Exponential Situations

Task Statement 1

Think about one of these situations, or write a similar situation 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 an hour, and then chooses someone to bite. The person he bit is now also a vampire. Each vampire takes an hour to choose a new victim. 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 the questions you could ask about the situation you chose. Write as many questions as you can. As a group, you will choose some interesting questions to answer. If doing calculations, making a sketch, or drawing a graph is required to answer, then it's probably an interesting question.

For every person in the group, answer two questions. Multiple people can work on a question together—each person in the group does not have to answer two questions by themselves.

As a group, 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 details, fill them in.
- 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. Explain what each answer means in the context of this situation.

Exponential Situations

Task Statement 2

Think about one of these situations, or write a similar situation of your own:

1. A vampire enters a town. He looks around for an hour, and then chooses someone to bite. The person he bit is now also a vampire. Each vampire takes an hour to choose a new victim. All the vampires continue choosing victims in the same way.
2. 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 $E(x) = 13.5e^{0.0128x}$.
3. There are 10,000 bacteria in a petri dish. The population of bacteria declines to 4,000 in 4 hours.
4. 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.
5. 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.

Write the questions you could ask about the situation you chose. Write as many questions as you can. As a group, you will choose some interesting questions to answer. If doing calculations, making a sketch, or drawing a graph is required to answer, then it's probably an interesting question. To get you started, here is an example question for each situation:

1. How long until there are 200 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 until the library has 1 million books?
5. How many rodents were born between 1987 and now?

For every person in the group, answer two questions. Multiple people can work on a question together—each person in the group does not have to answer two questions by themselves. As a group, 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 details, fill them in.
- 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. Explain what each answer means in the context of this situation.