Prof. Sergey Syzranov   **Homework 2**
                                                    Solve by 29 January 2019

1. **Ac conductivity of a metal.**

   By analysing the kinetic equation in the τ-approximation with an oscillating electric field $\mathbf{E}(t) = \mathbf{E}_0 e^{-i\omega t}$ demonstrate that the frequency dependence of the ac conductivity in a metal is given by

   $$\sigma(\omega) = \frac{\sigma_0}{1 - i\omega\tau}.$$

Bonus

1. Compute the density of states and heat capacity of bilayer graphene, a system in which two quadratically dispersing bands with the dispersion $\pm\frac{\mathbf{k}^2}{2m}$ touch at $\mathbf{k} = 0$.

2. Compute the heat capacity of a metal with the quadratic quasiparticle dispersion, $\varepsilon_{\mathbf{k}} = \frac{k^2}{2m}$. The system contains N electrons and has volume V.