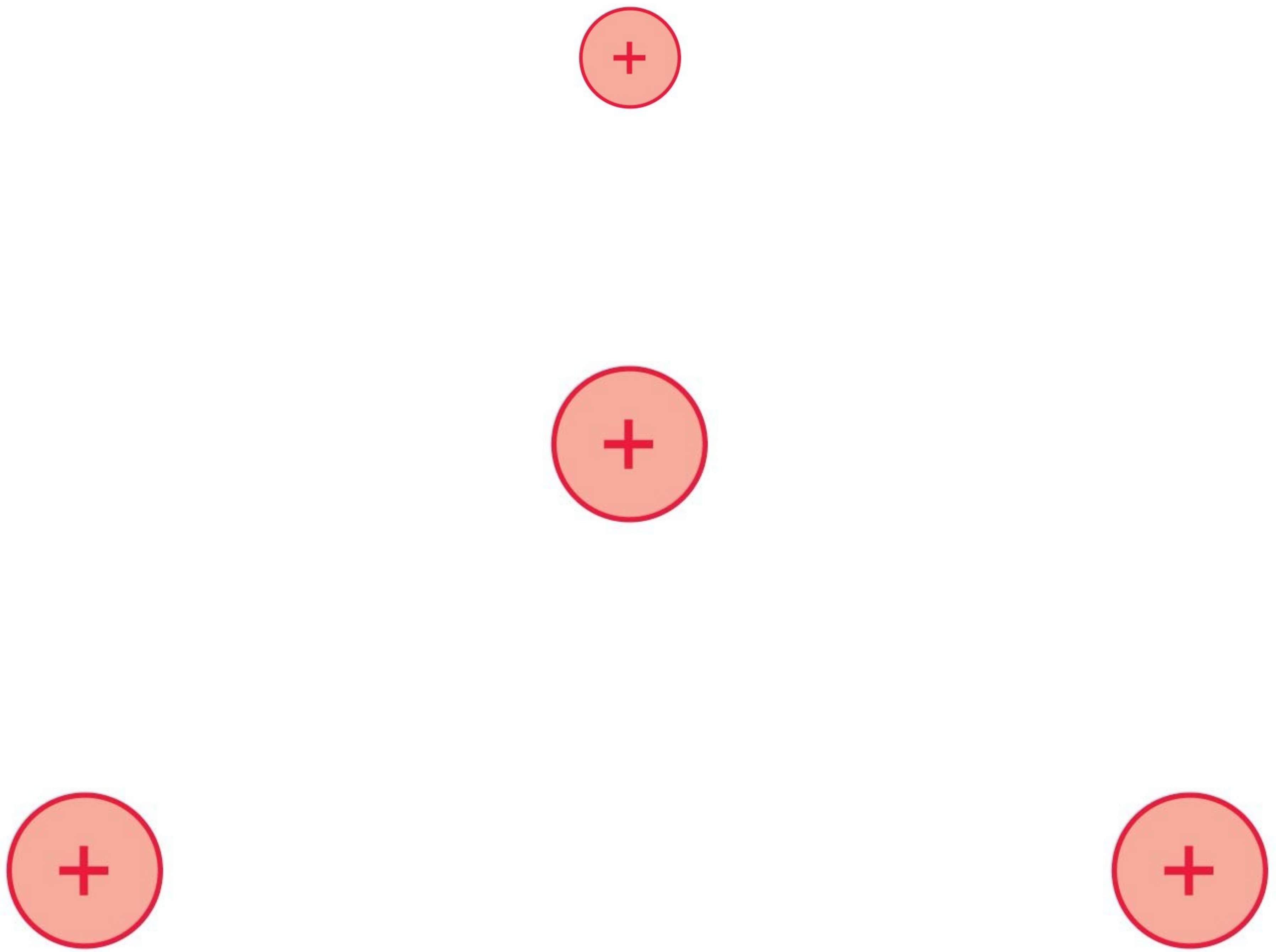
# Welcome to Class

*It is . . . my experience that people who ride gospel hobbies, who try to qualify themselves as experts in some specialized field, who try to make the whole plan of salvation revolve around some field of particular interest to them- it is my experience that such persons are usually spiritually immature and spiritually unstable. This includes those who devote themselves- as though by divine appointment- to setting forth the signs of the times; or to expounding about the Second Coming; or, to a faddist interpretation of the Word of Wisdom; or, to a twisted emphasis on temple work or any other doctrine or practice. The Jews of Jesus' day made themselves hobbyists and extremists in the field of Sabbath observance, and it colored and blackened their whole way of worship. We would do well to have a sane, rounded, and balanced approach to the whole gospel and all of its doctrines*

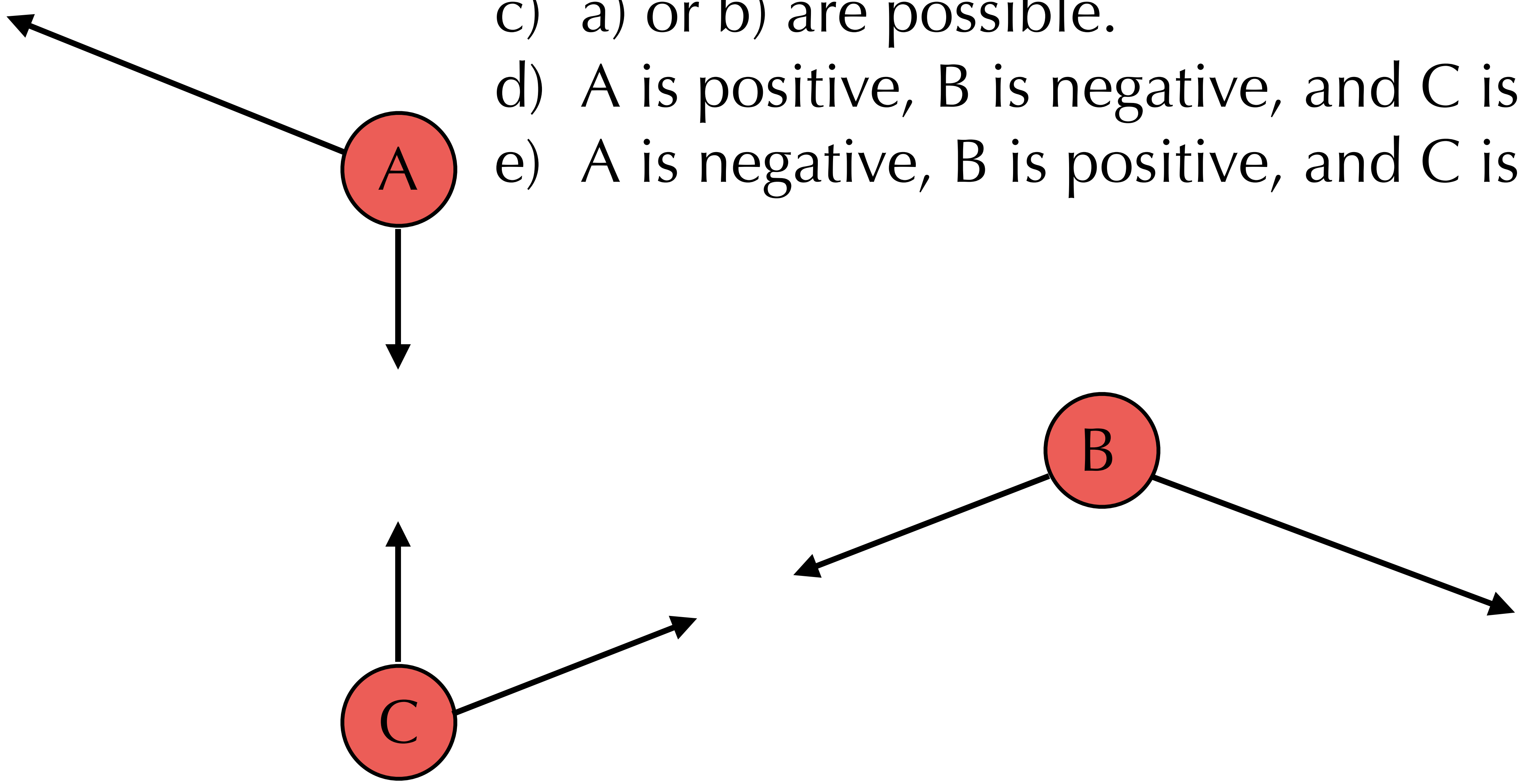
Bruce R. McConkie

# HW problem

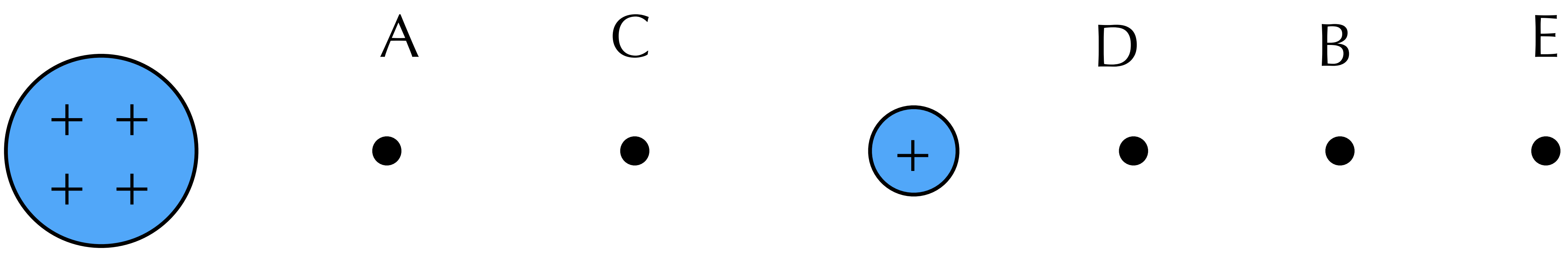


Shown are the forces on each charge due to the other two charges. What are the signs of the charges?

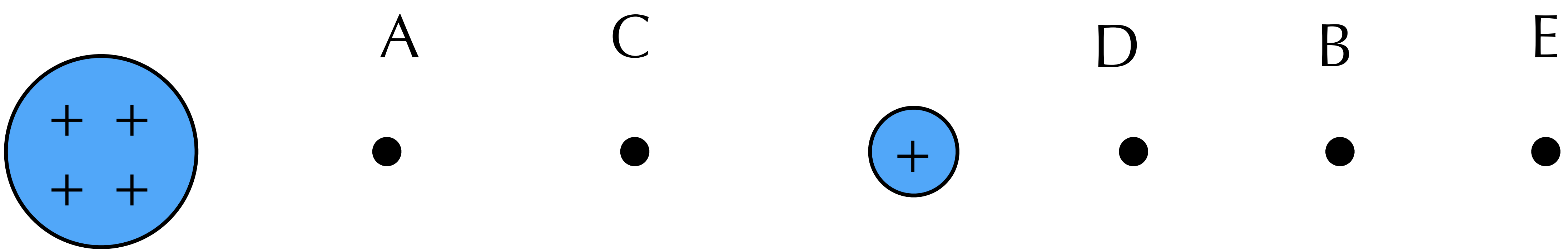
a) A is positive, B is positive, and C is negative.
b) A is negative, B is negative, and C is positive.
c) a) or b) are possible.
d) A is positive, B is negative, and C is negative.
e) A is negative, B is positive, and C is positive



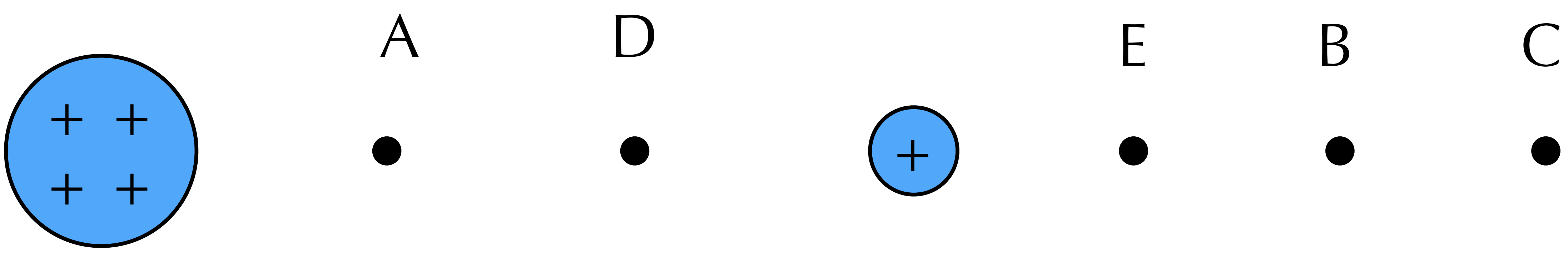
Where can you put a proton so that it will experience **no net force**?



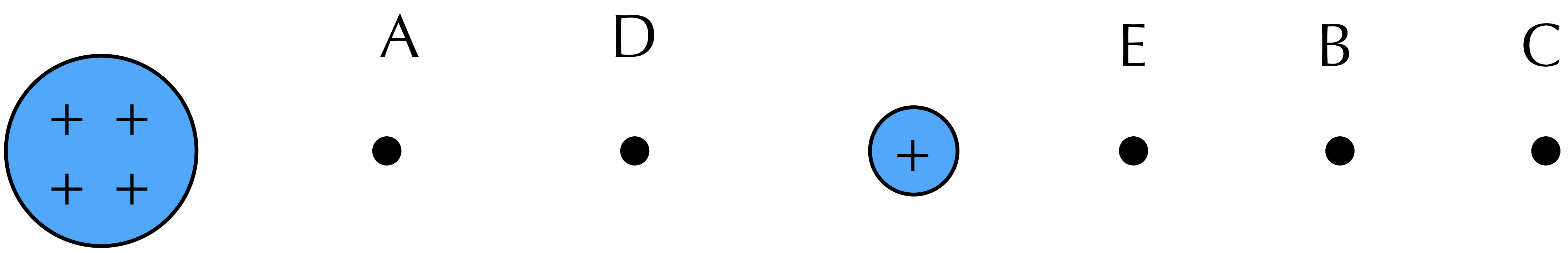
Where can you put an electron so that it will experience **no net force**?




The dot spacing is intended to be equal throughout.


+ +
+ +
A
D
+
E
B
C

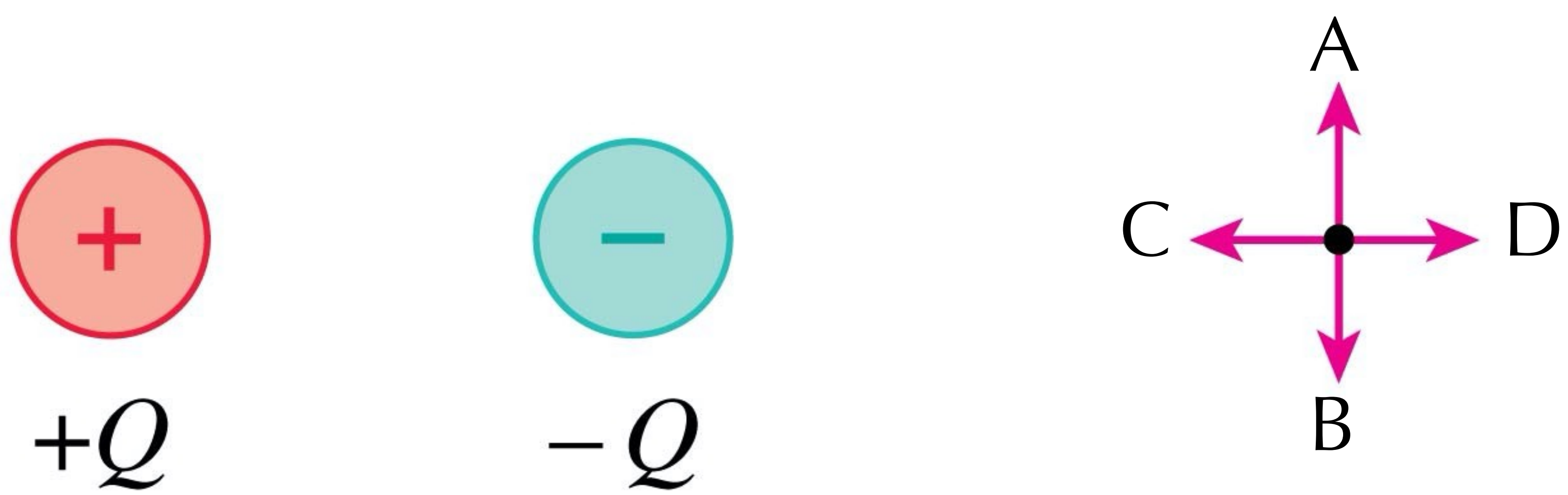
Where can you put an electron so that it will experience **no net force**?




The dot spacing is intended to be equal throughout.

# Question #23

What is the direction of the electric field at the dot?




E. The field is zero.

When $r >> d$, the electric field strength at the dot is

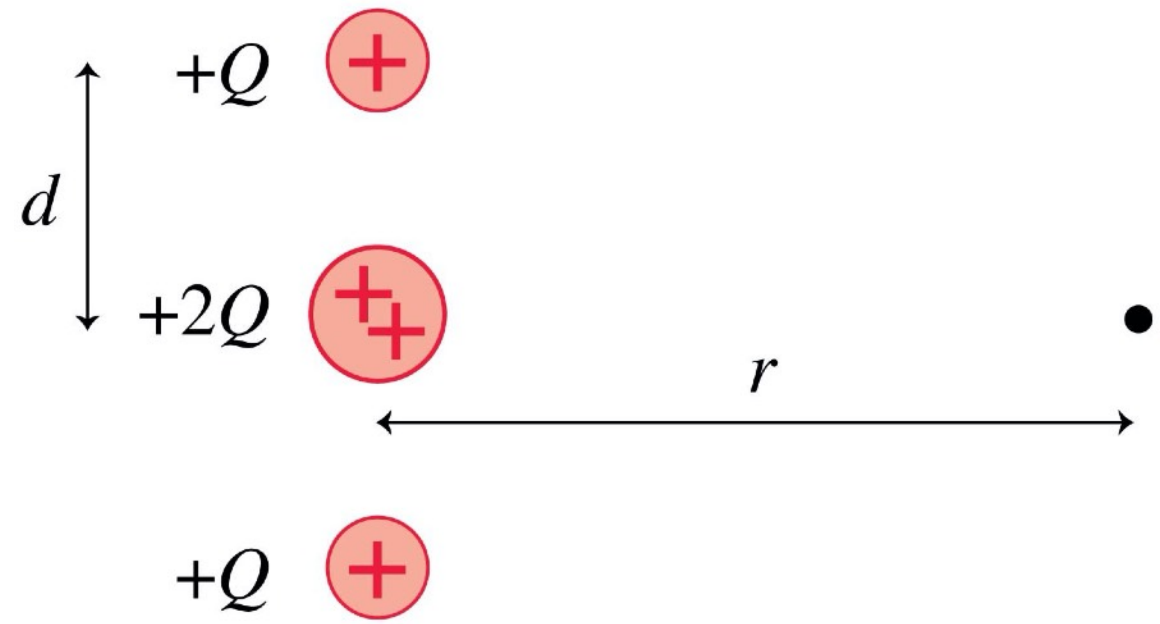
A. $\dfrac{Q}{4\pi\epsilon_0 r^2}$

B. $\dfrac{4Q}{4\pi\epsilon_0 r^2}$

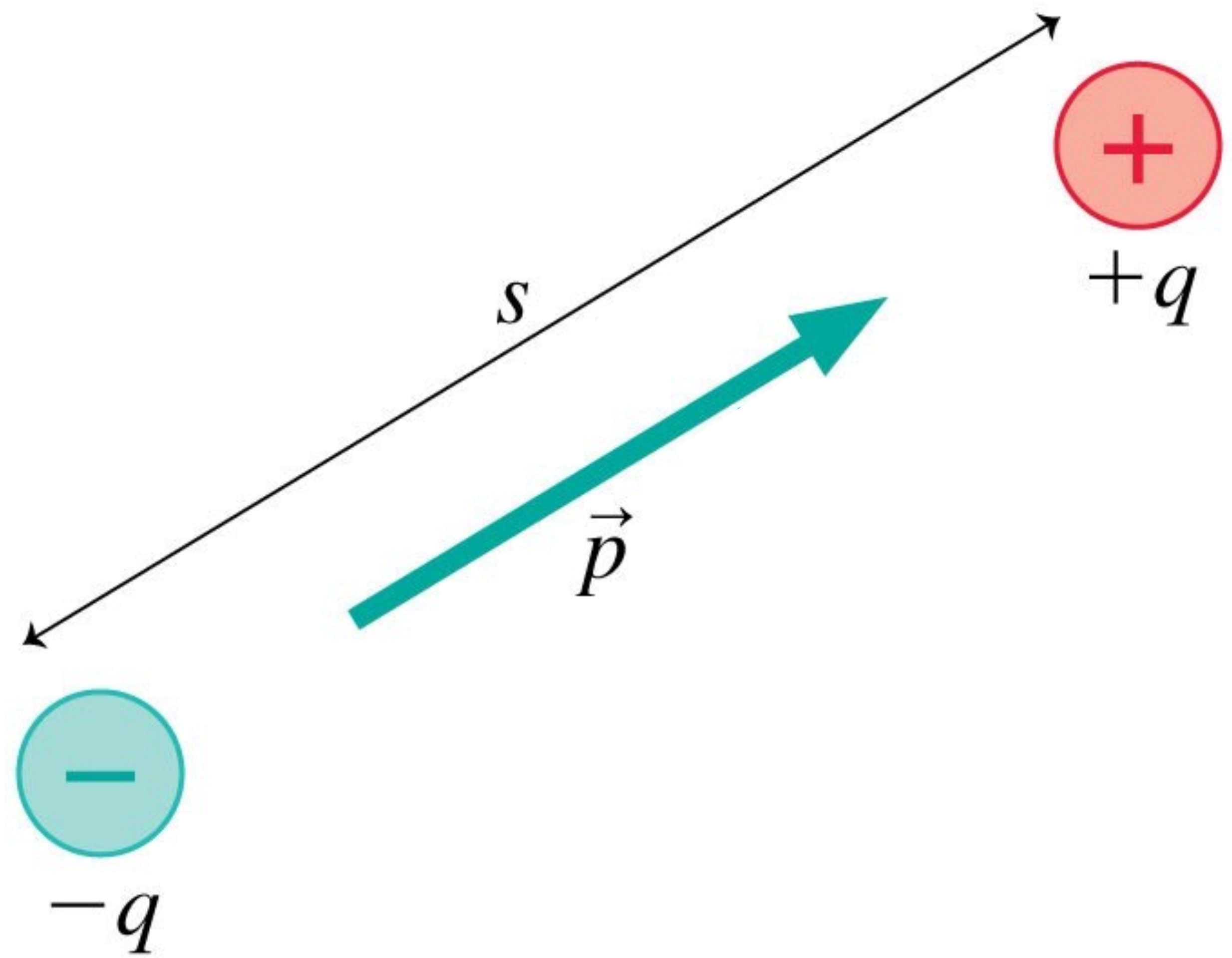
C. $\dfrac{2Q}{4\pi\epsilon_0 r^2}$

D. $\dfrac{4Q}{4\pi\epsilon_0 (r^2 + d^2)}$

E. $\dfrac{4Q}{4\pi\epsilon_0 r}$

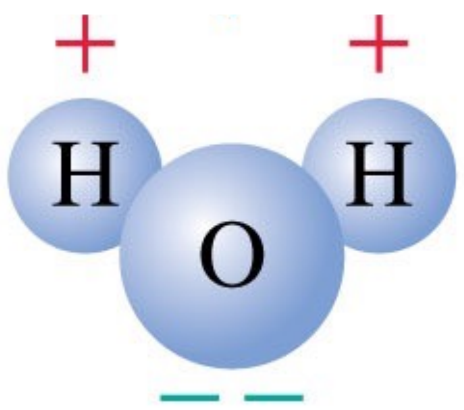


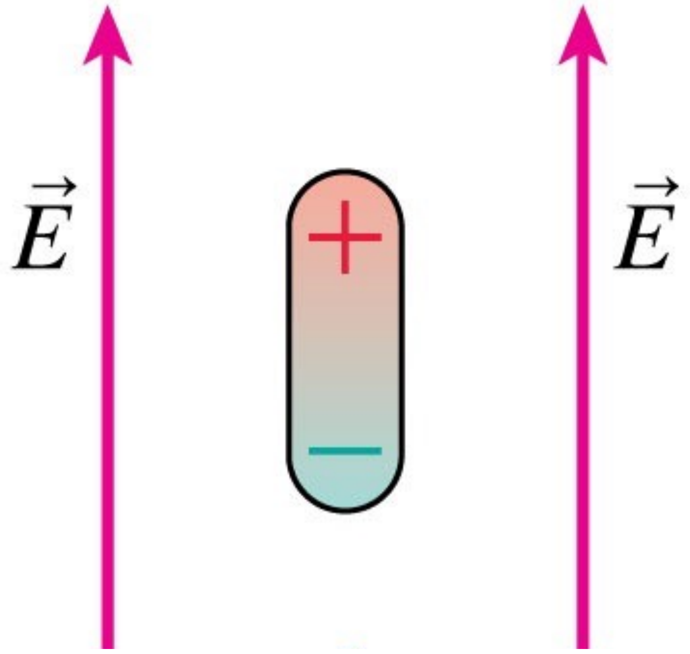
# The dipole moment




$$\vec{p} = (qs, \text{from the negative to the positive charge})C\ m$$

# Dipole

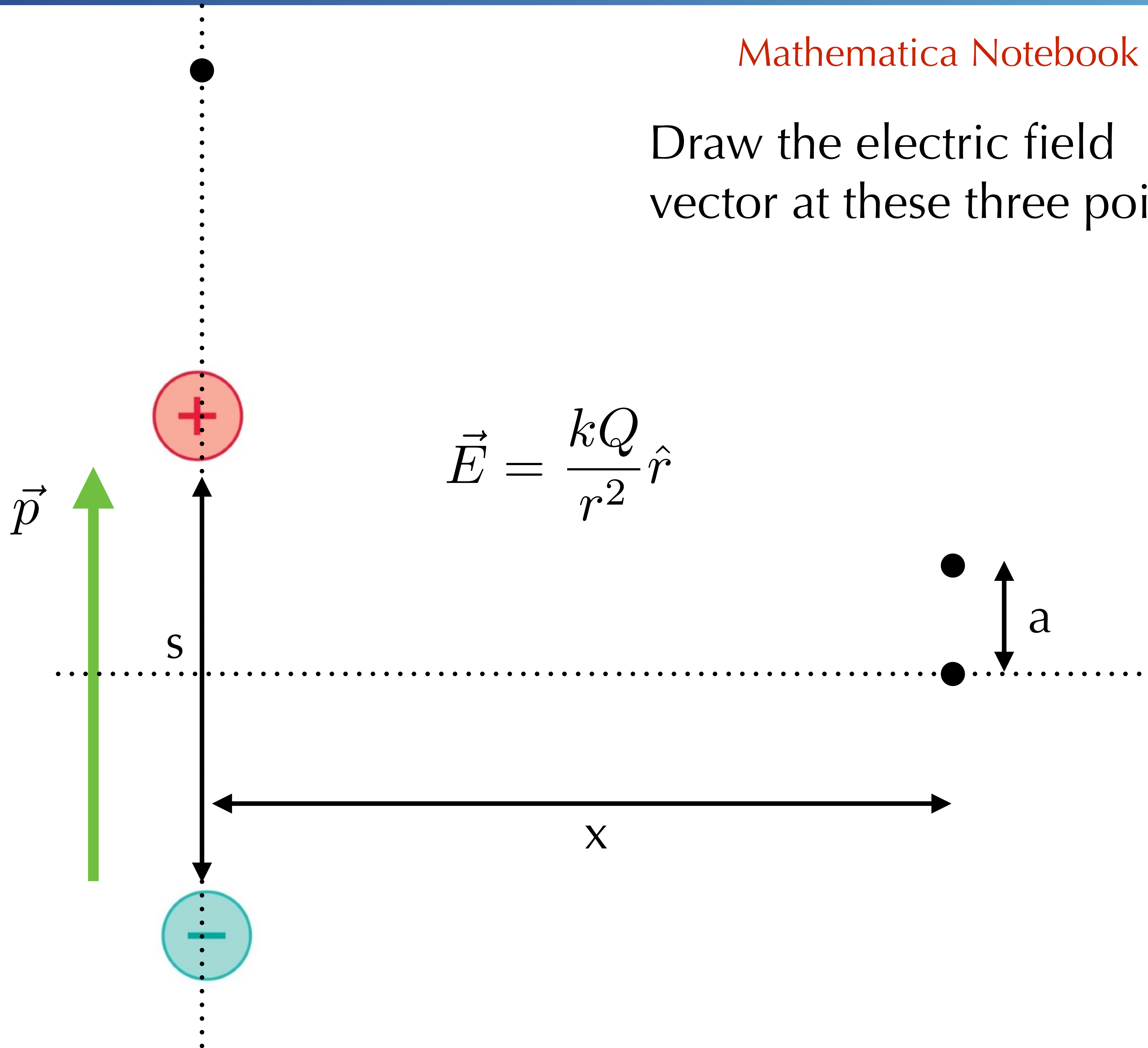


Mathematica Notebook

Draw the electric field vector at these three points.

$$\vec{E} = \frac{kQ}{r^2}\hat{r}$$

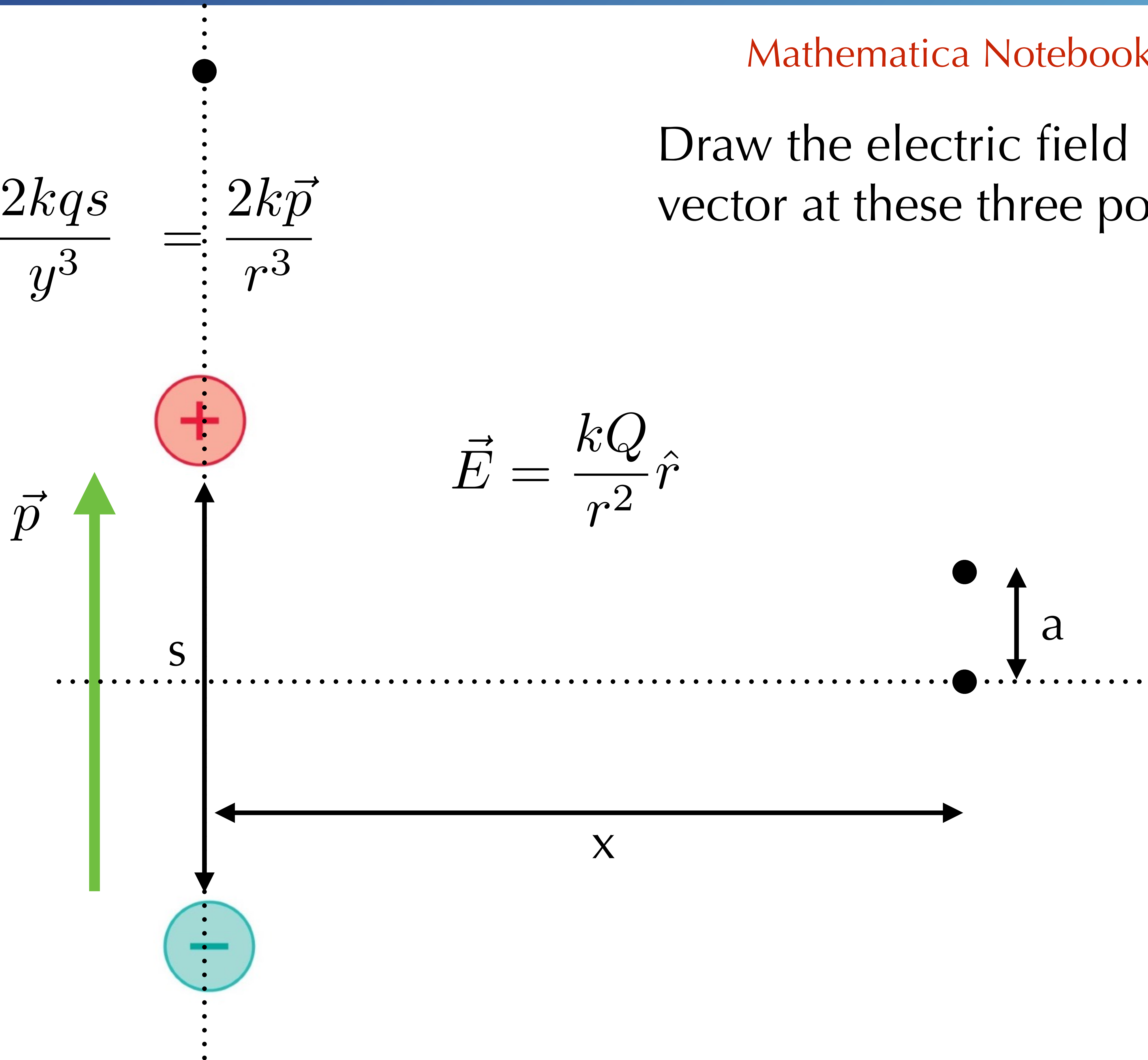


Mathematica Notebook

Draw the electric field vector at these three points.

$$E_y \approx \frac{2kqs}{y^3} = \frac{2k\vec{p}}{r^3}$$

$$\vec{E} = \frac{kQ}{r^2}\hat{r}$$



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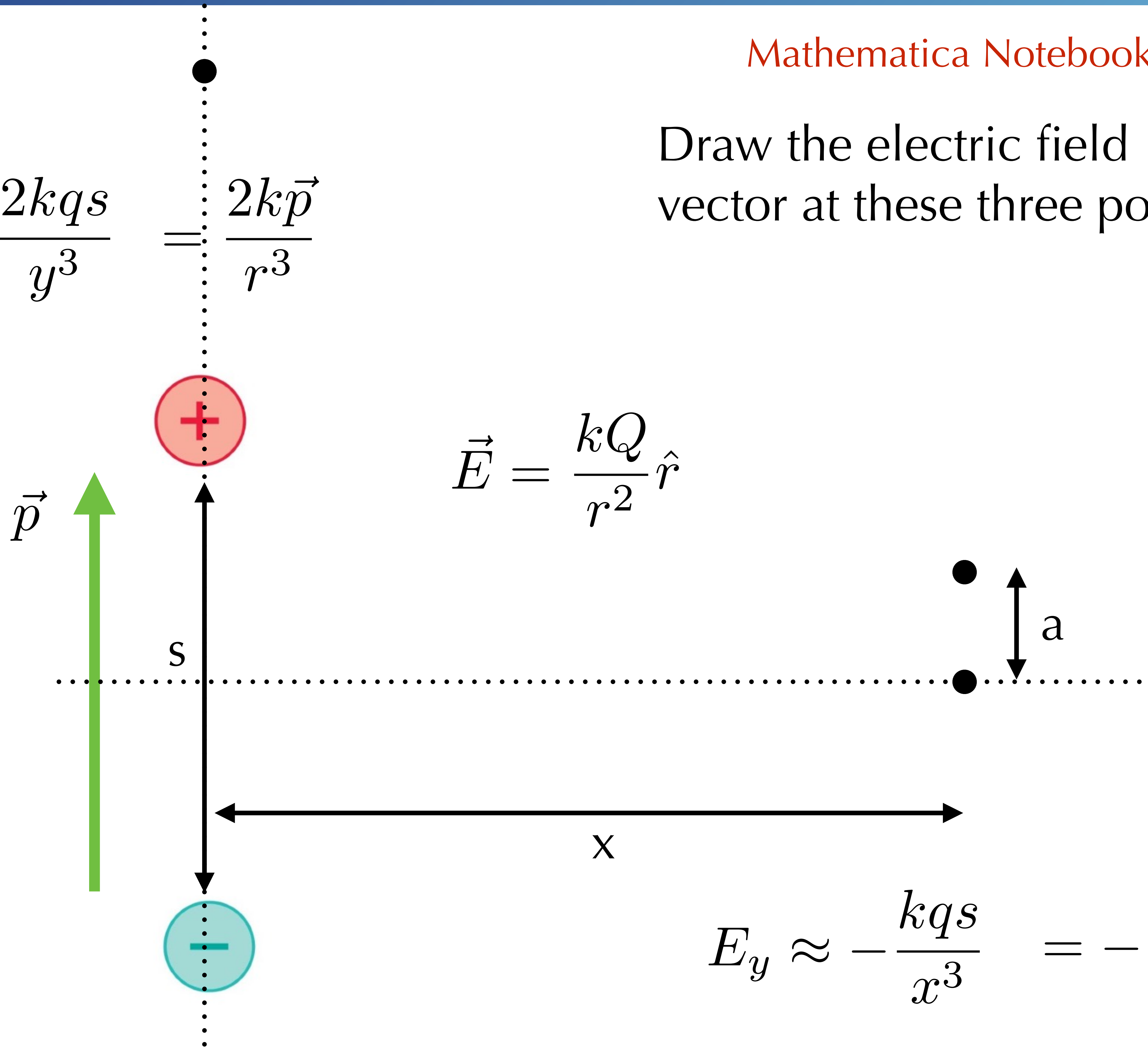
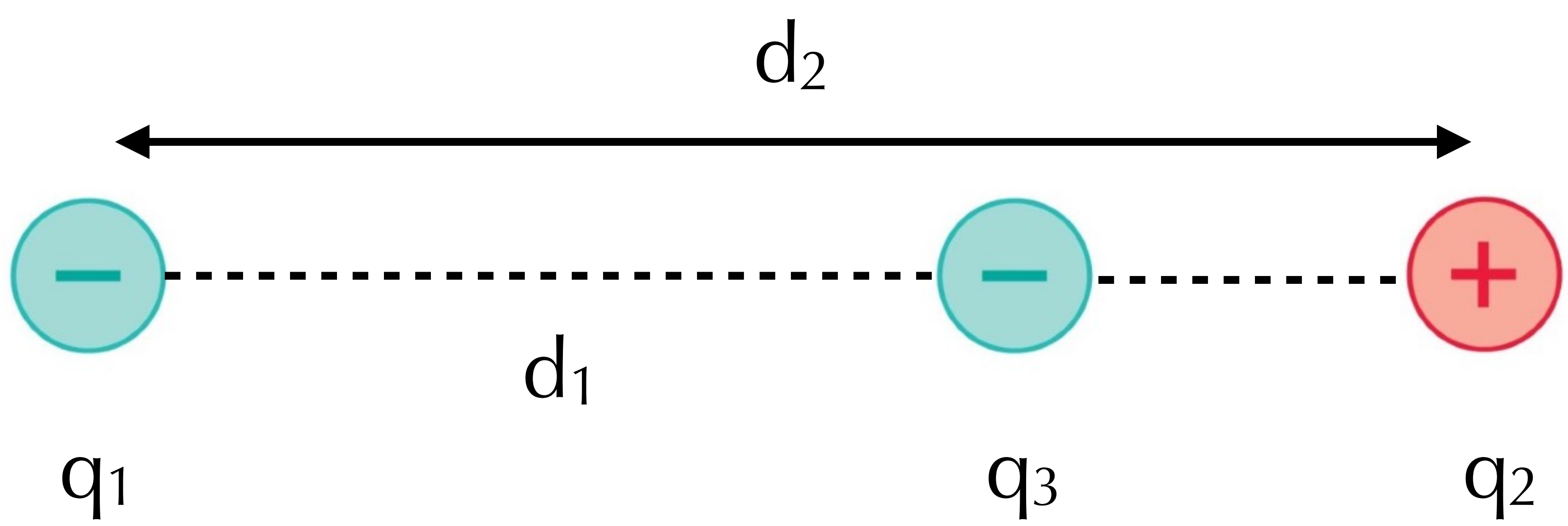
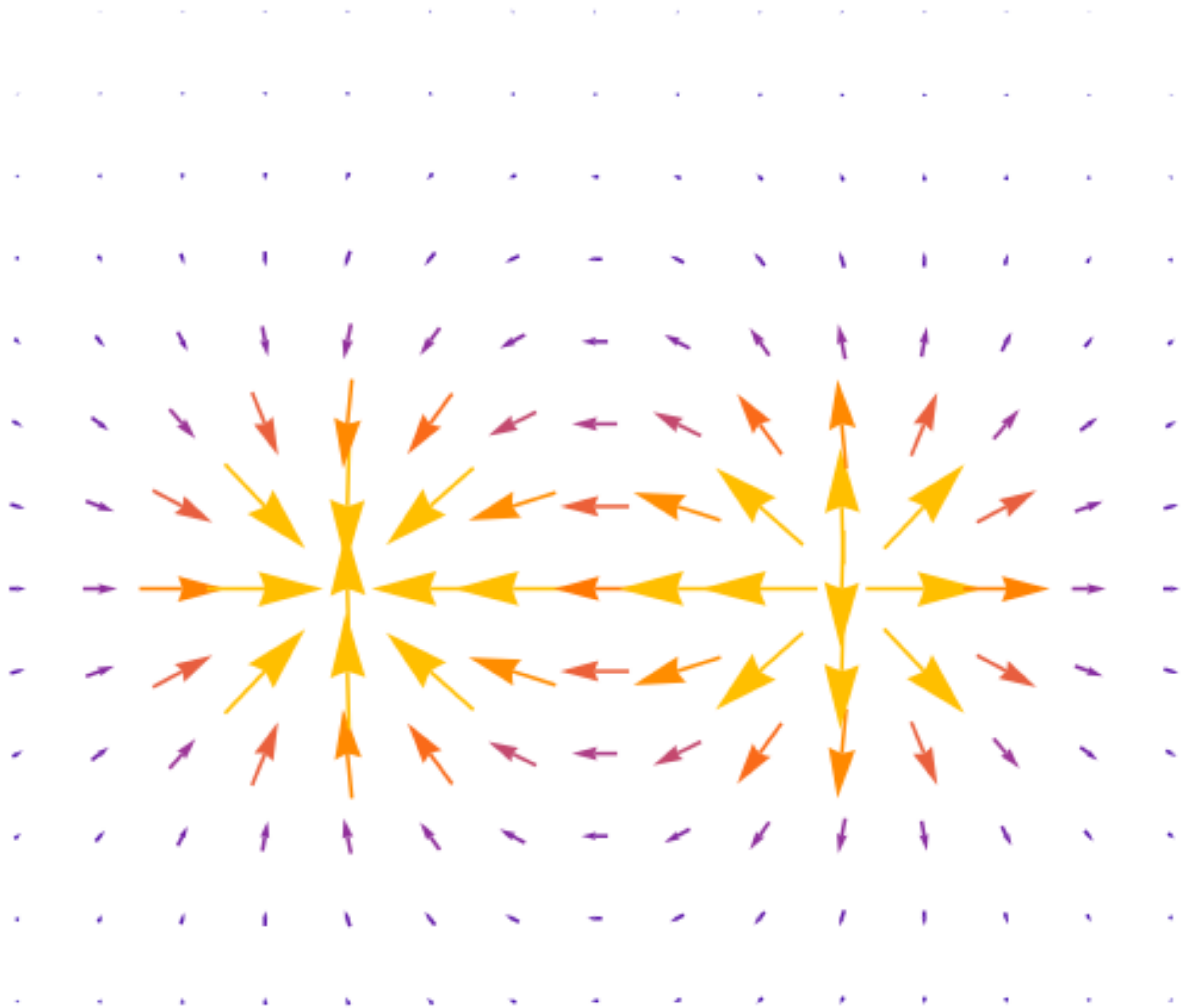


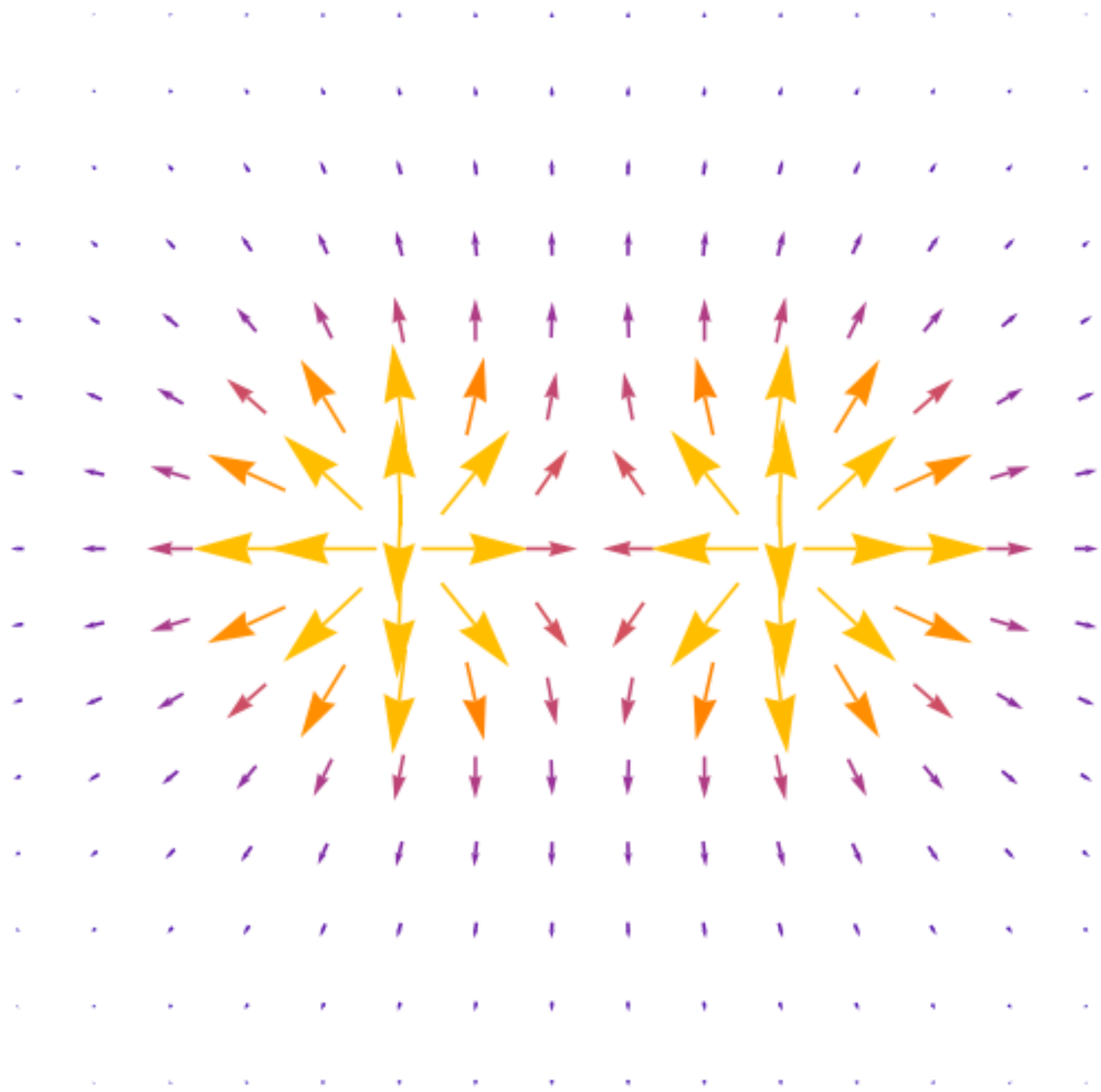

$$E_y \approx -\frac{kqs}{x^3} = -\frac{k\vec{p}}{r^3}$$


$d_2$
$d_1$
$q_1$
$q_3$
$q_2$

What are the signs of the charges?

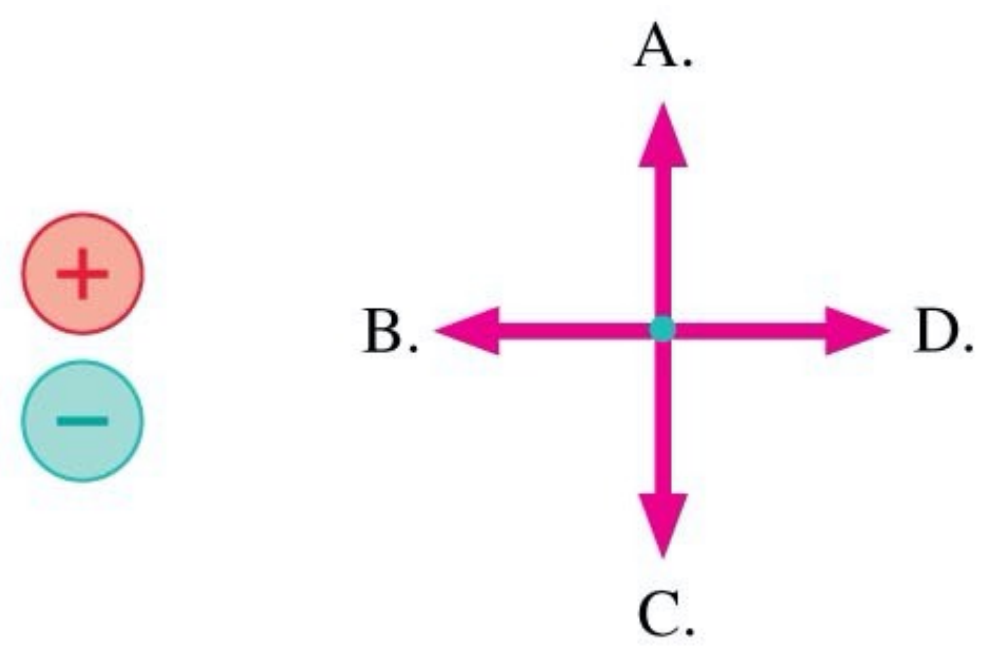


What are the signs of the charges?



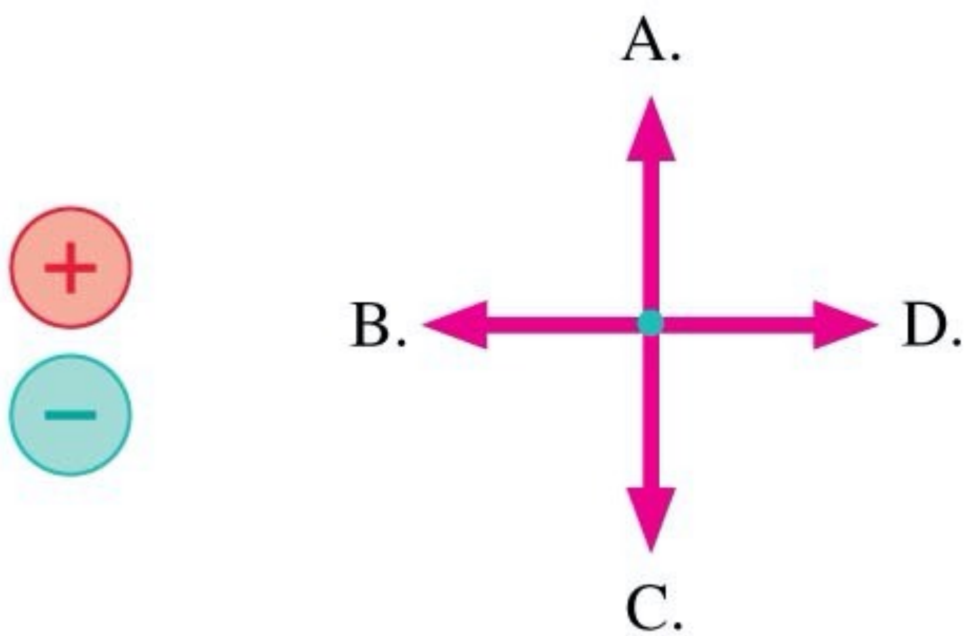
# Question #25

An electron is in the plane that bisects a dipole. What is the direction of the electric force on the electron?

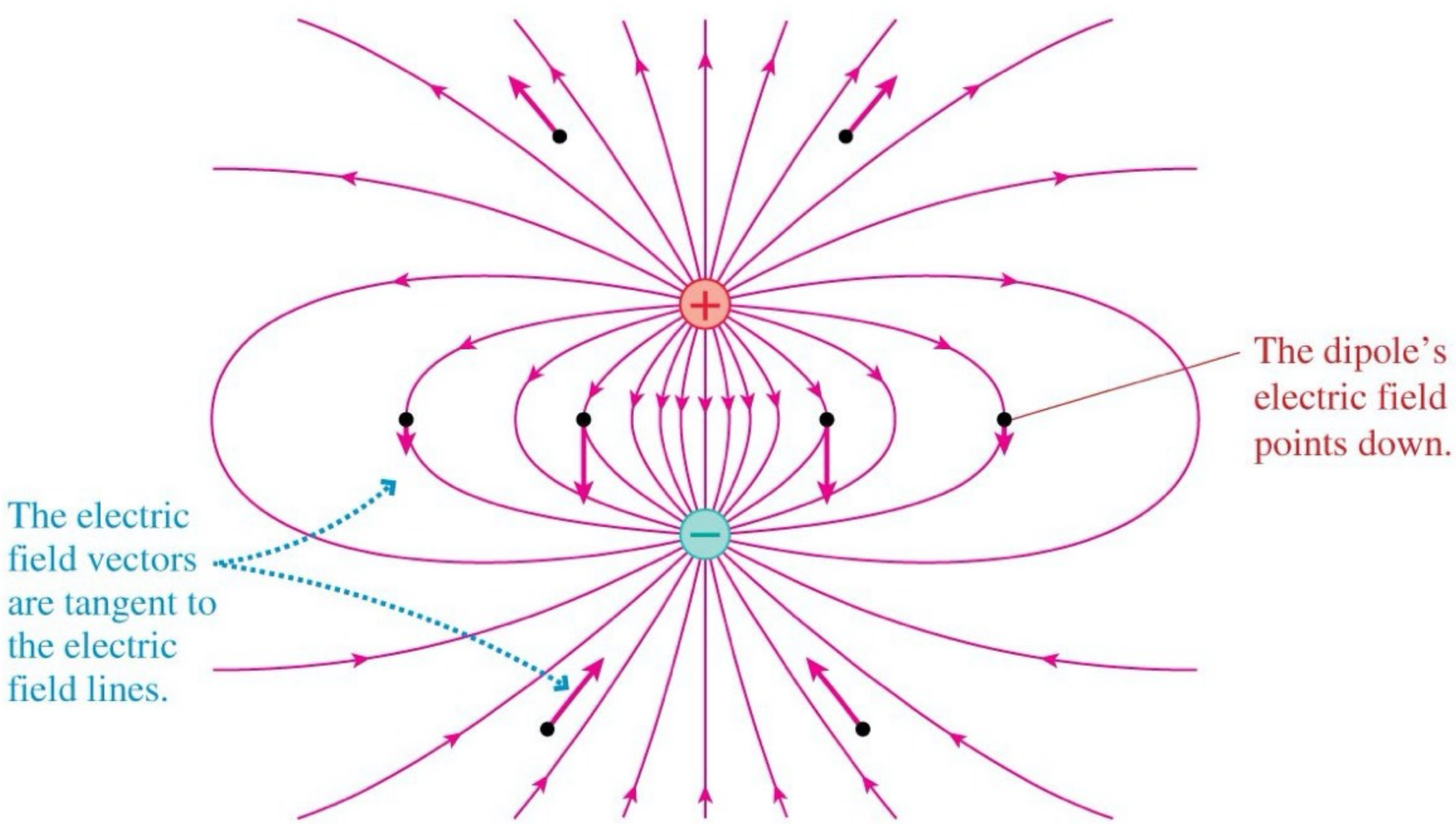



E. The force is zero.

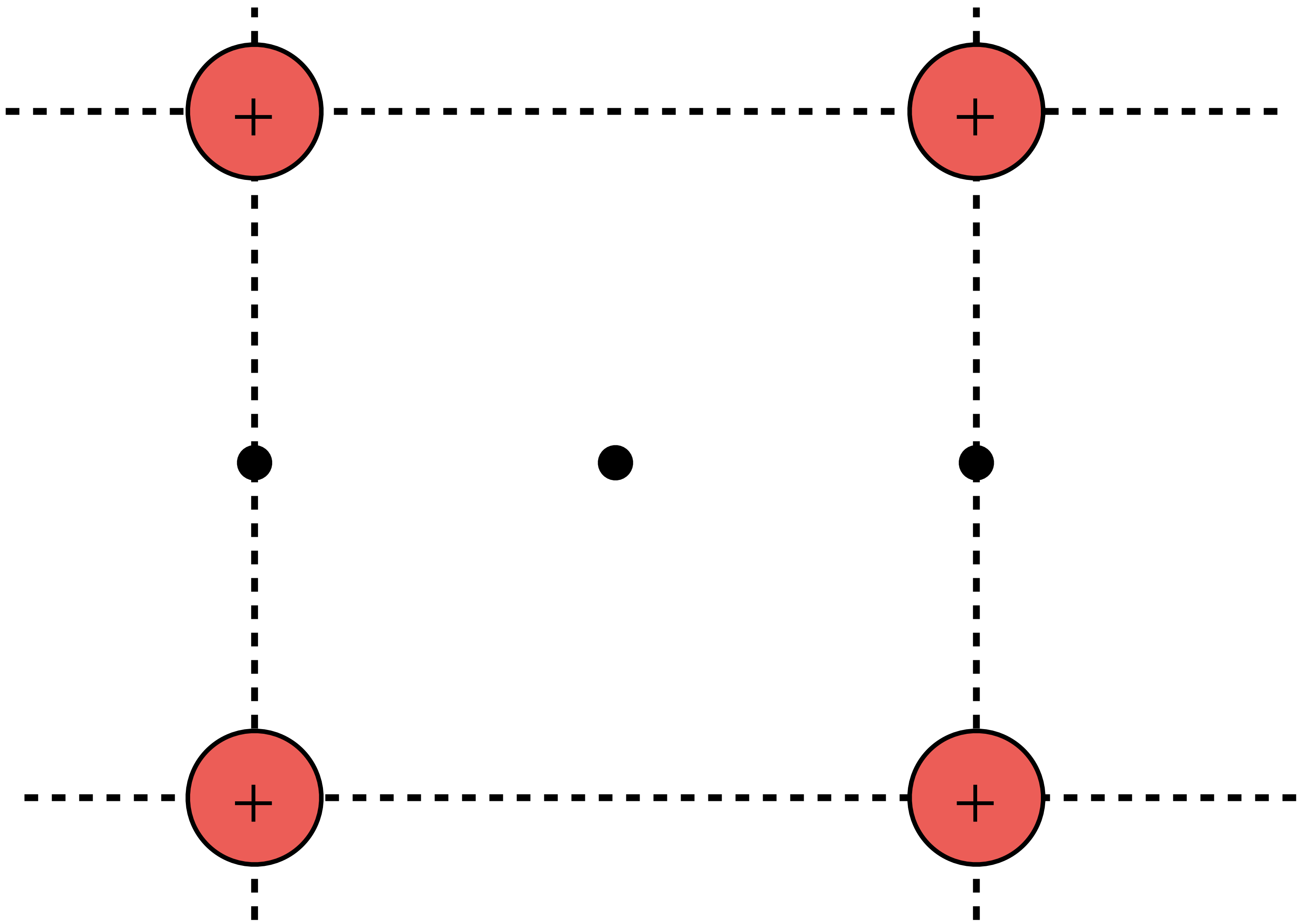
An electron is in the plane that bisects a dipole. What is the direction of the electric force on the electron?



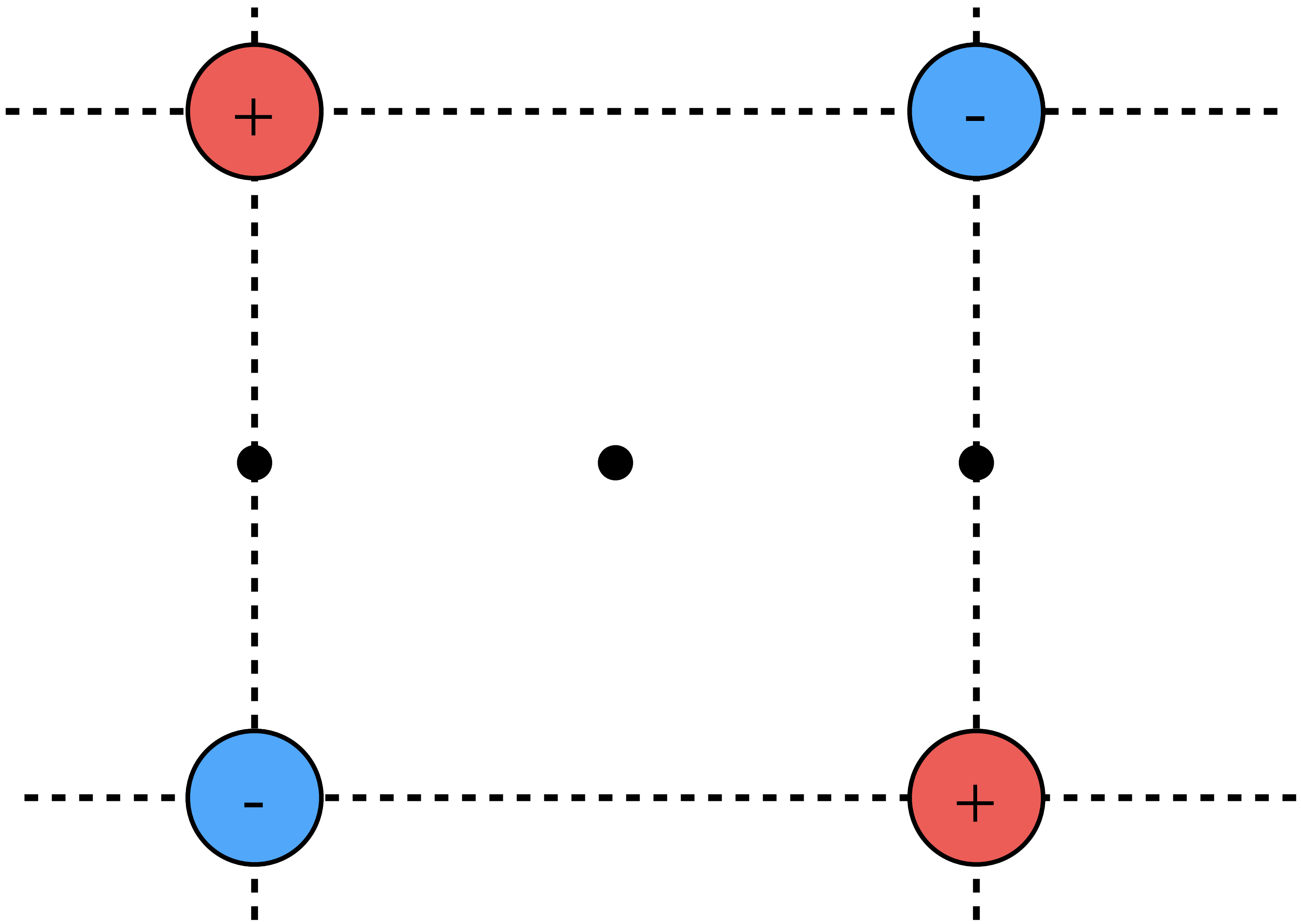

E. The force is zero.

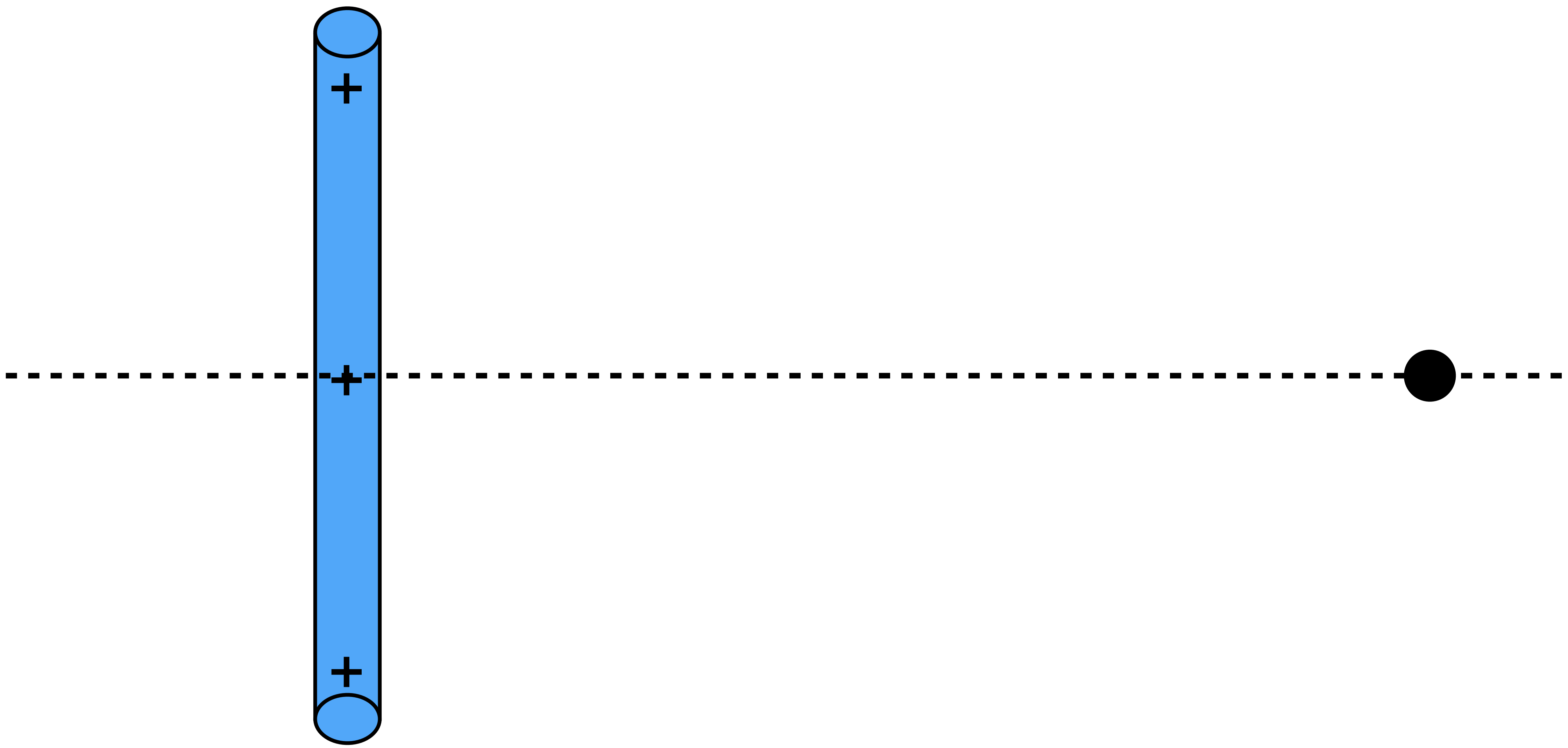


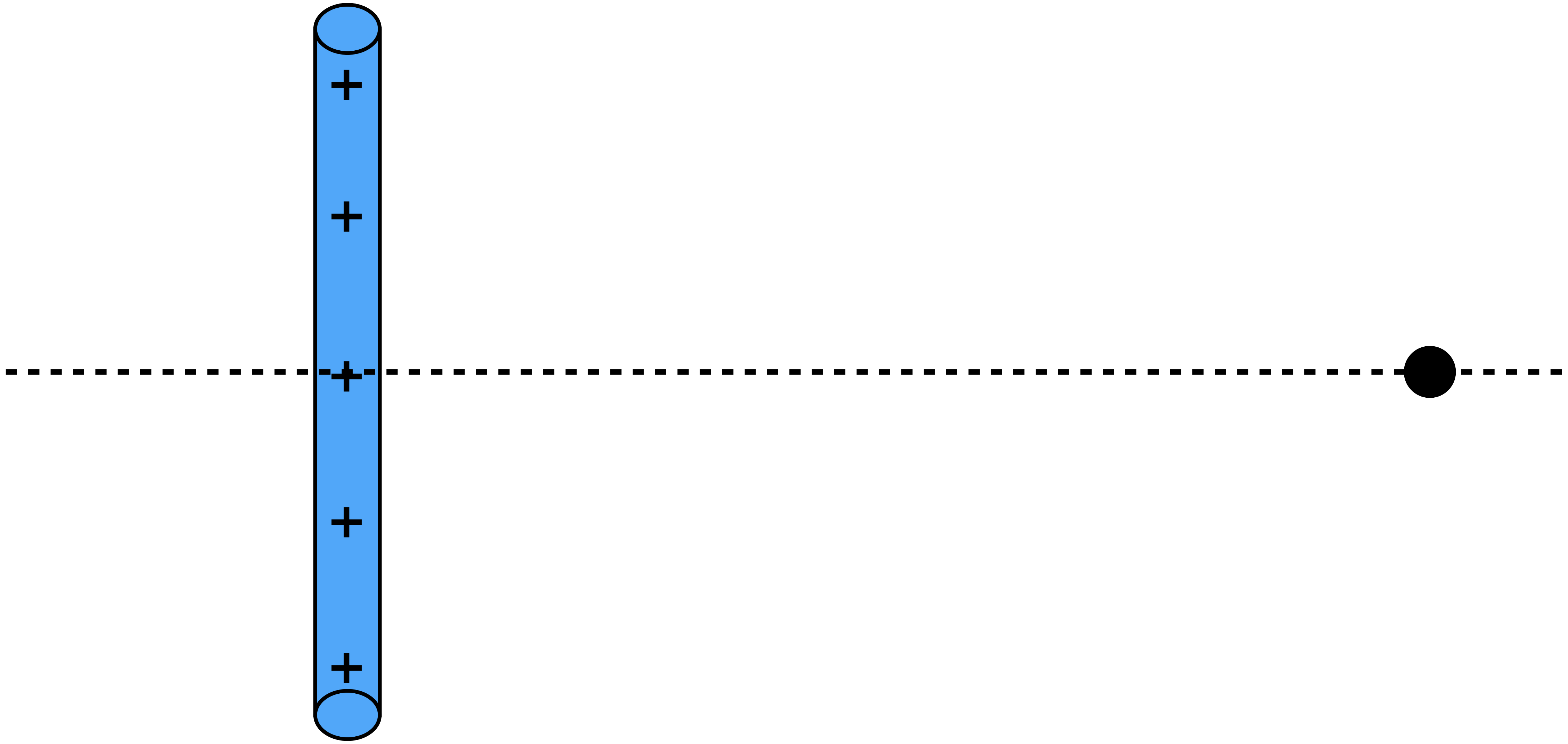
Draw the electric field due to these four point charges

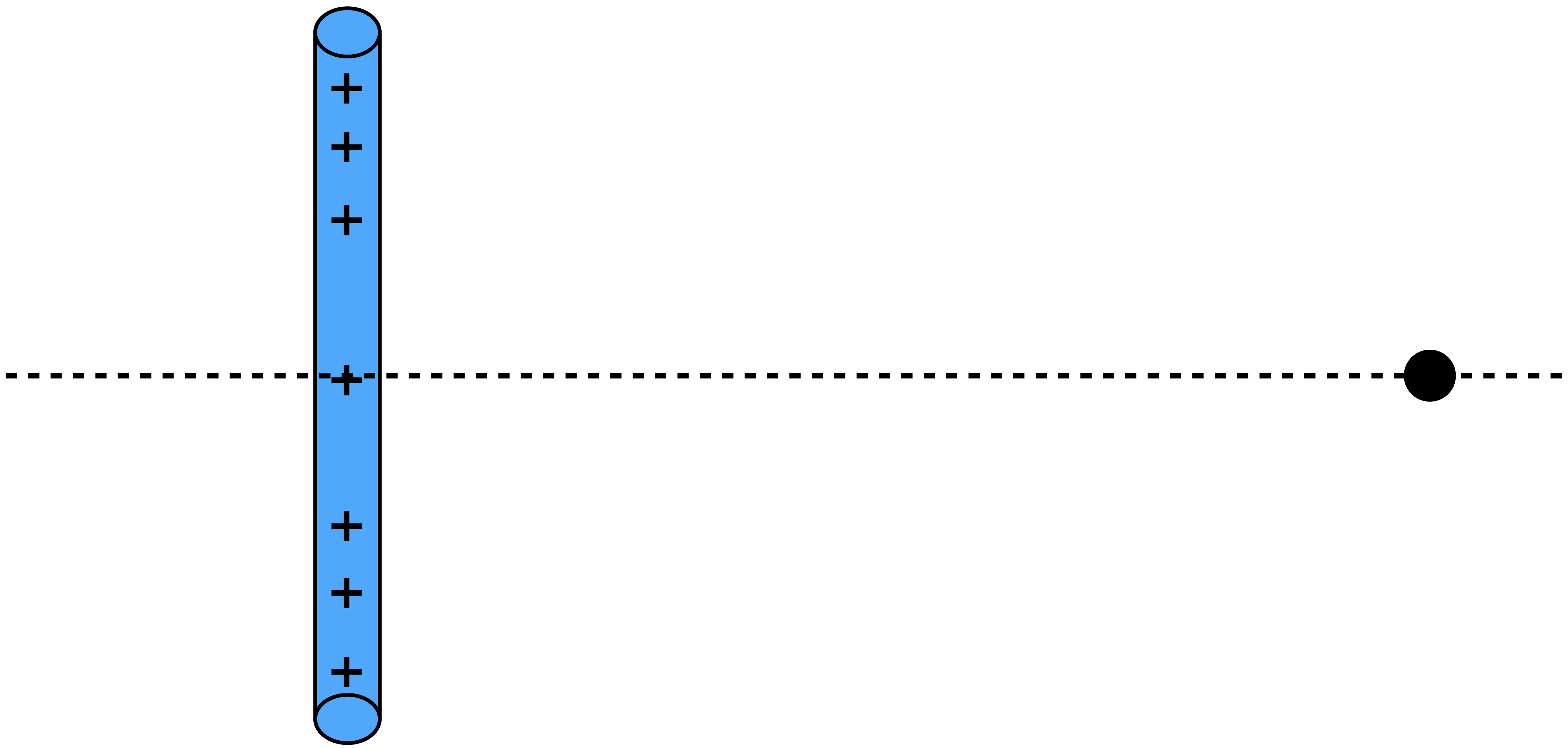


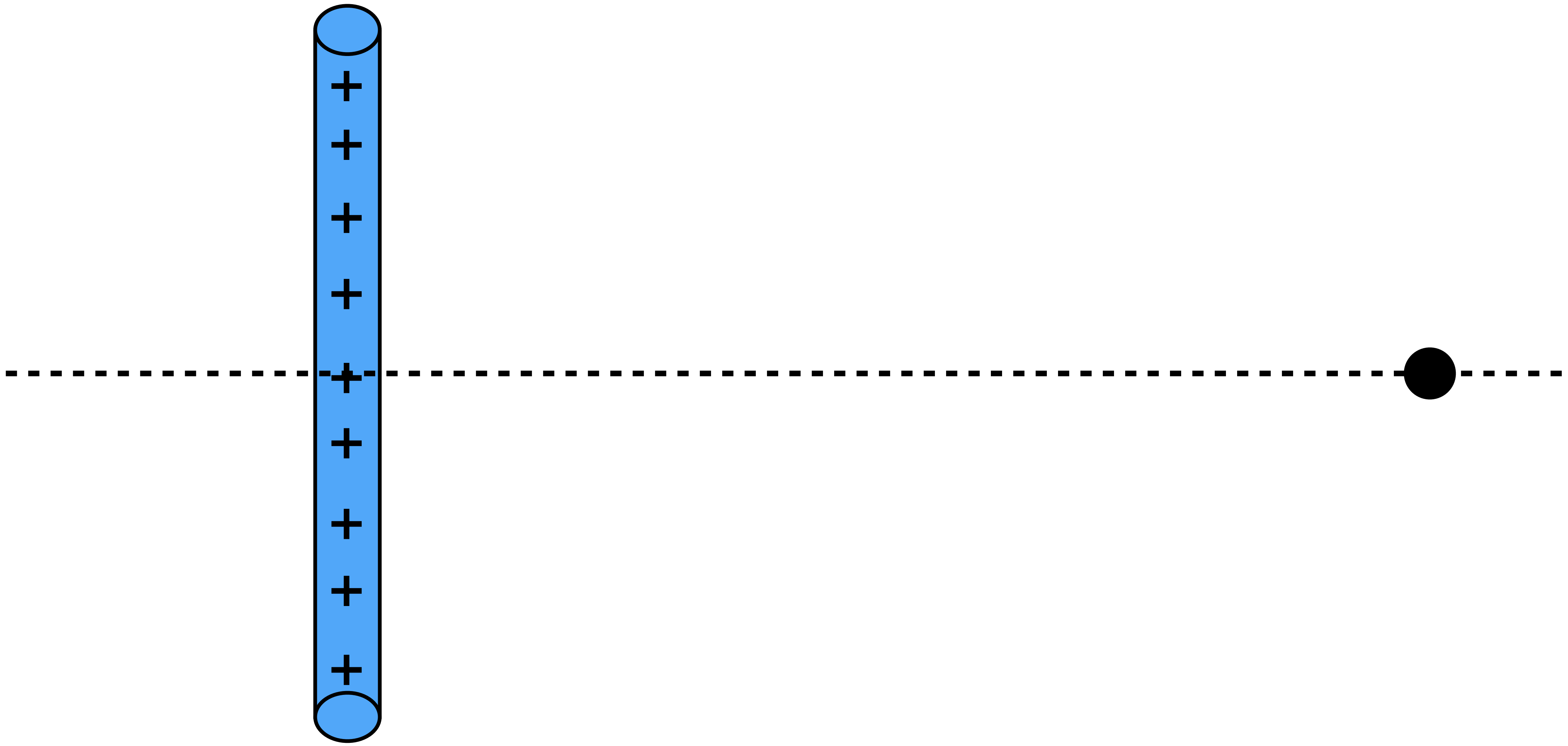
Draw the electric field due to these four point charges

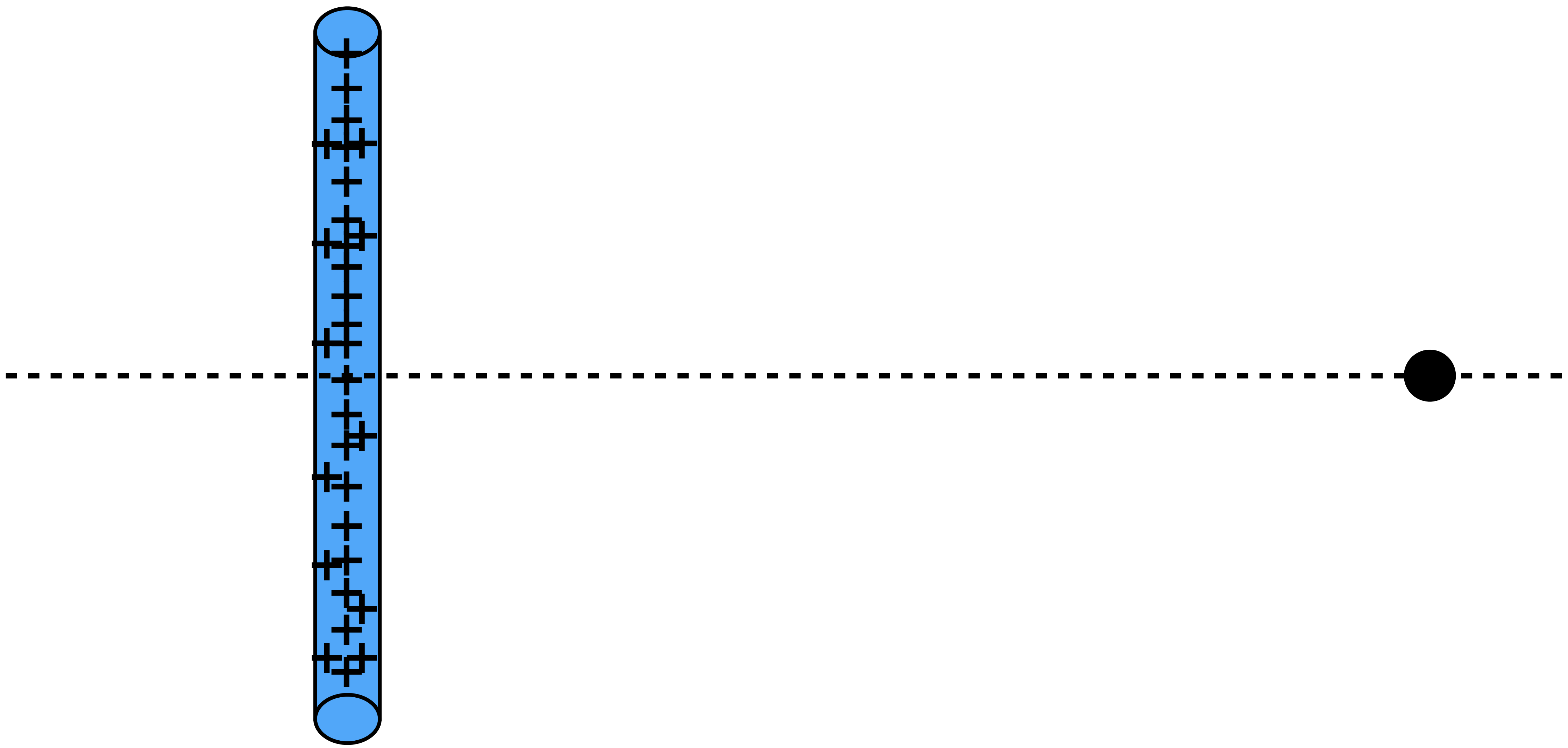






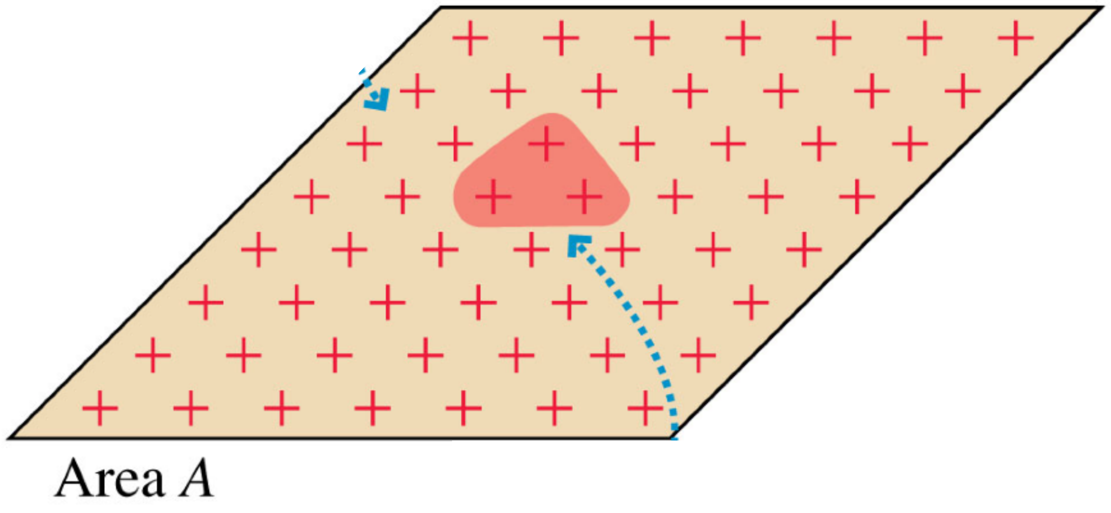




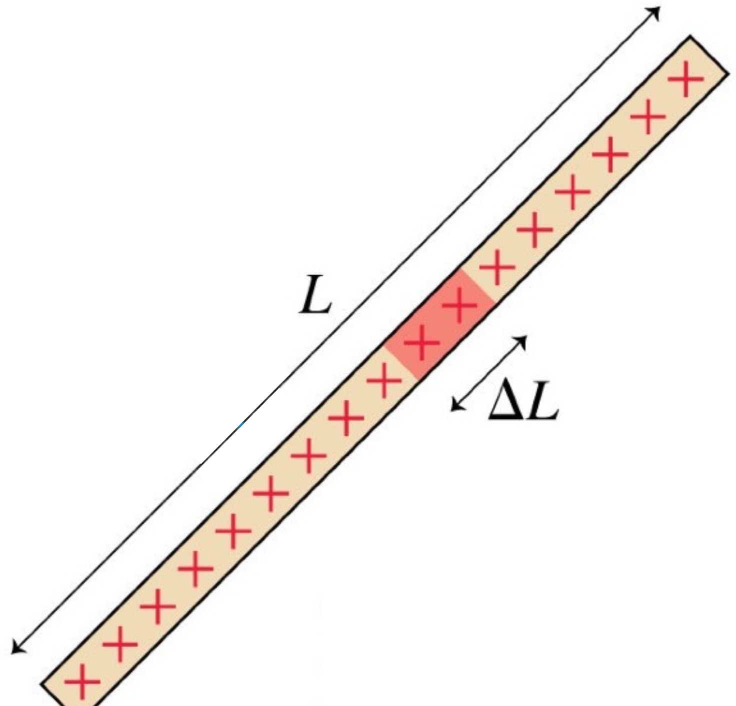


# Linear Charge density

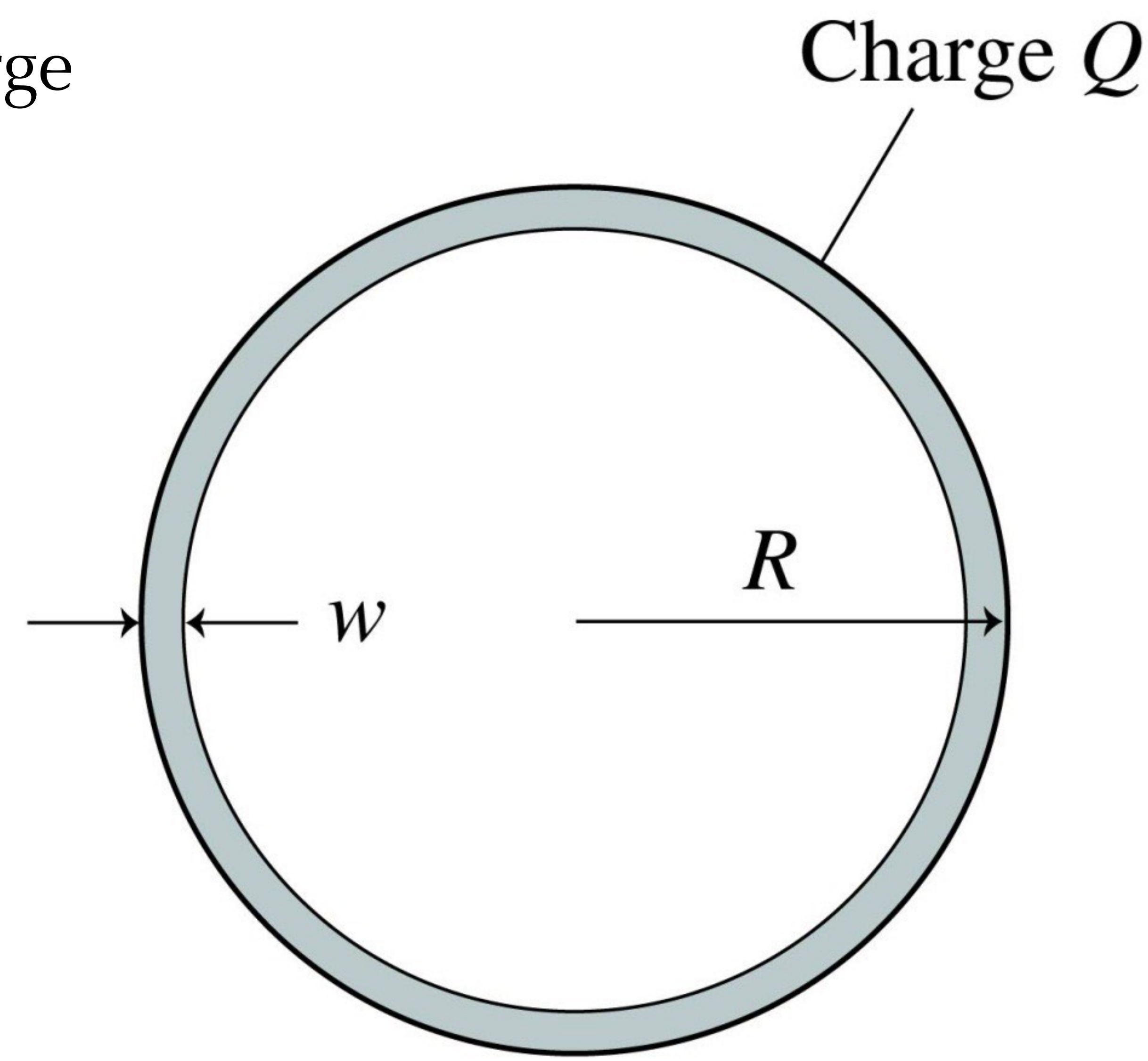
$$\eta = \frac{Q}{A}$$




$$\lambda = \frac{Q}{L}$$



A flat circular ring is made from a very thin sheet of metal. Charge $Q$ is uniformly distributed over the ring. Assuming $w << R$, the surface charge density $\eta$ is




A. $Q/\pi R^2$.
B. $Q/4\pi Rw$.
C. $Q/2\pi Rw$.
D. $Q/2\pi R^2$.
E. $Q/\pi Rw$.

At the dot, the *y*-component of the electric field due to the shaded region of charge is

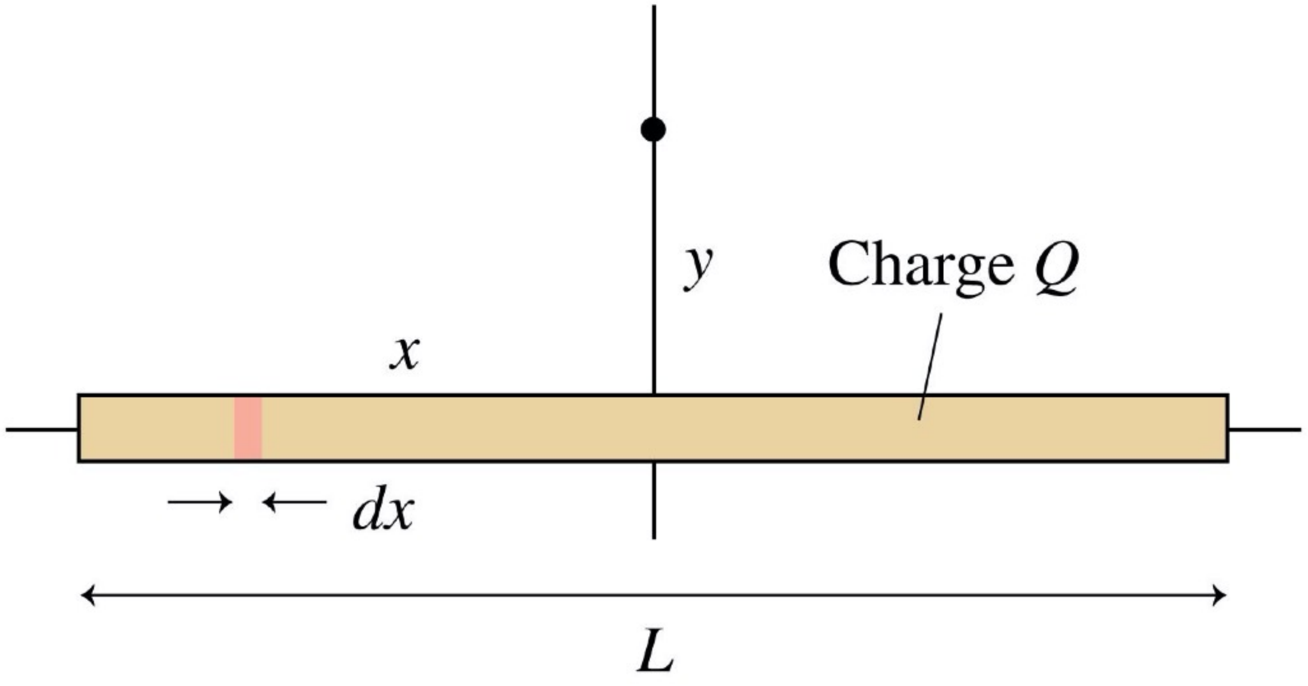
A. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \dfrac{y}{x}$

B. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \dfrac{x}{y}$

C. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \dfrac{y}{\sqrt{x^2+y^2}}$

D. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \dfrac{x}{\sqrt{x^2+y^2}}$

E. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0\sqrt{x^2+y^2}} \times \dfrac{y}{\sqrt{x^2+y^2}}$



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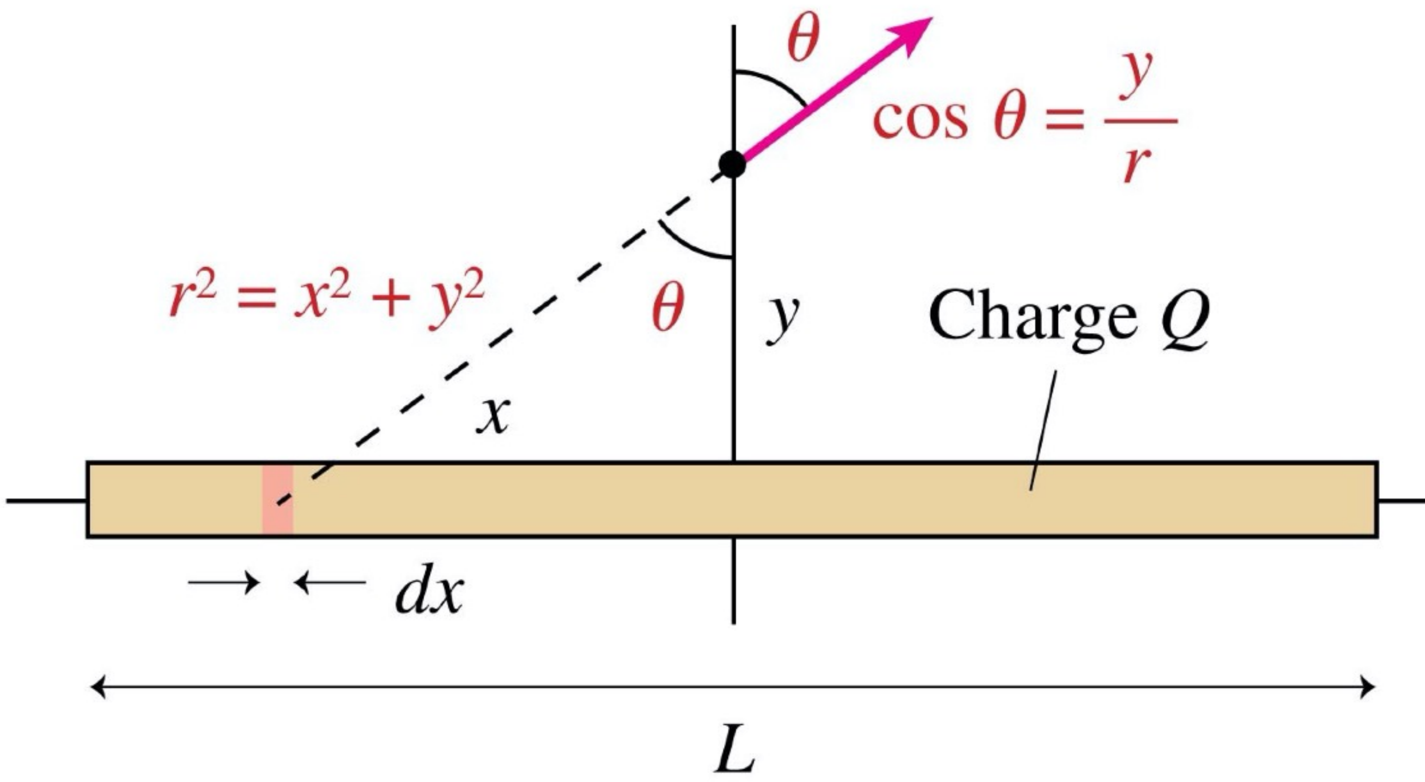
C. $$\frac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \frac{y}{\sqrt{x^2+y^2}}$$

D. $$\frac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \frac{x}{\sqrt{x^2+y^2}}$$

E. $$\frac{(Q/L)\,dx}{4\pi\epsilon_0\sqrt{x^2+y^2}} \times \frac{y}{\sqrt{x^2+y^2}}$$



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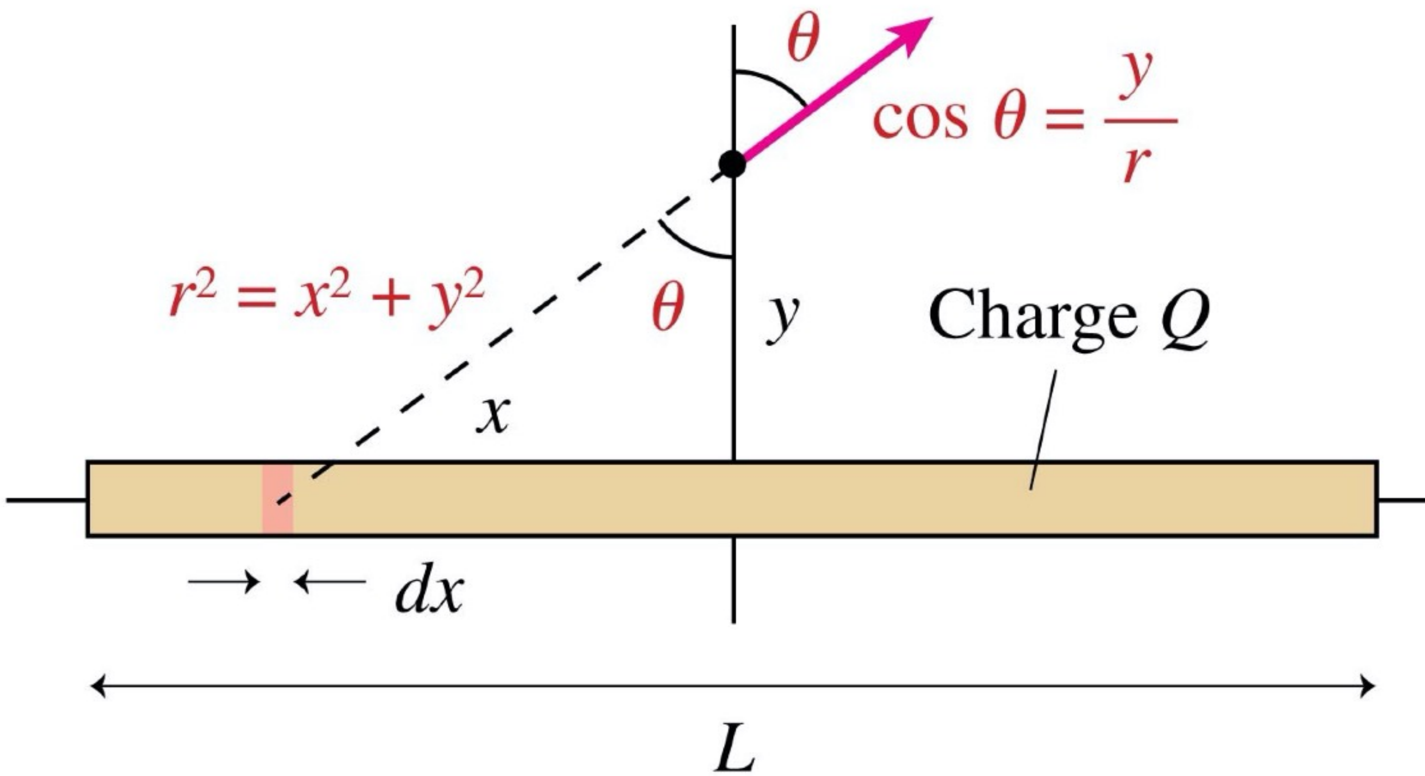
D. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0(x^2+y^2)} \times \dfrac{x}{\sqrt{x^2+y^2}}$

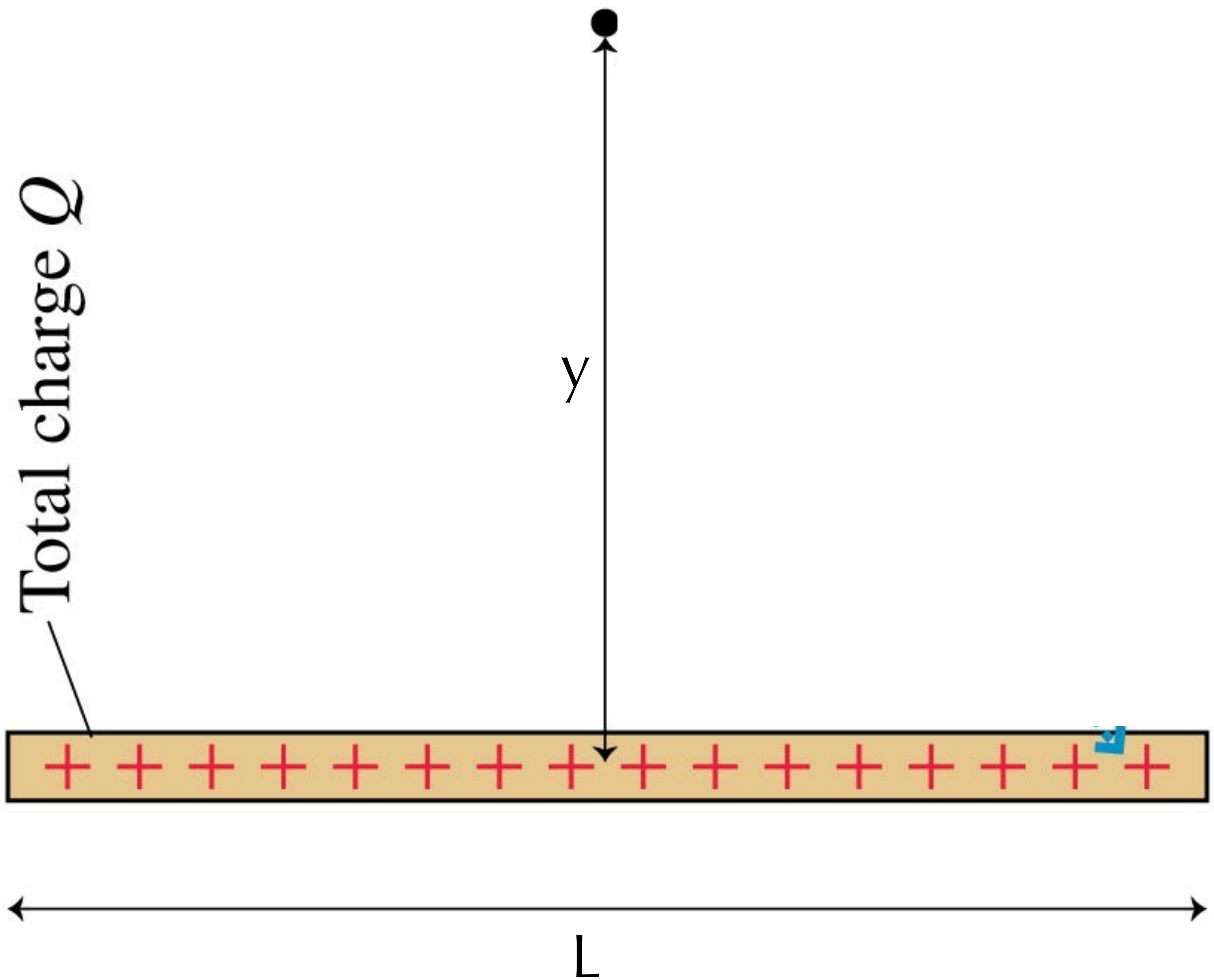
E. $\dfrac{(Q/L)\,dx}{4\pi\epsilon_0\sqrt{x^2+y^2}} \times \dfrac{y}{\sqrt{x^2+y^2}}$




$$dE_y = \frac{k\frac{Q}{L}y\,dx}{(x^2+y^2)^{3/2}}$$

# What is the E field due to this line of charge?

$$dE_y = \frac{k\frac{Q}{L}y\,dx}{(x^2+y^2)^{3/2}}$$



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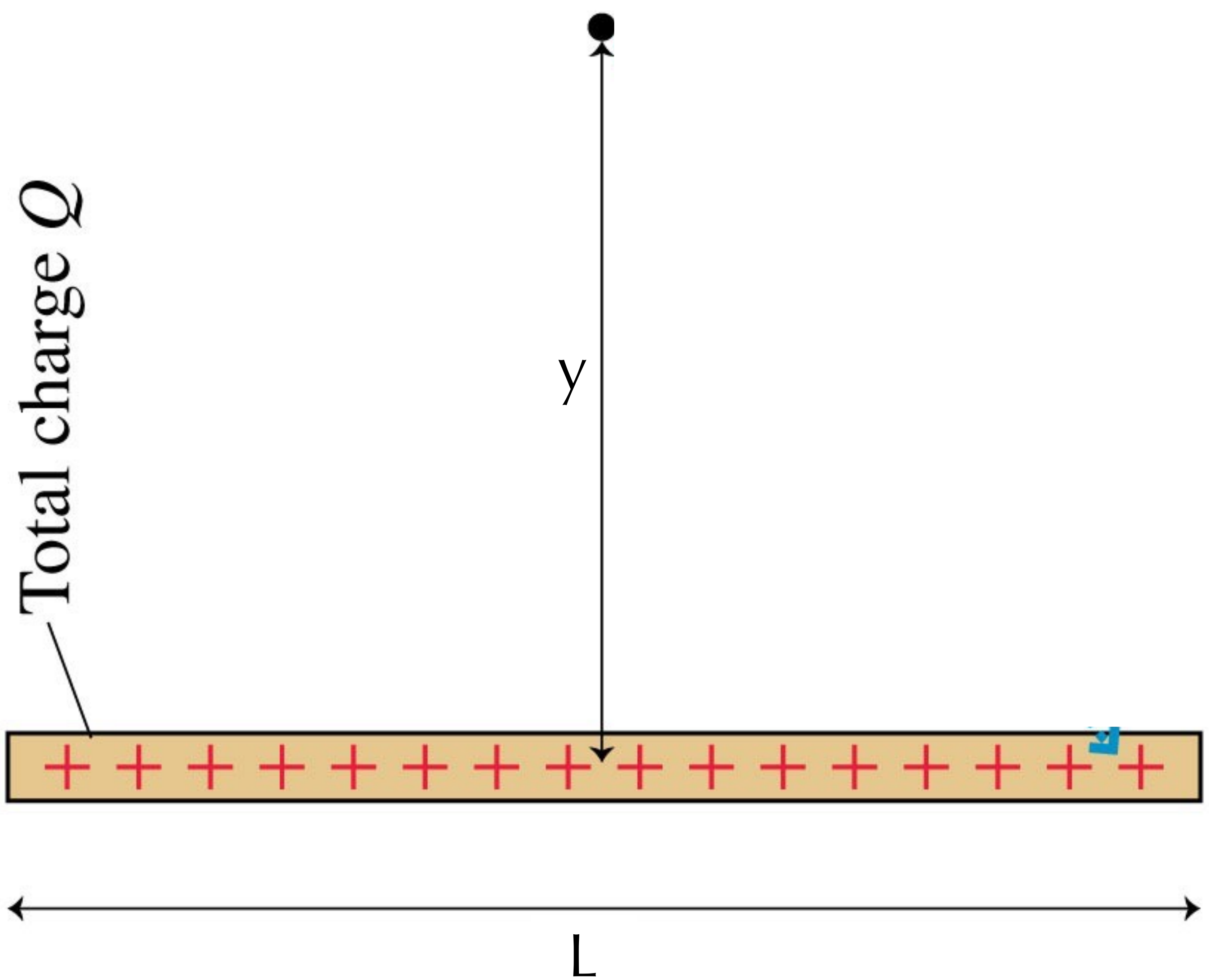
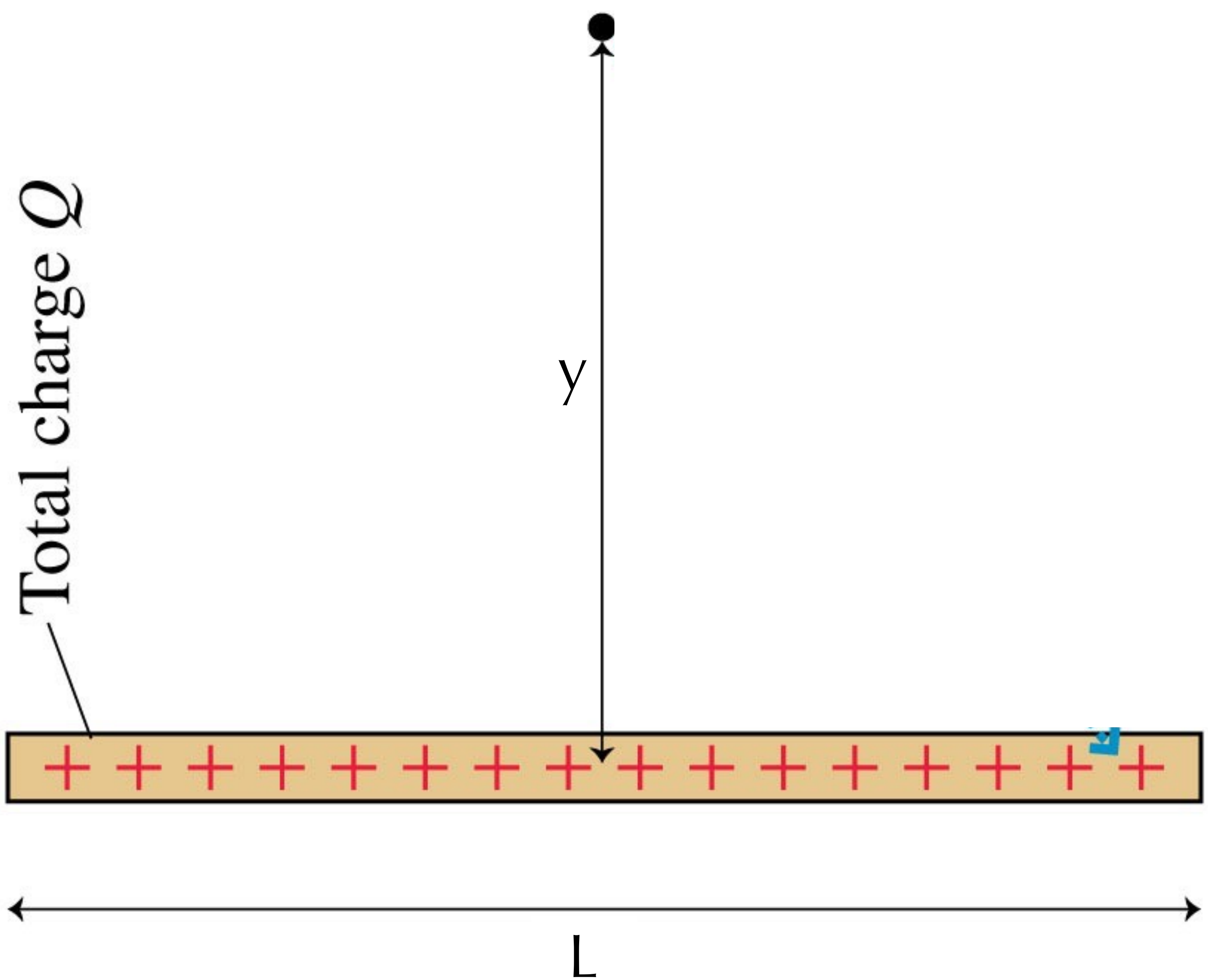



$$E_{\text{rod}} = \frac{2k\lambda}{d}$$

# What is the E field due to this line of charge?

$$dE_y = \frac{k\frac{Q}{L}y\,dx}{(x^2+y^2)^{3/2}}$$

$$E_y = \frac{kQ}{y\sqrt{y^2+(\frac{L}{2})^2}}$$

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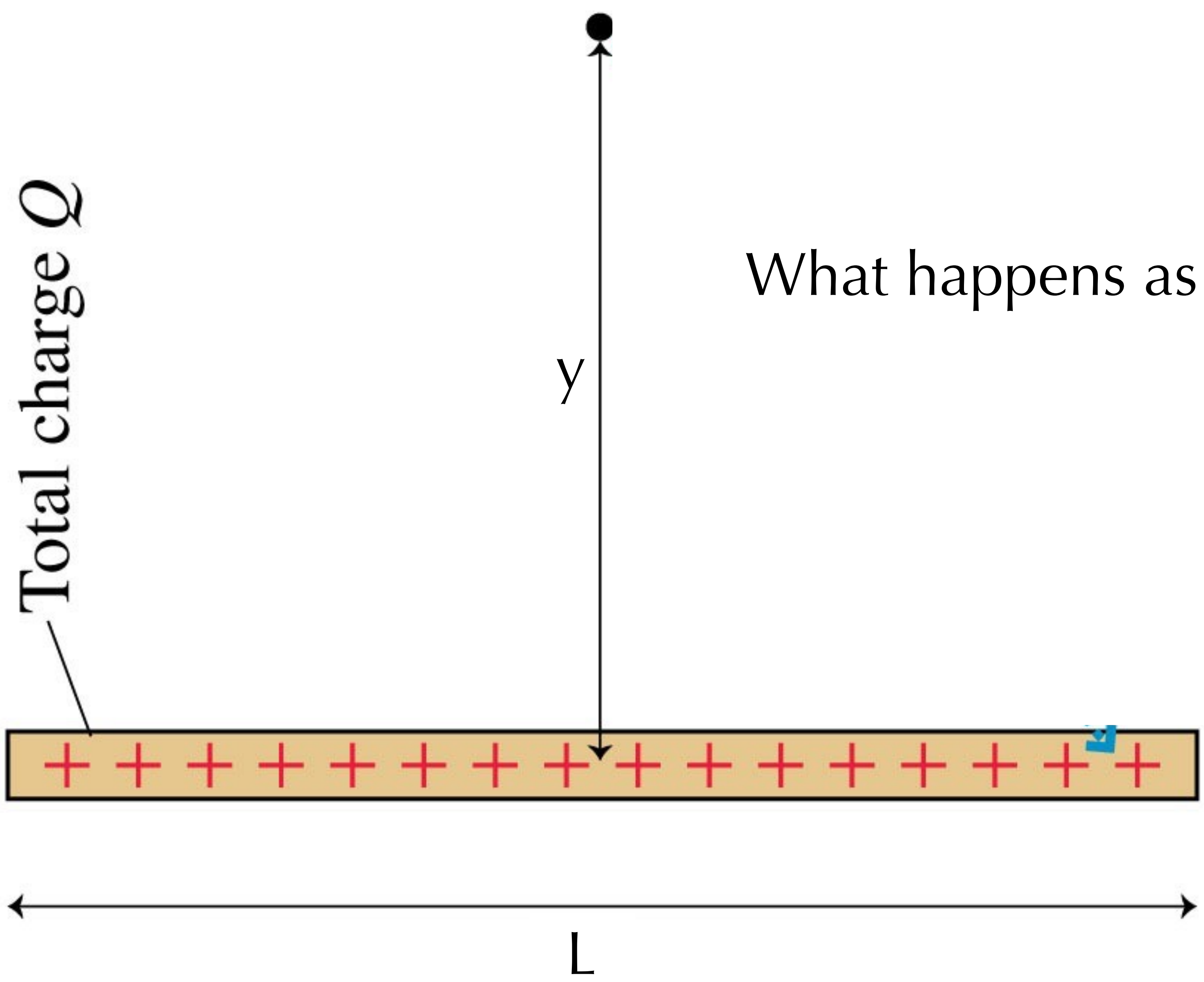
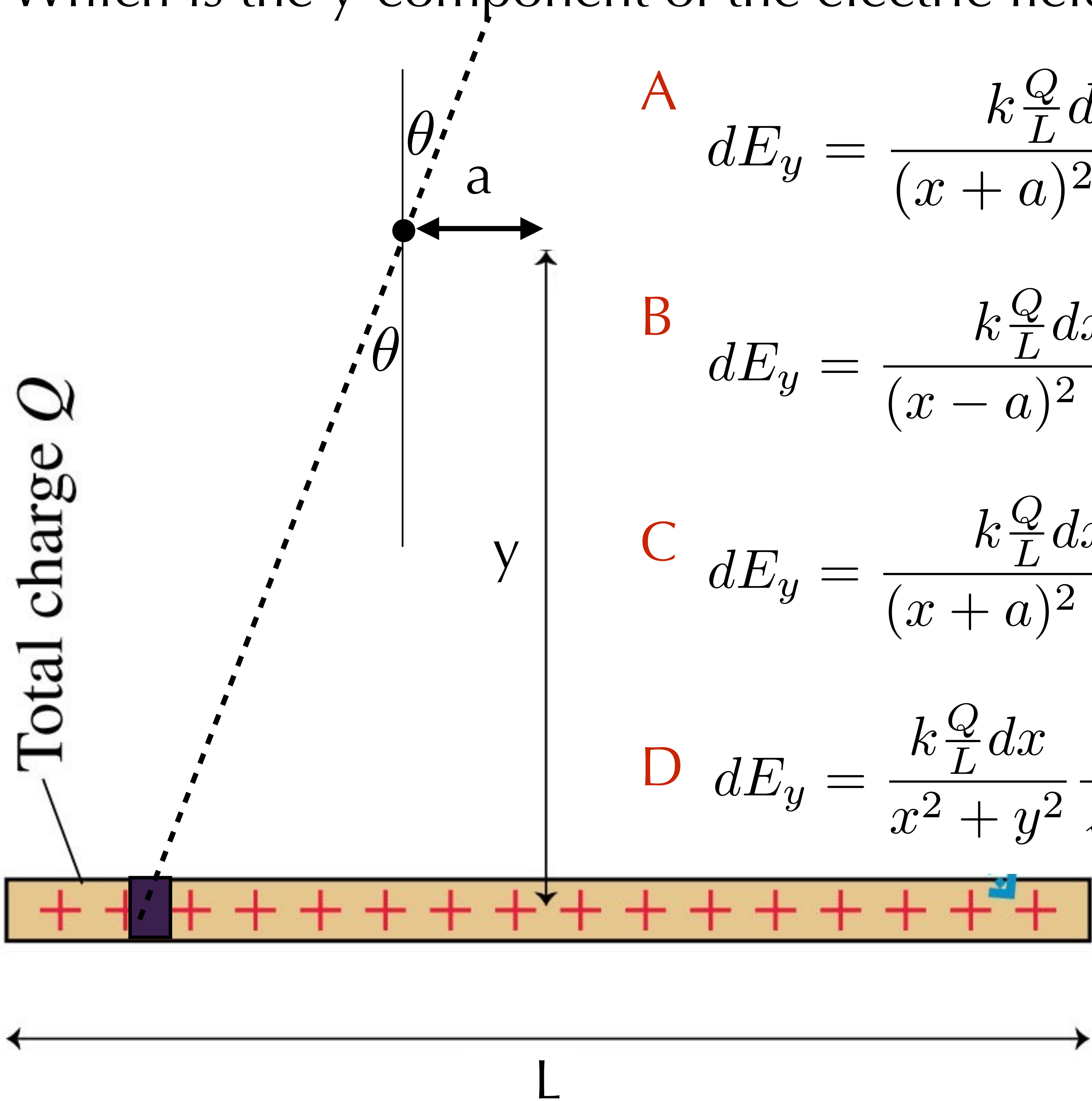



What happens as $L \to \infty$

$$E_{\text{rod}} = \frac{2k\lambda}{d}$$

Which is the y-component of the electric field due to the shaded region?



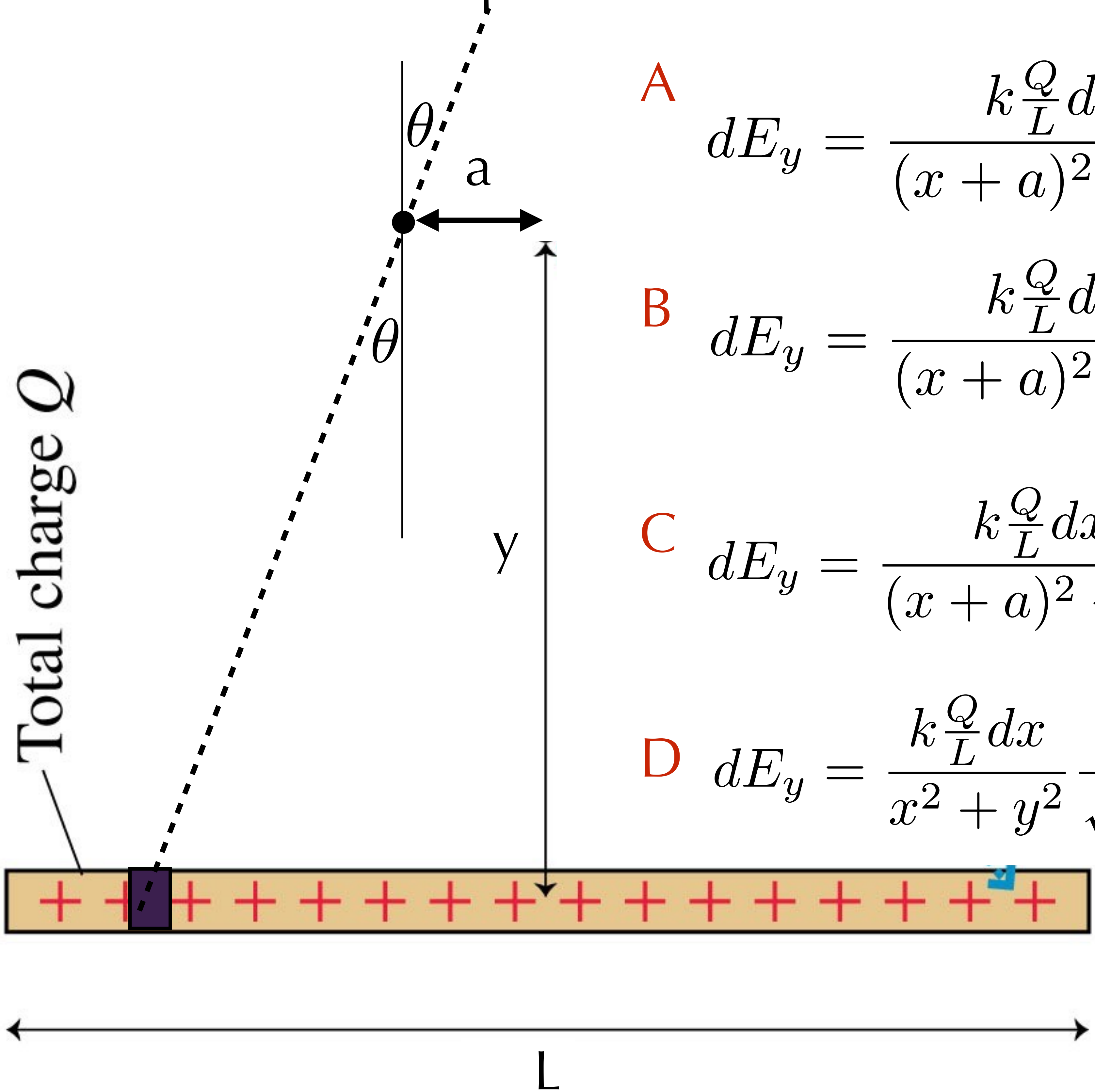

A
$$dE_y = \frac{k\frac{Q}{L}dx}{(x+a)^2+y^2}\frac{y}{\sqrt{(x+a)^2+y^2}}$$

B
$$dE_y = \frac{k\frac{Q}{L}dx}{(x-a)^2+y^2}\frac{y}{\sqrt{(x-a)^2+y^2}}$$

C
$$dE_y = \frac{k\frac{Q}{L}dx}{(x+a)^2+y^2}\frac{(x+a)}{\sqrt{(x+a)^2+y^2}}$$

D
$$dE_y = \frac{k\frac{Q}{L}dx}{x^2+y^2}\frac{y}{\sqrt{x^2+y^2}}$$

Which is the x-component of the electric field due to the shaded region?




A $$dE_y = \frac{k\frac{Q}{L}dx}{(x+a)^2+y^2}\frac{y}{\sqrt{(x+a)^2+y^2}}$$

B $$dE_y = \frac{k\frac{Q}{L}dx}{(x+a)^2+y^2}\frac{-(x+a)}{\sqrt{(x+a)^2+y^2}}$$

C $$dE_y = \frac{k\frac{Q}{L}dx}{(x+a)^2+y^2}\frac{(x+a)}{\sqrt{(x+a)^2+y^2}}$$

D $$dE_y = \frac{k\frac{Q}{L}dx}{x^2+y^2}\frac{y}{\sqrt{x^2+y^2}}$$