HW 10.1. In the first Born approximation, calculate the differential cross section \( \frac{d\sigma}{d\Omega} \) for the Gaussian potential

\[
V(r) = V_0 e^{-r^2/a^2}.
\]

Give your answer in terms of the momentum transfer \( q \) and the various constants.

HW 10.2. (a) Again in the first Born approximation, calculate the differential cross section \( \frac{d\sigma}{d\Omega} \) for the potential

\[
V(r) = V_0, \quad r \leq R
\]

\[
= 0, \quad r > R.
\]

(b) Show that \( \frac{d\sigma}{d\Omega} \) is a constant (independent of both \( k \) and \( \theta \)) in the limit of low momentum transfer \( q \).

(c) Now consider the 3-dimensional delta-function potential

\[ V(r) = A \delta(r). \]

Using the first Born approximation once more, calculate \( \frac{d\sigma}{d\Omega} \). Determine the constant \( A \) which gives the same result as was found in part (b).