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

In the geometry shown the charge +Q is at x = +a and the charge -2Q is at x = +2a.
The point P is at x = 0, y = ±a.

(a) Find the electric potential at point P (with the standard convention for
V = 0).

(b) If Q = 750 pC and a = 1.35 cm, calculate a numerical value for the potential
at P, including the sign.

(c) How much work (numerical answer) is required to bring an electron from
infinity to point P?

With standard convention \( V = 0 @ r = ∞ \), \( V = \frac{kQ}{r} \)

\[ V_P = \frac{kQ}{r_1} - \frac{2kQ}{r_2} \]

\[ r_1 = \sqrt{a^2 + a^2} = \sqrt{2}a \]

\[ r_2 = \sqrt{4a^2 + a^2} = \sqrt{5}a \]

\[ V_P = \frac{kQ}{\sqrt{2}a} - \frac{2kQ}{\sqrt{5}a} = \frac{kQ}{a} \left( \frac{1}{\sqrt{2}} - \frac{2}{\sqrt{5}} \right) = \frac{kQ}{a} \left( \frac{\sqrt{5} - 2\sqrt{2}}{\sqrt{10}} \right) \]

\[ = -187 \frac{kQ}{a} \]

\[ +5 \quad (-2 \text{ for sign})(-1 \text{ for unit})(-2 \text{ for wrong conversion}) \]

b) \( Q = 750 \times 10^{-12} \, \text{C} \), \( a = 0.135 \, \text{m} \), \( k = 9.00 \times 10^9 \, \text{N} \cdot \text{m}^2/\text{C}^2 \)

\[ V_P = -93.7 \, \text{V} \]

\[ +5 \quad (-2 \text{ for sign})(-1 \text{ for unit}) \]

c) \( W = ΔU = q \, ΔV \)

\[ ΔV = V_P - V_m = V_P \]

\[ q = -1.60 \times 10^{-19} \, \text{C} \]

\[ W = 1.50 \times 10^{-19} \, \text{J} \] (We had to do work)