HOMEWORK #16 – SOLUTIONS

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4) Russia. 0.4% per year.

6) 
\[ 1416 = 1049.7e^{0.015t} \Rightarrow 1.34895 = e^{0.015t} \Rightarrow \]
\[ \ln(1.34895) = 0.015t \Rightarrow t \approx 20 \text{ years} \Rightarrow 2023 \]

10) 
\[ A = 16e^{-0.000121(11430)} = 4 \text{ grams} \]

12) 25,000 years -> 8 grams
    50,000 years -> 4 grams
    75,000 years -> 2 grams
    100,000 years -> 1 gram
    125,000 years -> 0.5 grams

14) 
\[ A = A_0e^{-0.000121t} \]
\[ \frac{A}{A_0} = 0.88 \]
\[ 0.88 = e^{-0.000121t} \Rightarrow \ln(0.88) = -0.000121t \Rightarrow \]
\[ t = 1,056 \text{ years old in 1989} \]

24) logarithmic

28) 
\[ y = 1000(7.3)^x \Rightarrow y = 1000e^{(\ln7.3)x} = 1000^{1.988x} \]

42) 
\[ y = ax^b \quad a = 196.619, \quad b = 0.094 \]
\[ y = 196.619x^{0.094}, \quad r = 0.903 \]

44) a) 
linear regression:
\[ y = 0.5055x - 8.59, \quad r = 0.945 \]

logarithmic regression:
\[ y = -20.94 + 12.53 \ln x, \quad r = 0.674 \]

exponential regression:
\[ y = 3.38 (1.024)^x, \quad r = 0.995 \]

power regression:
\[ y = 1.187x^{0.701}, \quad r = 0.864 \]

The exponential model is the best based on \( r \).

b)
\[ y = 3.38 (1.024)^x \Rightarrow y = 3.38 e^{(\ln 1.024)x} = 3.38^{0.024x} \]

The population is increasing by 2.4% each year.