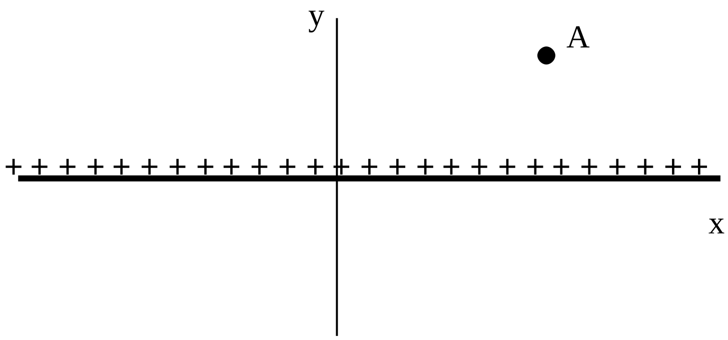
EII - 1.

The integral $\vec{E} = \int d\vec{E}$ means $\vec{E} = \hat{x}\int dE_x + \hat{y}\int dE_y + \hat{z}\int dE_x$.

Often, from symmetry, one can see that one or more of the three component integrals vanishes.

An infinite line of charge with linear charge density λ is along the x-axis and extends to $\pm \infty$. At the point A shown, what can you say about the x- and y- components of $\vec{E}$?

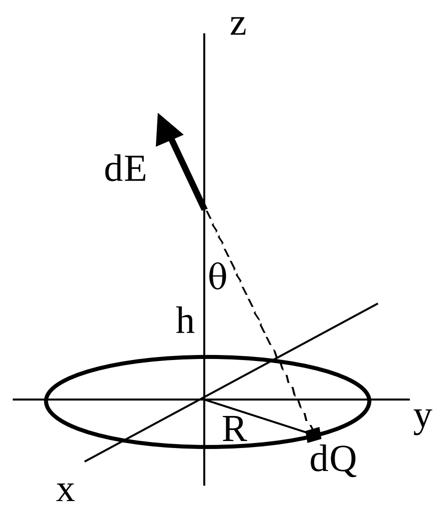


A: $E_x = 0$, $E_y < 0$
B: $E_x < 0$, $E_y = 0$
C: $E_x = 0$, $E_y = +\infty$
D: $E_x = 0$, $E_y > 0$
E: $E_x > 0$, $E_y > 0$

Answer: $E_x = 0$, $E_y > 0$

EII - 2.

A circular ring of radius R, uniformly charged with total charge +Q, is in the xy plane centered on the origin. The electric field $d\vec{E}$ at position z = h on the z-axis, due to a small piece of the ring with charge dQ, is shown. What is the magnitude of the field dE?



A: $\dfrac{kQ}{h^2}$ B: $\dfrac{k\,dQ}{h^2}$

C: $\dfrac{k\,dQ}{R^2+h^2}$ D: $\dfrac{k\,dQ}{\sqrt{R^2+h^2}}$

E: None of these.

What is dE_z, the z-component of $d\vec{E}$?

A: dE sinθ B: dE cosθ C: dE tanθ D: None of these.

What is cosθ?

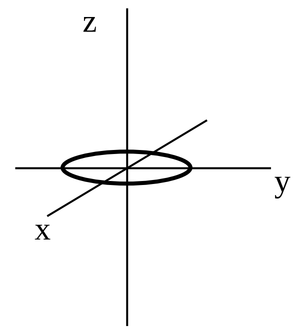
A: $\dfrac{h}{R^2+h^2}$ B: $\dfrac{h}{\sqrt{R^2+h^2}}$ C: $\dfrac{h}{R}$

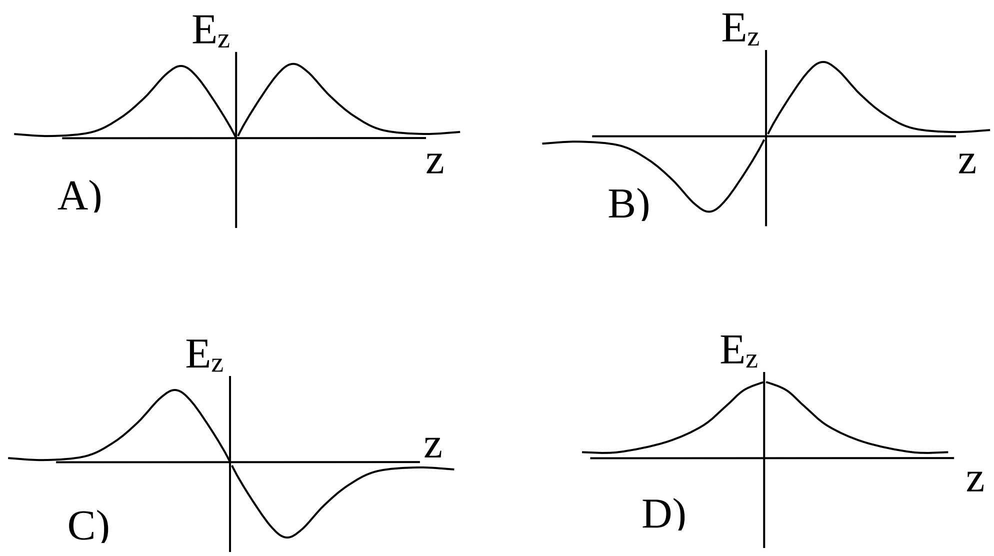
D: $\cos^{-1}\left(\dfrac{h}{\sqrt{R^2+h^2}}\right)$ E: None of these!

Answers: $dE = \dfrac{k\,dQ}{R^2+h^2}$, dE_x = dE cosθ, $\cos\theta = \dfrac{h}{\sqrt{R^2+h^2}}$

EII - 3.

A circular ring uniformly charged with positive charge Q is in the xy plane centered on the origin as shown. On the z-axis, $\vec{E} = E_z\,\hat{z}$. Which graph accurately represents the electric field E_z on the z-axis?





E: None of these is an accurate representation of E_z

Answer: B

EII - 4. The magnitude of the E-field on the z-axis due to ring of charge is given by

$$E = \frac{k\,h\,Q}{\left(h^2 + R^2\right)^{3/2}}$$

What is the E-field magnitude on the z axis in the far away limit (h >> R)?

A) $\dfrac{k\,h\,Q}{R^3}$ B) $\dfrac{k\,Q}{h^2}$ C) $\dfrac{k\,Q}{h\,R}$ D) $\dfrac{k\,Q}{R^2}$ E) None of these

Answer: $E = \dfrac{kQ}{h^2}$ In the limit, h >> R, the ring should act like a point charge with charge Q.

EII - 5.

What the magnitude of the vector $(\hat{\mathrm{i}} - \hat{\mathrm{j}}) = (\hat{\mathrm{x}} - \hat{\mathrm{y}})$?

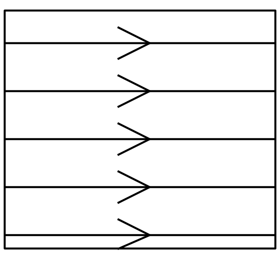
A) 1 B) 2 C) 0 D) Some other number.

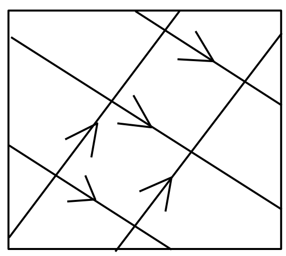
E) No answer, because $(\hat{\mathrm{x}} - \hat{\mathrm{y}})$ is not a vector.

Answer: Some other number. The magnitude of the vector is $\sqrt{2}$.

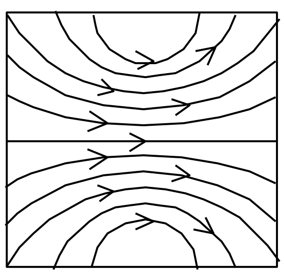
EII - 6.

There are **no charges** inside the regions shown. Which of the following are possible electric field line configurations?


(a)


(b)

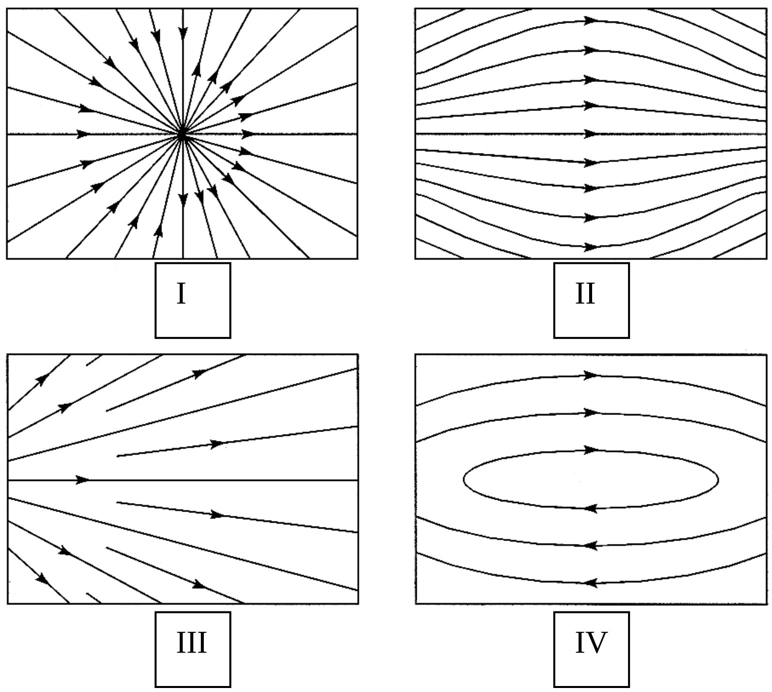
A: (a) only
B: (b) only
C: (c) only
D: None are possible
E: Some other answer (all, a and b only, etc.)


(c)

Answer: Configurations (a) and (b) are possible, so the answer is E) Some other answer.

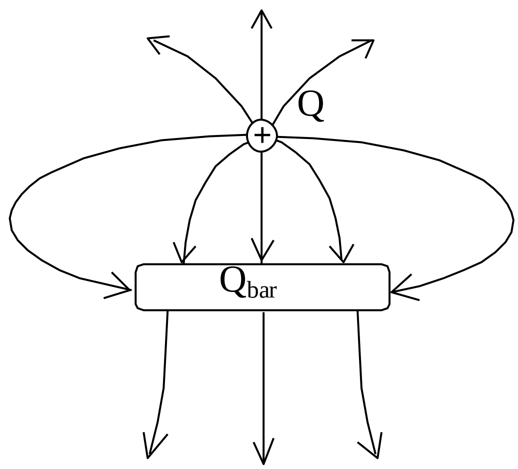
EII - 7.

Consider the four electric field line patterns shown. Assume that that are **<u>no</u> charges** in the regions shown. Which, if any, of the patterns represent possible electrostatic fields?
A: All are possible.   B: II only   C: II and III only
D: None are possible.   E: Some other combination.



Answer: II only

EII - 8.
From the figure, what can you say about the net charge on the bar?
A: $Q_{bar} = 0$
B: $Q_{bar} > 0$ (that is, the bar has a net positive charge)
C: $Q_{bar} < 0$ (the bar has a net negative charge)
D: Not enough information in the figure to answer the question.

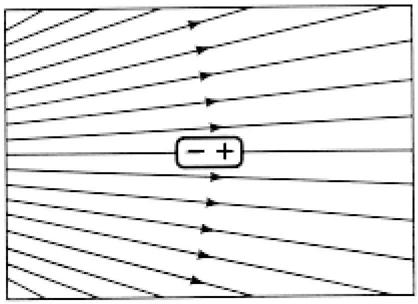


From the figure, what can you say about the magnitude of the charge on the bar $\left|Q_{bar}\right|$, compared to the magnitude of the charge Q of the positive point charge?

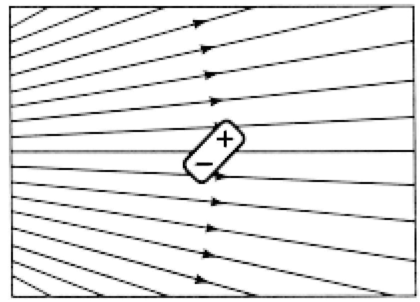
A: $\left|Q_{bar}\right| > Q$ B: $\left|Q_{bar}\right| = Q$

C: $\left|Q_{bar}\right| < Q$

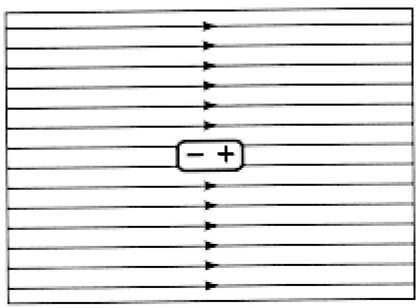
Answers: The net charge on the bar is negative. $\left|Q_{bar}\right| < Q$



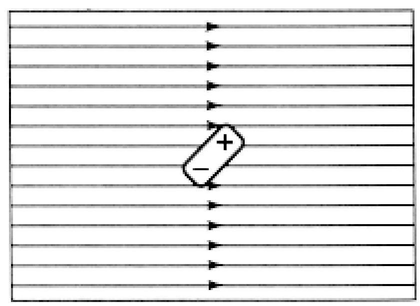
(1)



(2)



(3)



(4)

EII - 9. A dipole is placed in an external field as shown. In which situation(s) is the **net force** on the dipole zero?

A) 1 only B) 2 only C) 1 and 2

D) 3 and 4 E) 2 and 4

Answer: 3 and 4
