Written HW1 – MATH 3504 Spring 2021

Due by 18 January for timely completion credit

Pu-239 (an isotope of plutonium) is produced from uranium-238. According to an article in Popular Science (https://www.popsci.com/its-not-so-easy-to-get-rid-34-metric-tons-plutonium/), the United States and Russia have a combined stockpiled 209.3 metric tons of Pu-239. The mass of Pu-239 (due to radioactive decay) is given by

$$y' = -0.00002876y.$$

1. Find the general solution to the differential equation.
2. Attach a plot of at least four different particular solutions to the differential equation (using Desmos is easiest).
3. Write an initial value problem corresponding to the combined stockpile of the United States and Russia.
4. Solve the initial value problem.
5. What is the half-life of Pu-239? (*hint: find a time t_ℓ such that $y(t_\ell)$ equals half of the initial amount*)
6. How many years will it take for the stockpile to naturally decay to 1 metric ton? (*hint: find a time t_1 such that $y(t_1) = 1$*)