

# Ch 21 Electric Charge & Electric Field

## Season 2 Episode 4 - *LEVEL UP*

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In this episode of LARC Physics 3B, we're going to . . .

- Level up our vector game by solving “Electric Field” problems in 2 dimensions!

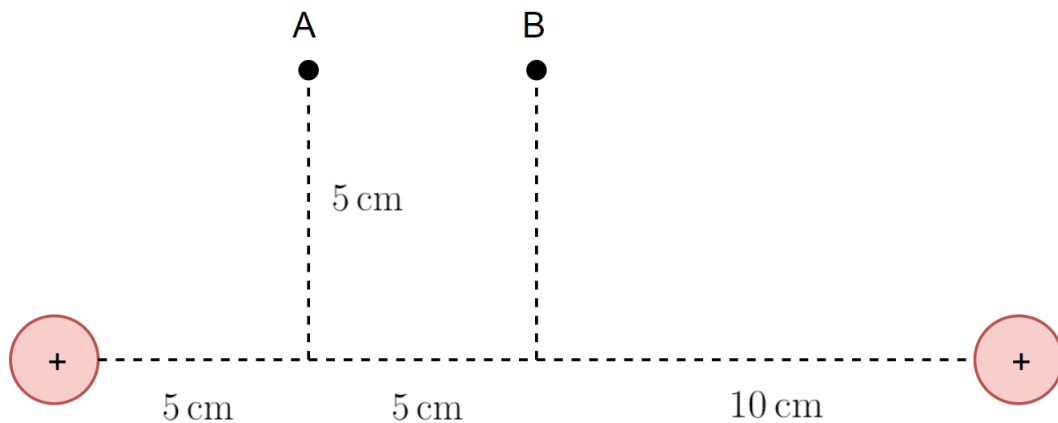
### Guided Practice

Find the magnitude and electric field at points  $A$  and  $B$  due to the two positive point charges with charge  $Q = +5.7 \mu\text{C}$ .

Answer:

$$\vec{E}_A = (5.30 \times 10^6 \text{ N/C}) \hat{i} + (7.89 \times 10^6 \text{ N/C}) \hat{j}, \quad \left| \vec{E}_A \right| = 9.51 \times 10^6 \text{ N/C}$$

$$\vec{E}_B = (3.7 \times 10^6 \text{ N/C}) \hat{j}, \quad \left| \vec{E}_B \right| = 3.7 \times 10^6 \text{ N/C}$$

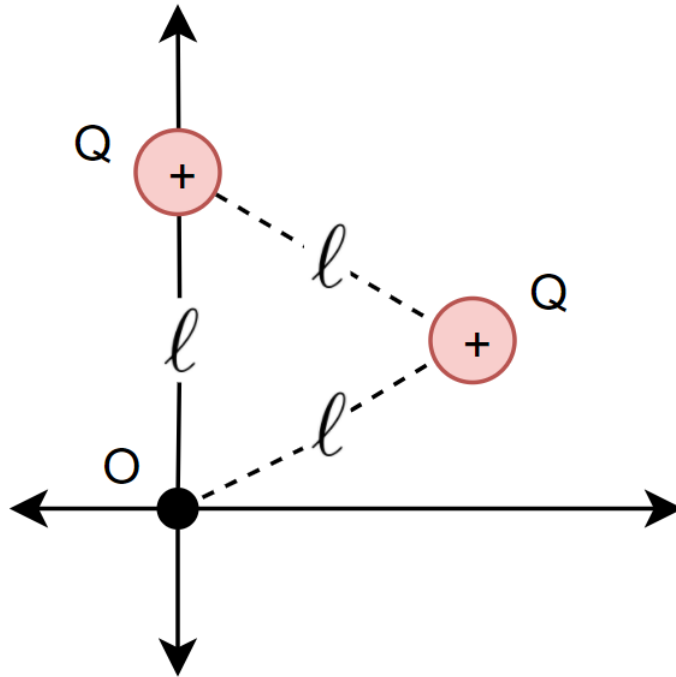


## Breakout-Room Activity

Two charges are arranged as shown in the figure. In terms of the given variables  $Q, \ell$ , and fundamental constants, determine the following:

- (a) the magnitude of the electric field  $\vec{E}$  at the origin  $O$
- (b) write  $\vec{E}$  in  $\hat{i}, \hat{j}$  notation
- (c) give the direction of  $\vec{E}$  as an angle from  $+x$  axis

Answer: (a)  $E = k \frac{Q\sqrt{3}}{\ell^2}$       (b)  $\vec{E} = k \frac{Q}{\ell^2} \left[ -\frac{\sqrt{3}}{2} \hat{i} - \frac{3}{2} \hat{j} \right]$       (c)  $240^\circ$  from  $+x$  axis



## Challenge Problem

Calculate the electric field  $\vec{E}$  at the center of a square with sidelength 52.5 cm if one corner is occupied by a  $-38.6\ \mu\text{C}$  charge and the other three are occupied by  $-27.0\ \mu\text{C}$  charges.

Answer:  $7.57 \times 10^6\ \text{N/C}$ , towards the  $-38.6\ \mu\text{C}$  charge.

