Finding Potential Energy

Previously it was considered a force of the form $\vec{F} = \hat{\imath}\, xy + \hat{\jmath}\, c x^2 + \hat{k}\, z^3$, and found a value of "c" from the following list such that this was a conservative force. Note: there must really be extra 'constants' in front of each term, with magnitude 1 but the proper units (such as Newton m^{-2} for the first term) to make "F" have the right units of force. For this problem ignore these unit conversion constants and just use the right numerical magnitude of C, and these other constants.)

[A]: $C = \frac{1}{4}$ [C]: $c = 1$

[B]: $C = \frac{1}{2}$ [D]: $c = 3$

- Given the correct "c", and using $(x, y, z) = (0, 0, 0)$ as the reference position, find the potential energy $U(x,y,z)$ by computing the appropriate line integral from the reference position to the final (x, y, z). Do the line integral even if you can see what the final $U(x,y,z)$ must be just by examing "F." Finally, show that $-\nabla U$ produces the right F.