Exponential Situations

Choose one of these situations to think about, or write a similar one of your own:

1. There are currently 61 million cars in a certain country, increasing by 6% annually.

2. A vampire enters a town. He looks around for about an hour, and then chooses someone to bite. The person he bit is now also a vampire. Both of them take an hour to choose new victims, and then they each bite someone. All the vampires continue choosing victims in the same way.

3. The population in millions, W, of the country of West Mathlandia is modeled by $W(x) = 17.9e^{0.0015x}$, where x is the number of years since September 1998. The population in millions, E, of East Mathlandia is modeled by $E(x) = 13.5e^{0.0128x}$.

4. There are 10,000 bacteria in a petri dish. The population of bacteria declines to 4,000 in 4 hours.

5. An artifact is discovered. It has 57% of the carbon-14 it originally contained. Carbon-14 decays at the rate of 0.0125% per year.

6. The number of books, B, in a small library increases according to the function $B = 5{,}300e^{0.02t}$, where t is measured in years.

7. The growth in the population, P, of a certain species of rodent at a landfill is modeled by the exponential function $P(t) = 648e^{0.016t}$, where t is the number of years since 1987.

8. The initial mass of a certain compound is 448 g, and every 27 hours it decreases by half.

Write down questions you could ask about the situation you chose. Write as many questions as you can think of. As a group, you will choose some interesting questions to answer. If you would need to do calculations, make a sketch, or draw a graph in order to answer a question, then it's probably an interesting question.

You should answer 2 questions for every person in your group. Multiple people can work on a question together—each person in the group does not have to answer 2 questions by themselves.

Write a report to explain your questions and answers. The report should include:

- A context for your situation. Write a story that includes all the relevant information. If the description of the situation is missing some details, fill them in however you want.

- An equation to describe the situation, with an explanation of what each part of the equation represents.

- A labeled graph of the situation.

- The questions you chose and your answers. Include your process for finding the answers. Say what the answers mean in the context of this situation.

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1. If there are 200 people in the town, how long will it be before all of them are vampires?

2. Will the populations of East and West Mathlandia ever be the same, and if so, when?

3. How much does the population of bacteria decline each hour?

4. How long will it be before the library has 1 million books?

5. How many rodents were born between 1987 and now?

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