Computational Physics 3
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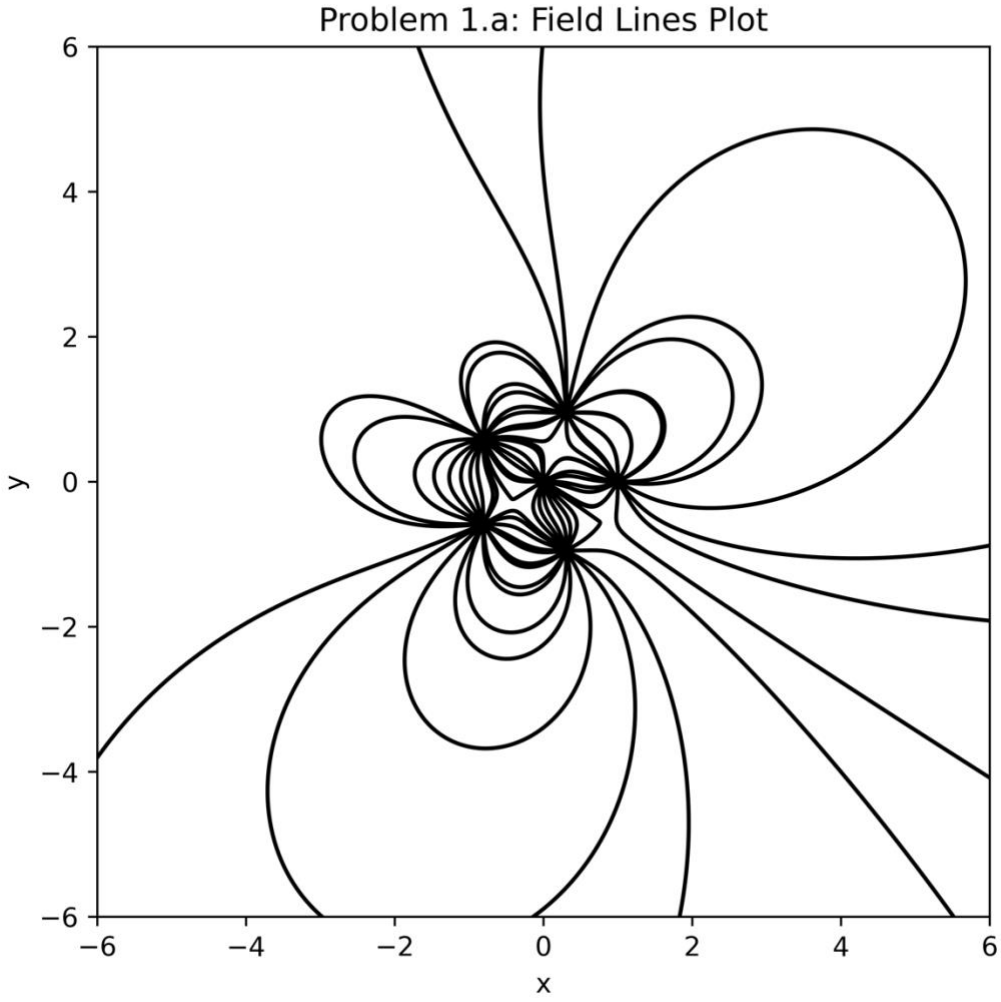
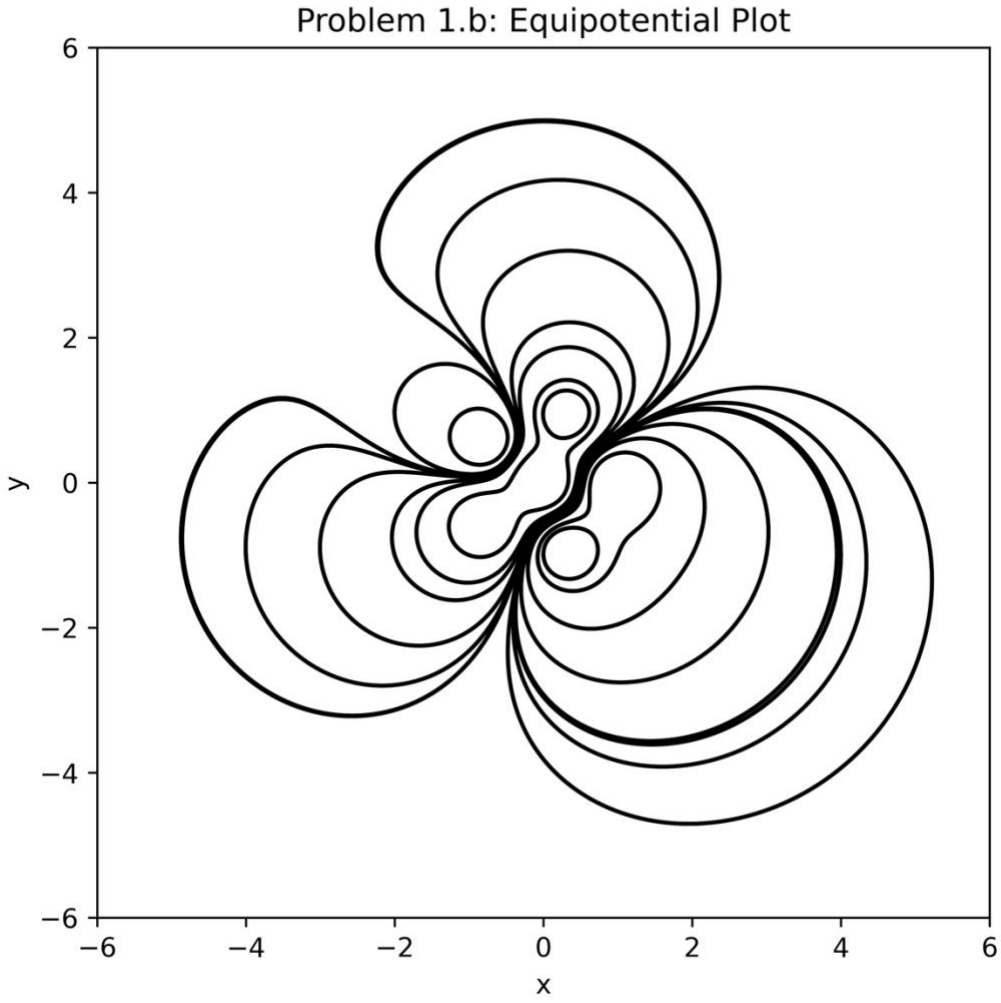
HW 1

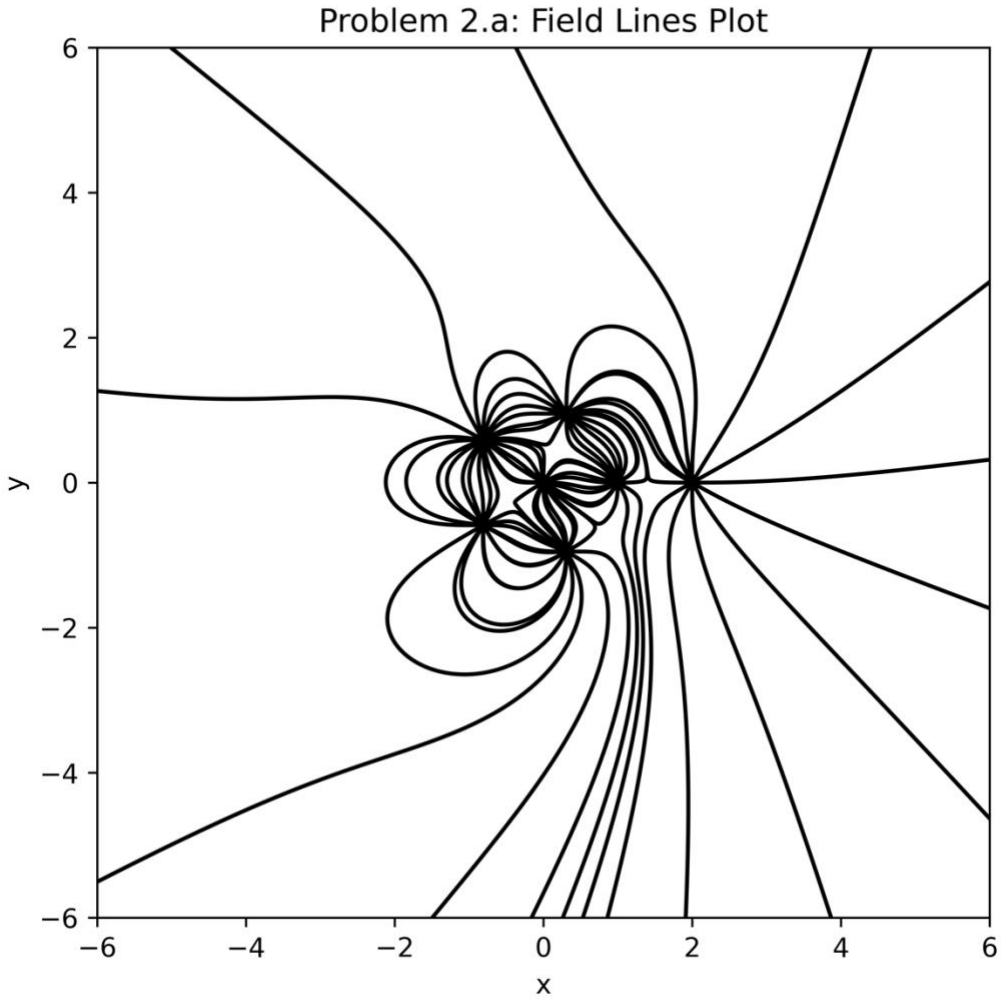
1.a)



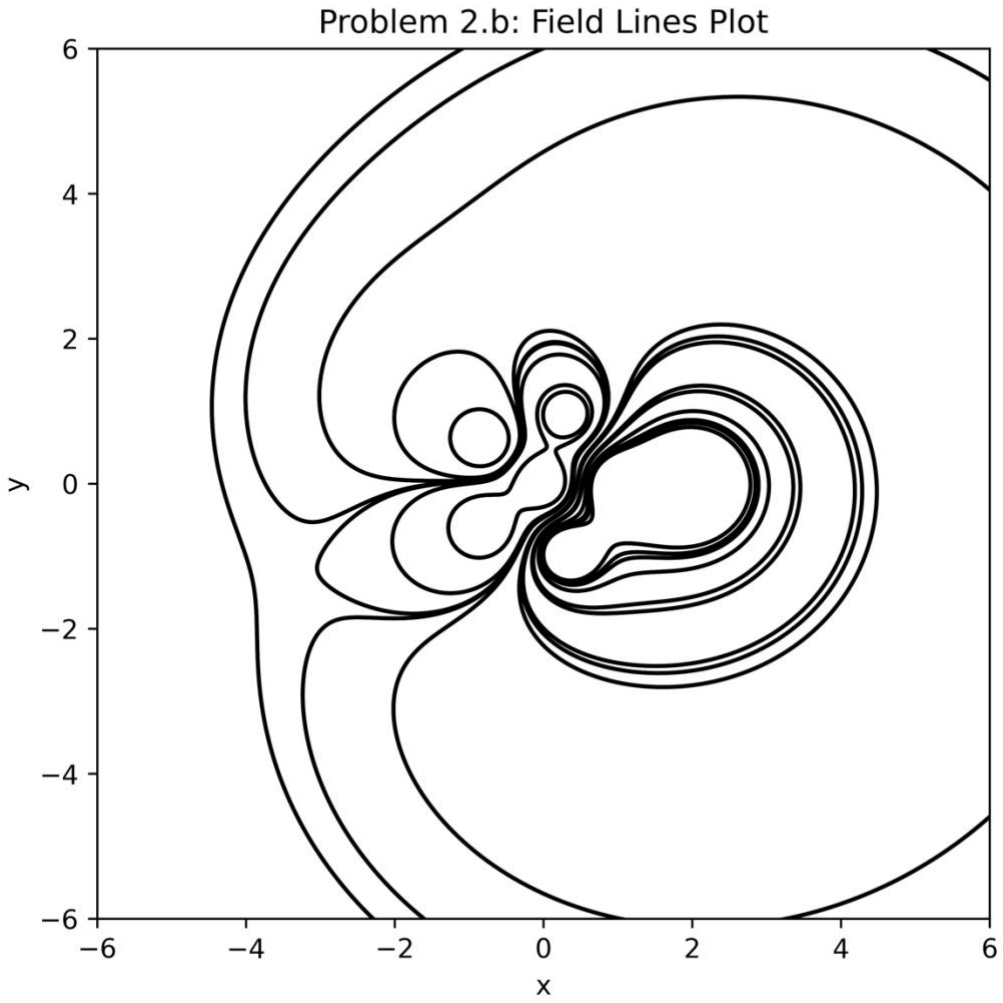
1.b)



2.a)



2.b)



2.b Qualitative)

- For the E-field lines, the original lines formed large loops at large distances, these loops would grow wider the further away from the charges. At large distances, the field lines look like that of a dipole. With the 7^{th} charge, the loops are pushed towards the -x axis. However, at larger distances, the field lines spread out and form the diverging field lines like that of a monopole.
- For the Equipotential lines, the original lines formed three distinct loops that combined together closer to the charges. At further distances, two of the three loops join into one loop where the two remaining loops are divided by a line almost parallel to the line y = x. However, now with the 7^{th} charge the three distinct loops have merged into one large loop at far distances. While this large loop looks almost like a cardioid close to the charges, the effects from the charges will lessen and so loop will look like more of a circle further away.

The multipole expansion for electric charges provides clarification to this effect. For the 6 charges Q = 0, so the dominate term in the multipole expansion is the dipole term: hence why the field lines and equipotential look like those produced by a dipole at large distances. With the 7^{th} charge Q is no longer 0, so the dominate term is the monopole term.