Quiz 4

1. In a region of space, there is a constant electric field $\vec{E} =< 800, 0, 0 >$ N/C. Locations A, B, and C are given:

   - $\vec{A} =< -0.5, 0, 0 >$ m
   - $\vec{B} =< 0.5, 0, 0 >$ m
   - $\vec{C} =< 0.5, -0.5, 0 >$ m

   Calculate ΔV along each of the following paths:

   (a) From A to B
   (b) From B to A
   (c) From B to C
   (d) From A to C

a) $\Delta V = -\vec{E} \cdot \Delta \vec{r}$

$\Delta \vec{r} = \langle 0.5, 0, 0 \rangle - \langle -0.5, 0, 0 \rangle$

$\Delta \vec{r} = \langle 1, 0, 0 \rangle$

$\Delta V = -\langle 800, 0, 0 \rangle \cdot \langle 1, 0, 0 \rangle$

$\boxed{\Delta V = -800 \text{ V}}$

b) $\Delta V_{BA} = -\Delta V_{AB} = 800 \text{V}$

c) $\Delta V = -\langle 800, 0, 0 \rangle \cdot \langle 0, -.5, 0 \rangle$

$\boxed{\Delta V = 0}$

d) $\Delta V_{ABCA} = 0$

$\Delta V_{AB} + \Delta V_{BC} + \Delta V_{CA} = 0$

$= -800 + 0 + \Delta V_{CA} = 0$

$\Delta V_{CA} = 800 \text{ V}$

so

$\boxed{\Delta V_{AC} = -800 \text{ V}}$

2. At a point in space the electric potential (relative to infinity) can be expressed as:

$$V = 3x^2 - 4y + z^3$$

What is the electric field vector $\vec{E}$ at this location?

$\vec{E} = -\left\langle \frac{dV}{dx}, \frac{dV}{dy}, \frac{dV}{dz} \right\rangle = -\langle 6x, -4, 3z^2 \rangle$

$\boxed{\vec{E} = \langle -6x, 4, -3z^2 \rangle}$