Math 151 – Python Lab 2

Directions: Use Python to solve each problem. (Template link)

1. Consider the polynomial:
$$f(x) = 1 + x(x+1)(x+2)(x+3)$$

   (a) Find all values for x for which $f(x) = 0$.

   (b) Find an expression for $f(x)$ in expanded form.

   (c) Find an expression for $f(x)$ in factored form.

   (d) Plot $f(x)$ on the window $x \in [-5, 1]$. Does your plot agree with the values you found in part (a) and the expression you found in part (c)? (May want to adjust y-axis to analyze.)

2. In a moment of rage, a MATH 151 student threw their calculus book out the window. Ignoring air resistance, the height of the textbook dropped from an initial height, s_0, is given by

$$s = -\frac{1}{2}gt^2 + s_0$$

   If there is air resistance represented by a constant R (dependent on the mass and drag coefficient), then the height is given by

$$s = -Rgt - R^2ge^{-t/R} + R^2g + s_0$$

   (a) Suppose the textbook is dropped from a window $6m$ off the ground (so $g = 9.8m/s^2$). Ignoring air resistance, determine when the object hits the ground.

   (b) Suppose the textbook has an air resistance constant of 2. Determine when the object hits the ground.

   (c) Plot both functions in the domain $t \in [0, 2]$.

   (Problem #3 on the next page)

3. Curves of the form

$$x = a\sin(nt)$$
$$y = b\cos(t)$$

with n a positive integer are called Lissajous figures.

   (a) Plot the following three curves on the same axes. Use different colors to identify different curves.

     i. $x = \sin(2t), y = \cos(t)$

    ii. $x = 3\sin(2t), y = \cos(t)$

   iii. $x = \sin(3t), y = 2\cos(t)$

   (b) Based on your graphs, what happens as we change a, b, and n?