M05E.1 - Periodic Surface Charge and Magnetization

Problem

a) A thin sheet lies in the x-y plane and carries a periodic surface charge density given by $\sigma = \sigma_0 \sin(kx)$. Calculate the electric field produced by this charge distribution everywhere in space.

b) A periodic magnetization pattern is written onto a magnetic tape of thickness w. The magnetization is perpendicular to the plane of the tape (the x-y plane) and is given by $M_z = M_0 \sin(kx)$ for $|z| \leq w/2$ and $M_z = 0$ otherwise. Calculate the magnetic field inside and outside of the tape for distances close to the surface of the tape. Here the edges of the tape can be considered at infinity.