MATH 315 Fall 2024
Assignment 6
Due Monday, September 30

I. Chapter 3: 1 – 3, 5, 7, 8, 12, 13, 16, and 19

II. *Complete problems **A*** and ***B**:*

Problem A: Suppose a population grows exponentially with Population ***P*** at time **t** given by **P(t) = C e^at^.** If we observe the population to be P_1 at time t_1 and to have size P_2 at time t_2, show that $C = P_1 e^{-at_1}$ and that $a = \dfrac{\log P_2 - \log P_1}{t_2 - t_1}$ and hence that the number of "person-years" between times t_1 and t_2 is $\dfrac{(P_2 - P_1)(t_2 - t_1)}{\log P_2 - \log P_1}$

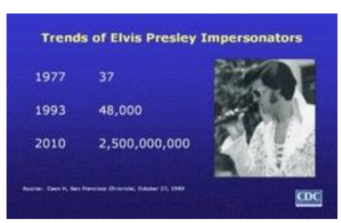
Problem B: Given the following population estimates, calculate the total number of people who have ever lived:

Year	Population	Average Life Expectancy
-1,500,000	2	20
-8,000	5 million	25
-50	300 million	30
1750	800 million	35
1825	1 billion	40
1925	2 billion	45
1960	3 billion	50
1990	5 billion	55
2024	8.2 billion	60

Use the formulas from Problem A. As a partial check on your work, you should get a value of about $.144 \times 10^{12}$ for the period between 1825 and 1925 with an estimated number of $.36 \times 10^{10}$ people for that 100 year span

The data for the Elvis Impersonator problem appear in a Power Point presentation by a member of the staff of the Center for Disease Control

The Burden of Chronic Disease and the Future of Public Health (January 13, 2003)



III. Develop your own version of a two nation arms race that incorporates some assumptions you think are more valid and realistic than Richardson's. Explain verbally what your assumptions are and how they are reflected in your model, which should be a system of differential equations. These equations are likely to be more complicated than his. Perform whatever qualitative analysis of the system you can (you may be dealing with *stable curves* rather than *stable lines*, for example. Create a MATLAB version of your model, run some appropriate experiments with it, and discuss the results.