Written HW9 – MATH 1530 Fall 2020

For interest problems, we use $A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$ where P is the initial amount invested (the "principal" amount), r is the annual interest rate, n is how many times the investment compounds per year, and t is measured in years.

For the radioactivity problem, assume the continuous model $A(t) = m_0 e^{rt}$ where m_0 is the mass you start with and r is the decay rate of the substance. Recall that the "half life" is how much time it takes for half of the substance to decay.

1. Suppose you invested \$5,000 into an account that has a 1.3% interest rate, compounded four times per year. How much money would you have in the account five years later?

2. 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 stockpiled 209.3 metric tons of Pu-239. Pu-239 has a half-life of 24,100 years.

   - Write the model down (i.e. "$A(t) = ...$"). You should only know m_0 from the prompt but not r.
   - Since you know the half-life is $24,100$ years, use that information to find the decay rate r. (*hint: you started with 209.3, how much is half? what value of t in your model corresponds to $24,100$ years?*)
   - Using your answer above, how long would it take for the combined stockpile of the United States and Russia to decay to only 50 metric tons?