Bonus Quiz 1

You may or may not make use of the following:

$\epsilon_0 = 8.85 \times 10^{-12}\ Nm^2C^{-2} \quad k = \frac{1}{4\pi\epsilon_0} = 9 \times 10^9\ C^2N^{-1}m^{-2}$

$|\vec{E}_{\text{dipole,on-axis}}| \approx \frac{1}{4\pi\epsilon_0}\frac{2p}{r^3} \qquad |\vec{E}_{\text{dipole,perp}}| \approx \frac{1}{4\pi\epsilon_0}\frac{p}{r^3}$

1. Two point charges are arranged in a region of space as follows:
   $q_1 = -2$ nC, located at $< -3, 1 >$ mm
   $q_2 = -6$ nC, located at $< 1, 2 >$ mm
   What is the electric field vector $\vec{E}$ (including units!) at the location $< 0, 4 >$ mm?
   Recall: $nC = 10^{-9}\ C$, $mm = 10^{-3}\ m$
2. A third charge $q_3 = 4$ nC is added to the above configuration and set at the location $< 0, 4 >$ mm. What is the net electric force on this charge, due to the presence of the other two charges?

A neutron walks into a bar...