

DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

PH2140 Mathematics on the Computer Assignment 3 1 September 2017

(1) Electrostatic potential of a line charge

Consider a line charge with density $\lambda(z)C/m$ and length $L = 1m$, placed along the z -axis, symmetrically about $z = 0$.

- (i) Let $\lambda = \lambda_0 = \text{constant}$. Use the **Integrate** command to evaluate the potential $V(x, y, z)$ everywhere (you may set it to be zero at infinity). Plot the equi-potential lines in the $x - z$ plane (You may consider using the **ContourPlot** command for this).
- (ii) Use the **NIntegrate** command to evaluate the potential $V(x, y, z)$ everywhere (you may set it to be zero at infinity) and plot the equi-potential lines on the $x - z$ plane, when,
 - (a) $\lambda(z) \propto z$
 - (b) $\lambda(z) \propto \exp(-(z/a)^2)$, where a is a constant. You may consider the specific cases $a = 0.5m$ and $a = 2m$.

(2) Simple Pendulum

Consider a simple pendulum of length L in the constant gravitational acceleration g of the earth. Let T be the time-period of this pendulum and let $T_0 = 2\pi\sqrt{\frac{L}{g}}$ be the time-period of small amplitude oscillations.

Plot T/T_0 for the pendulum as a function of the amplitude A_0 .