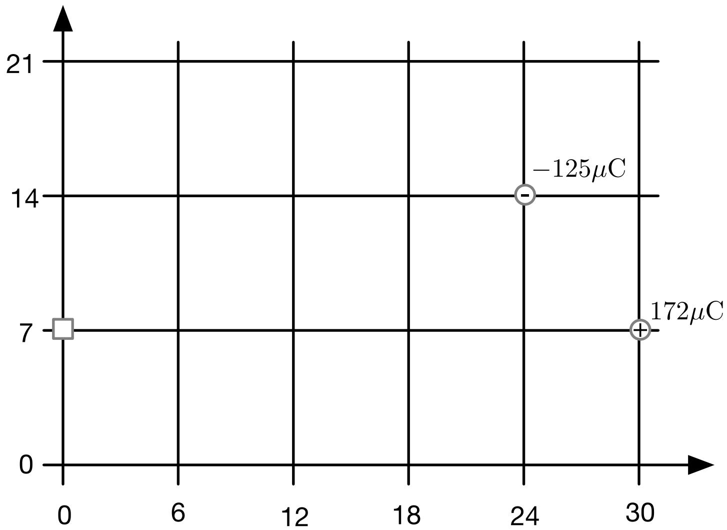
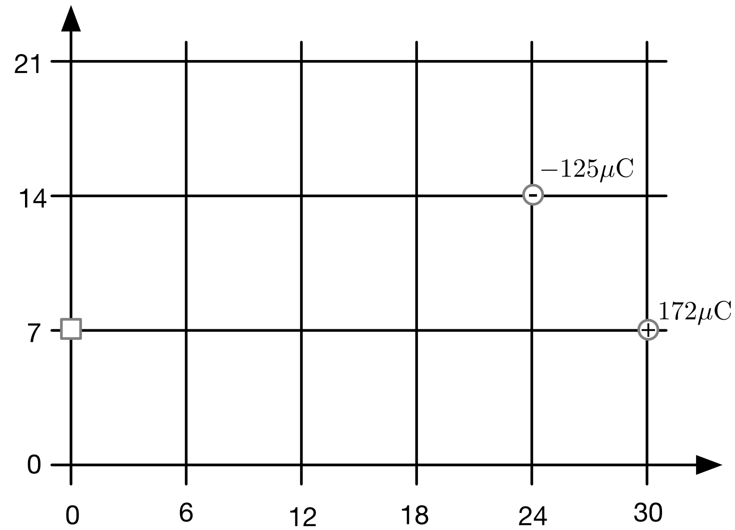
There are two charges located as shown, position is given in **meters**. Compute the magnitude of the electric field due to the two charges at the location of the small square.



$k = 9.0 \times 10^9 \frac{\mathrm{N \cdot m^2}}{\mathrm{C^2}}$.

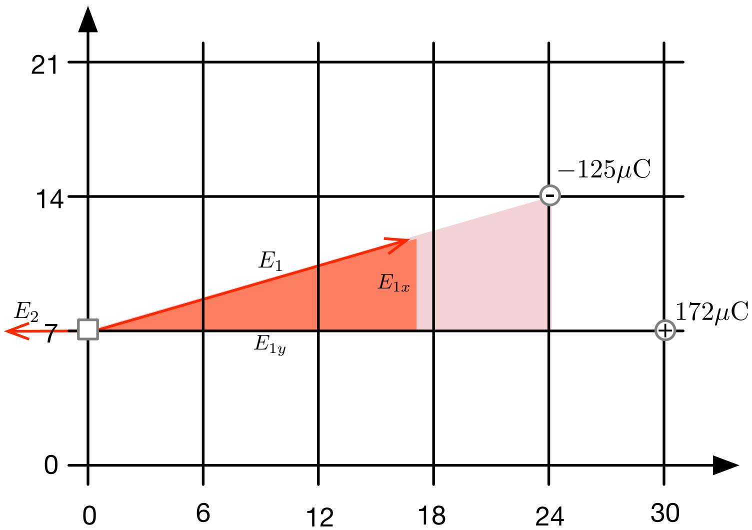
Physics 11 - Quiz 6 Alternate 3/2/2020

There are two charges located as shown, position is given in **meters**. Compute the magnitude of the electric field due to the two charges at the location of the small square.



$k = 9.0 \times 10^9 \frac{\mathrm{N \cdot m^2}}{\mathrm{C^2}}$.

(a) We see that the pink triangle has sides of 24m and 7m so that the diagonal has a length $\sqrt{24^2 + 7^2} = 25\text{m}$.



First compute the magnitude of the electric field produced by the $0.5\mu\text{C}$ charge.

$$\begin{aligned} E_1 &= k\frac{|q|}{r^2} \\ &= \left(9.0 \times 10^9 \frac{\text{N}\cdot\text{m}^2}{\text{C}^2}\right) \frac{(125 \times 10^{-6}\text{C})}{(25\text{m})^2} = 1800\tfrac{\text{N}}{\text{C}} \end{aligned}$$

By similar triangles

$$\frac{E_{1x}}{E_1} = \frac{24}{25} \longrightarrow E_1x = E_1\frac{24}{25} = 1728\tfrac{\text{N}}{\text{C}}$$

$$\frac{E_{1y}}{E_1} = \frac{7}{25} \longrightarrow E_1x = E_1\frac{7}{25} = 504\tfrac{\text{N}}{\text{C}}$$

Now for E_2.

$$\begin{aligned} E_2 &= k\frac{|q|}{r^2} \\ &= \left(9.0 \times 10^9 \frac{\text{N}\cdot\text{m}^2}{\text{C}^2}\right) \frac{(172 \times 10^{-6}\text{C})}{(30\text{m})^2} = 1720\tfrac{\text{N}}{\text{C}} \end{aligned}$$

so

$$\begin{aligned} E_{2x} &= -E_1 = -1720\tfrac{\text{N}}{\text{C}} \\ E_{2y} &= 0 \end{aligned}$$

The components of the net field then are

$$\begin{aligned} E_x &= E_{1x} + E_{2x} = 1728\tfrac{\text{N}}{\text{C}} + (-1720\tfrac{\text{N}}{\text{C}}) = 8\tfrac{\text{N}}{\text{C}} \\ E_y &= E_{1y} + E_{2y} = 504\tfrac{\text{N}}{\text{C}} + 0 = 504\tfrac{\text{N}}{\text{C}} \end{aligned}$$

The direction θ is given by $\tan\theta = \frac{E_y}{E_x} = \frac{504}{8} \longrightarrow \theta = 89.1°$.