Electric Field of Point Charges in Plane (1)

Determine magnitude of $\vec{E}_1$ and $\vec{E}_1$
and identify directions in plane:

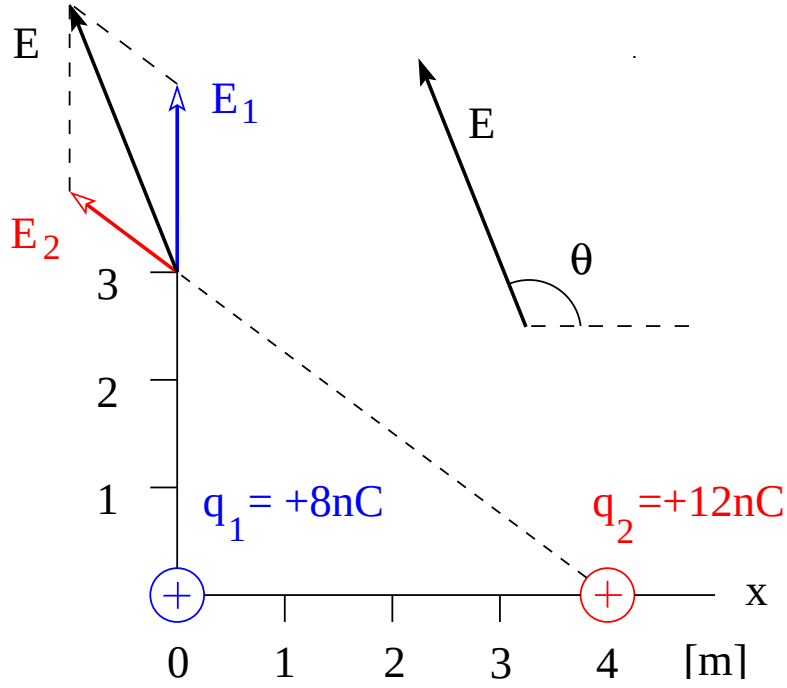
$$E_1 = \frac{k|q_1|}{(3\mathrm{m})^2} = 7.99\mathrm{N/C},\ E_2 = \frac{k|q_2|}{(5\mathrm{m})^2} = 4.32\mathrm{N/C}.$$

Determine x- and y-components of $\vec{E}_1$ and $\vec{E}_1$
and of the resultant field $\vec{E}$:

$$\begin{aligned} E_1^x &= 0, \quad E_1^y = 7.99\mathrm{N/C}; \\ E_2^x &= -3.46\mathrm{N/C}, \quad E_2^y = 2.59\mathrm{N/C}; \\ E_x &= -3.46\mathrm{N/C}, \quad E_y = 10.6\mathrm{N/C}. \end{aligned}$$

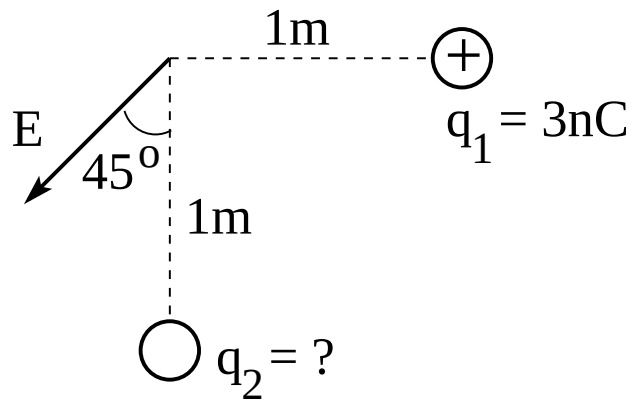
Determine magnitude and direction of $\vec{E}$:

$$E = \sqrt{E_x^2 + E_y^2} = 11.2\mathrm{N/C}, \quad \theta = \arctan\left(\frac{E_y}{E_x}\right) = 108°.$$

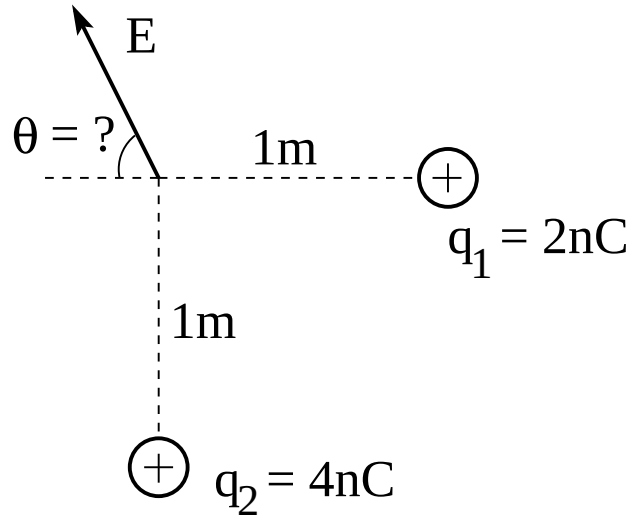


Electric Field of Point Charges in Plane (2)

(a) Find the electric charge q_2.



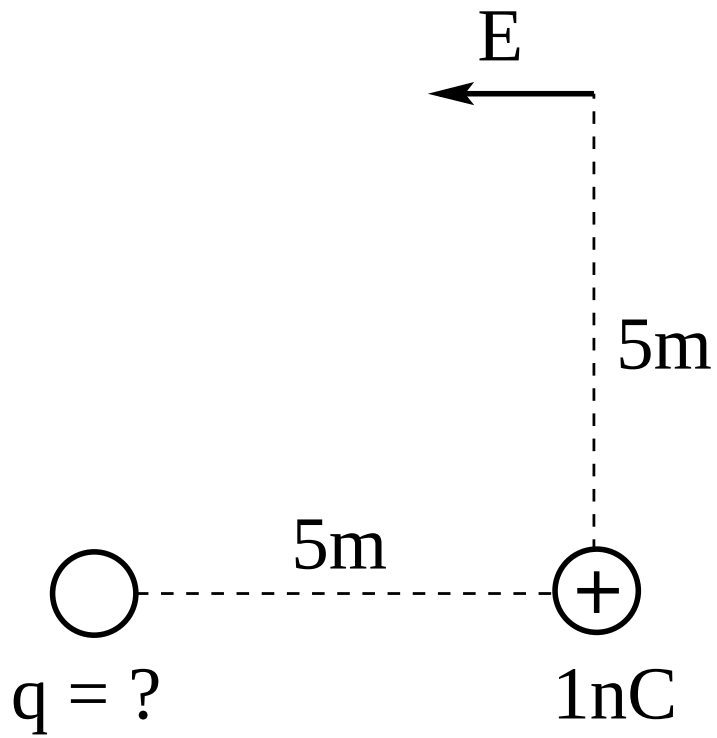
(b) Find the angle θ.



Electric Field of Point Charges in Plane (3)

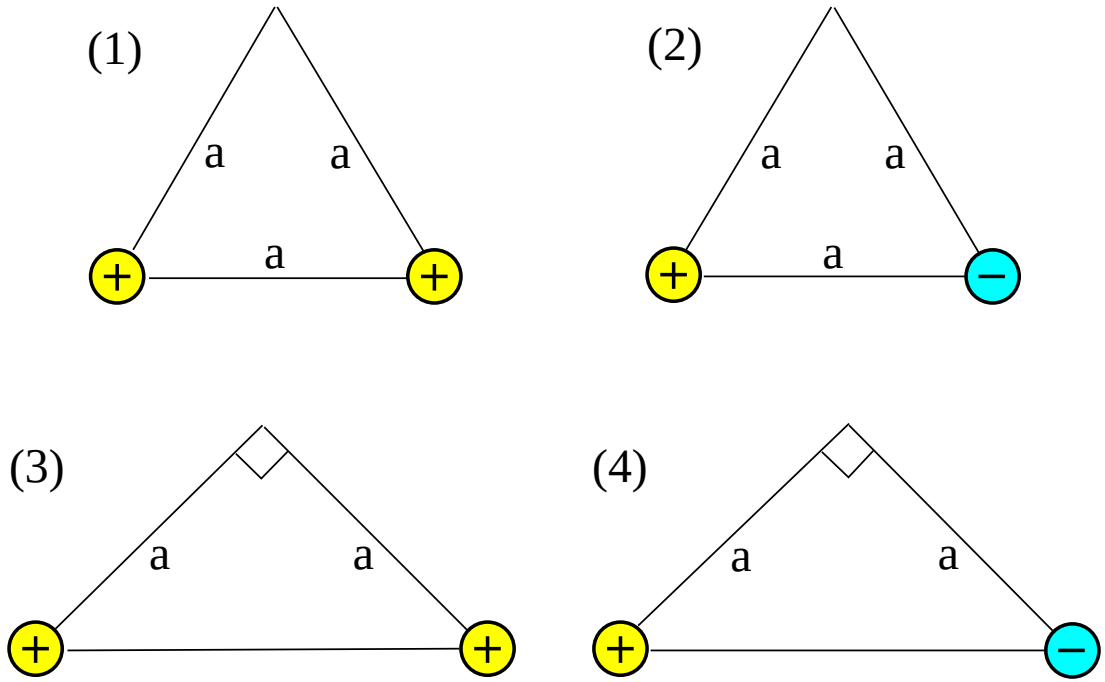
Two point charges, one known and the other unknown, produce a horizontal electric field as shown.

What is the value of the unknown charge?



Electric Field of Point Charges in Plane (4)

Consider four triangles with point charges of equal magnitude at two of the three corners.



(a) Determine the direction of the electric field $\vec{E}_i$ at the third corner of triangle (i).

(b) Rank the fields E_i according to strength.

Electric Field of Point Charges in Plane (5)

Find magnitude and direction of the resultant electric field at point P.

- $E_1 = \dfrac{k|q_1|}{8\text{m}^2} = 3.38\,\text{N/C}.$
- $E_2 = \dfrac{k|q_2|}{4\text{m}^2} = 6.75\,\text{N/C}.$
- $E_3 = \dfrac{k|q_3|}{8\text{m}^2} = 3.38\,\text{N/C}.$
- $E_x = E_1 \cos 45^\circ + E_3 \cos 45^\circ = 4.78\,\text{N/C}.$
- $E_y = E_2 = 6.75\,\text{N/C}.$
- $E = \sqrt{E_x^2 + E_y^2} = 8.27\,\text{N/C}.$
- $\tan\theta = \dfrac{E_y}{E_x} = 1.41.$
- $\theta = \arctan 1.41 = 54.7^\circ.$