Step potential summary

This is a summary of the *results* of the calculation for the step potential done in class. It is *not* intended to be the complete calculation or to be a substitute for the full discussion. It is supposed to be enough of the results that you can check yourself and reproduce other things you might want or need.

V(x)=0 for x<0 and V(x)=V_0 for x>0.
To the left of x=0, $\psi_{EL}(x) = ae^{ipx/\hbar} + be^{-ipx/\hbar}$
and to the right $\psi_{ER}(x) = ce^{iqx/\hbar}$ with $p^2=2mE$ and $q^2=2m(E-V_0)$.
The boundary conditions at x=0 are $\psi_{EL}(0) = \psi_{ER}(0)$ and $\psi'_{EL}(0) = \psi'_{ER}(0)$
After some calculation, I got $b = a\frac{p-q}{p+q}$ and $c = a\frac{2p}{p+q}$.
In the case that $E-V_0<0$, q is imaginary, and the x>0 form is $\psi_{ER}(x) = ce^{-\sqrt{2m(V_0-E)}\,x/\hbar}$.

The quanton fluxes are important physical quantities. The flux is the density times the velocity. So the flux on the left heading right is p $|a|^2$/m. The flux on the left heading left is p $|b|^2$/m. The flux on the right heading right is q $|c|^2$/m.