

Name: _____

Evaluation 8

Introductory Programming Fall 2006

A charged particle can be characterized by a charge, q , a mass m , a position vector P and a velocity vector V . In three-dimensional space, P and V have three elements, which we think of as Cartesian coordinates x , y and z .

A magnetic field can be characterized by a function that takes a position P as an input variable and returns a vector B as an output variable, where the components of B represent the strength of the field in each of the three dimensions.

The force on the particle, caused by the field, is $qV \times B$. Note: the `cross` function in MATLAB computes the cross product of two vectors.

Write a function named `particle` that we could use with `ode45` to compute the trajectory of a charged particle in a magnetic field. As usual, it should take t and a vector as input variables. The vector will contain 6 elements: the first three are the current position of the particle in 3-space; the next three are the current velocity.

The function should compute and return a column vector that contains the velocity and acceleration of the particle at the given time, position and velocity.

Assume that the mass of the particle is 1 kg, the charge of the particle is 1 coulomb and the strength of the magnetic field (everywhere and everytime) is 1 Tesla in the positive z direction (all of these values are are ridiculously big).

Use `ode45` to compute the trajectory of the particle with initial conditions $P = [1 \ 0 \ 0]$ and $V = [0 \ 1 \ 0]$. Use `plot3` to display the results in 3D.

How long does the particle take to complete one revolution? What is the radius of the circle?