

USC, DEPARTMENT OF PHYSICS & ASTRONOMY.

Graduate student problem competition

AUG 17–SPT 1, 2024

All graduate students are eligible to participate.

To submit your solution, e-mail it to bazaliy@mailbox.sc.edu

Electric field lines' asymptotes

Consider the same arrangement as in Round 1. A charge $Q > 0$ is placed at the origin of coordinates. In addition, an external uniform field $\vec{E}_0 = (E_0, 0, 0)$, pointing along the x -axis ($E_0 > 0$), is present in the whole space. Together they produce the total space-dependent field $\vec{E}(r)$. Electric field lines are schematically shown in the figure.

Consider all lines that start at $x \rightarrow -\infty$. Among them there are lines that have the smallest absolute value $|y|$ for $x \rightarrow +\infty$. Compute this value. You may solve this problem numerically but then you need to provide an estimate of the error of your computation.

