SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Three charges are placed at the corners of a square as shown. \[ Q = 1.70 \times 10^{-10} \text{ C} \]

(a) Determine the electric field at point P in \( \hat{i}, \hat{j} \) notation (numerical value).
(b) Calculate the magnitude of the electric field at point P (numerical value).

(a) The electric field at point P is equal to the sum of the fields due to each charge. \[ \vec{E}_P = \vec{E}_{1P} + \vec{E}_{2P} + \vec{E}_{3P} \]

\[ \vec{E}_{1P} = -\frac{2kQ}{r^2} \hat{j} \] \( (r = \frac{\sqrt{2}}{2}l) \)

\[ \vec{E}_{2P} = \frac{3kQ}{2\sqrt{2}l^2} \hat{i} - \frac{3kQ}{2\sqrt{2}l^2} \hat{j} \] \( (r = \frac{\sqrt{3}}{2}l) \)

\[ \vec{E}_{3P} = -\frac{4kQ}{\ell^2} \hat{i} \] \( (r = \ell) \)

\[ \vec{E}_P = \left[ \frac{3kQ}{2\sqrt{2}l^2} - \frac{4kQ}{\ell^2} \right] \hat{i} + \left[ \frac{3kQ}{2\sqrt{2}l^2} - 2kQ \right] \hat{j} = \]

\[ = \left[ -1.997 \times 10^{12} \text{ N/C} \right] \hat{i} + \left[ -6.39 \times 10^9 \text{ N/C} \right] \hat{j} \]

(b) \[ ||\vec{E}_P|| = \sqrt{E_x^2 + E_y^2} = 2.10 \times 10^{12} \text{ N/C} \]