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3.2 Potential Due to Point charges

2 point charges q_2 & q_3 at x_2 & x_3 are fixed.

1. W_1 to move a charge q_1 from $\infty \rightarrow x_1$

$$V_{x_1} = \frac{1}{4\pi\epsilon_0}\frac{q_2}{x_1 - x_2} + \frac{1}{4\pi\epsilon_0}\frac{q_3}{x_1 - x_3}$$

$$= \frac{1}{4\pi\epsilon_0}\left(\frac{q_2}{r_{12}} + \frac{q_3}{r_{13}}\right)$$

$$\boxed{W_1 = q_1 V(r) = \frac{q_1}{4\pi\epsilon_0}\left(\frac{q_2}{r_{12}} + \frac{q_3}{r_{13}}\right)}$$

2. Now q_1 & q_3 are fixed at x_1 & x_3, Work to bring q_2 from infinity to x_2 is:

Following Similar Steps:

$$\boxed{W_2 = q_2 V_{x_2} = q_2 \frac{1}{4\pi\epsilon_0}\left(\frac{q_1}{r_{21}} + \frac{q_3}{r_{23}}\right)}$$ * where $r_{21} = x_2 - x_1$ & $r_{23} = x_2 - x_3$

3. Now q_1 & q_2 are fixed at x_1 & x_2, Work to bring q_3 from infinity to x_3 is:

$$\boxed{W_3 = q_3 V_{x_2} = q_3 \frac{1}{4\pi\epsilon_0}\left(\frac{q_1}{r_{31}} + \frac{q_3}{r_{32}}\right)}$$ * where $r_{31} = x_3 - x_1$ & $r_{32} = x_3 - x_2$