d) Let your solutions for the total time t and the position x be $t = t_0$ and $x = x_0$. Put these solutions in your main expression for the total time. Using elementary algebraic manipulations (squaring, etc.) you should get rid of all the square root(s) and fraction(s) in your expression. **[3 points]**

e) Now, if the solution for x is a little bit different from the real solution x_0 (in other words, if we put the point D a little bit closer to B or to C), then the solution for t would also be a little bit different from the real solution t_0. So, we need to try to "shake" the solutions to see if they really are the correct solutions. To do this, we suggest you to add small temporal and spatial displacements (perturbations) Δt and Δx, *i.e.*, instead of t_0 and x_0 put $t_0 + \Delta t$ and $x_0 + \Delta x$ in your main expression obtained in the previous step. **[3 points]**

f) Rewrite the expression from the previous step neglecting all terms containing very small products, such as $\Delta t \cdot \Delta t$, $\Delta t \cdot \Delta x$ and $\Delta x \cdot \Delta x$. **[4 points]**

g) Using the result from the previous step, express the ratio between small temporal and spatial displacements Δt and Δx, *i.e.*, express the quantity $\Delta t / \Delta x$. **[3 points]**

h) Your final job in this assignment is to calculate the route and the total time. To do this, equate $\Delta t / \Delta x$ to zero, and with the help of some previous steps you will be in the position to proceed towards obtaining x_0 and t_0. **[6 points]**

Problem 4

An electric circuit consists of four resistors and two switches (see the figure below). Let's denote the state of the switch with "0" if it is opened, and with "1" if it is closed (in the figure both switches are opened but this may not be true for the initial state of the circuit). The initial states of the switches are unknown. The resistance R_{AB} between the two ends A and B of the circuit is measured. Its initial resistance (state "α" of the circuit) is $R_{\mathrm{AB\alpha}} = 240\ \Omega$. The switch K1's state is reverted and the resistance of the circuit remains the same, $R_{\mathrm{AB\beta}} = 240\ \Omega$. After that, the switch K2's state is reverted and the resistance of the circuit becomes $R_{\mathrm{AB\gamma}} = 400\ \Omega$. Finally, the switch K1's state is once again reverted and the resistance of the circuit becomes $R_{\mathrm{AB\delta}} = 280\ \Omega$.