5/10 – Review for Final Exam, Part 1

This is in approximate chronological order. As always, it does not include everything we covered.

1. A particle of mass m has initial speed v_0 when it encounters a retarding force equal to $f = -mbv^2$, where m is the particle's mass and b is a positive constant. There are no other forces acting on the particle.

   (a) Write Newton's Second Law for this problem.

   (b) Substitute $a = \frac{dv}{dt}$ and use separation of variables to solve for v as a function of t.

   (c) You should now have $v(t)$. Do the same trick again, and integrate to get $x(t)$.

   (d) Write a structure plan for how you will calculate and plot $x(t)$.

   (e) Go to the computers and code it. Use values of $v_0 = 15$m/s, $x_0 = 0$, and $b = 1$ /m.

   (f) For the plot, please make this one Figure(1) and include a title and axis labels.

2. Use a `for` loop to find the first 10 terms of the Fibonacci sequence. Put the terms in a vector and then display the vector.

3. Ask for an integer as input, then use an `if` statement to determine if a given number is even or odd. Display an answer.

4. A projectile is launched with an initial speed of 5m/s at an angle of 36.87° with respect to the horizontal. Plot the trajectory of the particle (y vs x), and then animate it. This one should be Figure(2). Choose a time scale so that we see about a parabola for the trajectory. For the animation, make a red dot follow the trajectory.

5. For the previous problem, you probably made vectors for t, x and y. Write those out–as columns– to a text file called `projData.txt`. The first column should be t, second x, third y.

6. Write a function to find the sum of the first n terms of the series:

$$\frac{1!}{1} + \frac{2!}{2} + \frac{3!}{3} + \frac{4!}{4} + \cdots$$

   Call your function twice, for two different values of n.

7. Write a function that returns both the sum and the product of two numbers. Call your function twice, using different values of the two numbers to be added and multiplied.