1. Let's consider two indentical point charges with charge q separated by a distance a, so that Coulomb repulsion affects between the charges. Calculate the force, which is directed towards one of the point charges using Maxwell's stress tensor. How would the result change if the charges have opposite sign?
   Hint: The volume element surrounding the point charge can in this case be chosen arbitrarily. It is practical to make the choise in a way that the surface integral can be calculated as easily as possible.

2. Consider a conducting sphere with charge Q. The sphere can be considered to consist two hemispheres. Use the Maxwell's stress tensor to calculate the force which is directed towards one of the hemispheres.
   Show that one gets the same result by assuming that electric field, which is directed to a charge at the surface of the hemisphere is the average of the electric fields close to the surface inside and outside the sphere.

3. Let's consider a straight conducting wire, with current density $\mathbf{j} = \sigma\mathbf{E}$ inside the wire ($\mathbf{E}$ is the electric field inside the wire). Use Maxwell's equations to show that the electric field is the same inside and outside the wire and to solve the magnetic field $\mathbf{B}$ outside the wire. Integrate the Poynting vector over the surface of the wire to show that the energy transforming to heat inside the wire can be thought to be flowing into the wire from the fields outside the wire.