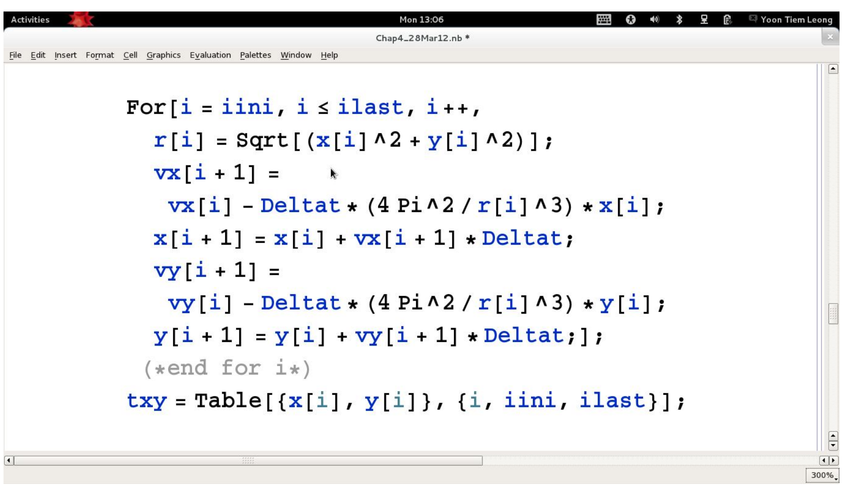
Homework Assignment 4

4.6 **Consider a planet that begins a distance of 1 AU from the Sun. By trial and error, determine what its initial velocity must be in order for it to escape from the Sun. Compare your estimate with the exact result (which you should also calculate).**

4.0.7.

Run the planetary motion program with initial conditions chosen to give orbits that are elliptical. You now can use the *Mathematica* code to "measure" (i) the sizes of the semimajor, (ii) semiminor, hence the positions of the (iii) perihelion (furthest point from the Sun), (iv) aphelion (closest distance to Sun), (vi) positions of the foci, and determine the (vii) planet's period? Write a code that calculates the above mentioned quantities (i) – (vii) for a hypothetical planet. Verify that the planet satisfies Kepler's third law by calculating the value of T^2/a^3.

4\. 3. This is a coding exercise. The following is part of a code that is supposed to generate all the locus points for a planet orbiting a central star, as discussed in the lecture note of Chapter 4. The 'weakness' of the code is that it makes use of list argument in Mathematica to store all the locus points during the looping calculation. This shall consume much memory and potentially slow down the calculation speed in more general cases (e.g., for 2 or 3 dimensional calculations, or when ilast becomes very large). Modify the code such that the locus points are generated without using list argument to store the values of the vectors (r, x, y, vx, vy). Be reminded that at the end, you still have to generate and plot the locus points of the planet.



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For[i = iini, i ≤ ilast, i++,
  r[i] = Sqrt[(x[i]^2 + y[i]^2)];
  vx[i + 1] =
   vx[i] - Deltat * (4 Pi^2 / r[i]^3) * x[i];
  x[i + 1] = x[i] + vx[i + 1] * Deltat;
  vy[i + 1] =
   vy[i] - Deltat * (4 Pi^2 / r[i]^3) * y[i];
  y[i + 1] = y[i] + vy[i + 1] * Deltat;];
 (*end for i*)
txy = Table[{x[i], y[i]}, {i, iini, ilast}];
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