In The Name Of God

Assignment number 3 of Electromagnetics 1

Spring 2020

1. Please answer the following questions from “Introduction to Electrodynamics” by D.J.Griffiths (fourth edition) :

   - 2.27
   - 2.33
   - 2.45
   - 2.50
   - 2.54
   - 2.57 (Graphs should be sketched with computer!)

2. Please answer the following questions from “Electricity and Magnetism” by E.M.Purcell and D.J.Morin (third edition - 2013) :

3.30 *Two ways of calculating energy* ***

A capacitor consists of two arbitrarily shaped conducting shells, with one inside the other. The inner conductor has charge Q, the outer has charge $-Q$. We know of two ways of calculating the energy U stored in this system. We can find the electric field E and then integrate $\epsilon_0 E^2/2$ over the volume between the conductors. Or if we know the potential difference ϕ, we can write $U = Q\phi/2$ (or equivalently $U = C\phi^2/2$).

(a) Show that these two methods give the same energy in the case of two concentric shells.

(b) By using the identity $\nabla \cdot (\phi \nabla \phi) = (\nabla \phi)^2 + \phi \, \nabla^2 \phi$, show that the two methods give the same energy for conductors of any shape.

3. *Potential energy in a two-dimensional crystal* $**$
Use a computer to calculate numerically the potential energy, per ion, for an infinite two-dimensional square ionic crystal with separation a; that is, a plane of equally spaced charges of magnitude e and alternating sign (as with a checkerboard).

NOTE: Some questions contain coding and you may do it by any programming language you prefer. Your submission for this questions must contain two files, the code itself and a report of the code with it's output.

Please do not copy the codes; This is just an assignment to improve your learning, both in electromagnetism and coding! :)