Assignment

Write

What are the attributes of a data set that indicate that it can be modeled by an exponential function?

Remember

Exponential and logarithmic equations can be used to model situations in the real world and solve for unknowns.

Practice

1. Allison found an equation to calculate the depreciated value of a vehicle. The equation is $t = \frac{\log\left(\frac{V}{C}\right)}{\log(1 - r)}$, where V represents the value of the vehicle after t years, C represents the original value of the vehicle, and r represents the average rate of depreciation as a decimal. Stephanie found a different equation used to calculate depreciation. The equation she found is $\frac{V}{C} = (1 - r)^t$.
   a. Use properties of logarithms to show that the equation Stephanie found is equivalent to the equation Allison found.
   b. Allison originally purchased her car for $45,000. It is currently valued at $36,520. The average rate of depreciation for the car is 16%. Determine the age of Allison's car using the logarithmic equation she found.
   c. Three years ago, Stephanie purchased her truck for $52,000. The truck has an average rate of depreciation of 18.5%. Determine the current value of Stephanie's truck using the logarithmic equation Allison found.
   d. Four years ago, Kayla purchased a car for $36,000. The current value of the car is $17,400. Determine the average rate of depreciation for the car.
2. The equation used to determine the amount, A, in an account after t years of continuous compounding is $A = Pe^{rt}$, where P represents the principal (or original) amount in the account and r represents the annual interest rate as a decimal.
   a. Six years ago, Dimitri invested $5000 in an account with continually compounded interest at an annual interest rate of 5.2%. Determine the current amount of money in the account.
   b. Kris invests $2500 in an account in which the interest is compounded continuously at an annual interest rate of 6%. Determine the amount of money that will be in the account after 10 years.
   c. Five years ago, Vaughn invested money into an account in which the interest is compounded continuously at an annual interest rate of 4%. The account is currently valued at $1099.26. Determine the amount of money Vaughn invested to the nearest dollar.
   d. Determine the number of years it will take for Cindy's initial investment of $10,000 to reach a value of $13,000 if she invests the money in an account in which the interest is compounded continuously at an annual interest rate of 6.5%.
   e. Determine the annual interest rate needed for an initial investment of $4000 to reach an amount of $6000 in 8 years if the money is invested in an account in which the interest is compounded continuously.
   f. How many years would it take for the amount in a continuously compounded account to triple in value if the annual interest rate was 6.3%?

Stretch

Christine has been training for a marathon. Immediately after her morning run, her heart rate is 180 beats per minute. One minute later, her heart rate has fallen to 147 beats per minute, and 2 minutes after her run, it is down to 124 beats per minute. Christine's resting heart rate is 70 beats per minute.

1. Determine the type of function that would best model the given data. Explain your reasoning.
2. Write the function $R(t)$ to model Christine's heart rate t minutes after her morning run.
3. Graph the function $R(t)$.
4. Use the function $R(t)$ to predict Christine's heart rate 5 minutes after her morning run.

Review

1. In music, the cent, c, is a unit of measure that is used to measure the differences in frequencies between musical notes. The formula $c = 1200 \log_2 \left(\frac{f_1}{f_2}\right)$ can be used to determine the number of cents, c, between a musical note of higher frequency f_1 and a musical note of a lower frequency f_2.
   a. Determine the number of cents between the notes A5 and D3 if A5 has a frequency of 880 Hz (hertz) and D3 has a frequency of 146.83 Hz.
   b. Determine the frequency (in hertz) of the note F2 if the notes F2 and B2 are separated by 600 cents and B2 has a frequency of 123.47 Hz. The note B2 has a higher frequency than the note F2.
2. Solve $\log_3 (x + 6) + \log_3 x = 3$. Check your work.
3. A scientist begins with a population of 20 bacteria in a culture. She records the population every hour. The year 0 corresponds to the date of the hour the study began.
   a. Does the population represent an example of exponential decay, exponential growth, or neither? Explain your reasoning.
   b. Write a function to represent the population of bacteria, B, as a function of the hour, h.
   c. Use your function to complete the table.

Hour	Bacteria Population
0	20
1	50
2	125
3	
4	
5	

4. Solve $\frac{a-4}{5a} = \frac{1}{5a+1}$.