- Use $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\int \frac{dq'}{\mathcal{r}}$ to find the electric potential at any point in the x-y plane due to a straight-line segment of length $2\,L$ and linear charge density λ. The segment is located along the x-axis with its midpoint at the origin.
- Use $\vec{E} = -\vec{\nabla}V$ to find the electric field. Compare your result with that of the previous homework. Are they the same?
- Use Mathematica to show on the same plot the segment, a stream plot of the electric field $\vec{E}$, and a contour plot of $V(\vec{r})$ in the range $-2 \le x \le 2$ and $-2 \le y \le 2$ and Use $L = 1$ and $\lambda = 4\pi\epsilon_0$. Use ContourShading -> None in your contour plot. What can you say about the direction of the electric field with respect to the equipotential surfaces (the contour lines)?