Exponential Growth and Decay; Modeling Data

Population growth/decline can be modeled by the function: $\boldsymbol{A = A_0 e^{kt}}$

A is the amount of people at time t

A_0 is the amount of people at time $t = 0$

k is a relative growth rate (ex: 0.02 would represent 2% of the population at time t)

Ex 1.

Suppose $A = 4.1e^{0.01t}$ represents the population in New Zealand (in millions) t years after 2006.

What was the population of New Zealand in 2006?

What is New Zealand's growth rate?

When will New Zealand's population be 8 million?

Ex 2.

What's different about a population modeled by the formula $A = 142.9e^{-0.004t}$, and what does it mean?

Carbon-14 is a radioactive substance that exists in plants and animals. After death, the supply in the body stops being replenished, and since the substance is radioactive, the amount of it decays over time. In fact, it decays exponentially, and can be modeled with the same $\boldsymbol{A = A_0 e^{kt}}$ formula, where $k < 0$ (so the function is decreasing).

The _____ of a substance is the time required for half of the given sample to disintegrate.

Ex 3.
Given that the half-life of carbon-14 is about 5715 years, find the exponential decay model for it.

Ex 4.
Suppose you find a paper with ancient Greek writing on it and want to find out if it really is ancient. You do some analysis and figure out that the paper contains 95% of its original carbon-14. Estimate the age of the paper.

Q: Suppose your boyfriend/girlfriend sends you this text message:
A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,V,W,X,Y,Z. What is does the message mean?