

APPC Lesson 5.8 Homework

Name _____

1. Sam works at a shop buying and selling used cars. When a car owner wants to sell their car, Sam estimates the value of the car. Which of the following functions provides the best model for the age of the car, y , given Sam's estimate, x ?
- A) An increasing exponential function
 - B) An increasing logarithmic function
 - C) A decreasing exponential function
 - D) A decreasing logarithmic function
2. The temperature of a pizza, in degrees Fahrenheit, t minutes after it is removed from the oven can be modeled by the function F where $F(t) = 425(0.916)^t$. How many minutes will it take for the temperature of the pizza to cool down to 100° Fahrenheit? Round to the nearest hundredth.
3. The function f is a logarithmic function that passes through the points $(3, 1)$ and $(9, 2)$. Write two possible equations that could define $f(x)$.

4. A table of values for a function f is given below. If $f(x) = a \log_4(x) + b$ find the values of a and b .

x	1	4	16	64
$f(x)$	3	8	13	18

5. Google PageRank is a rough measure of the popularity and authority of a website. The larger the PageRank, the more popular the website. PageRank is a logarithmic scale. As a website's popularity increases multiplicatively by a factor of 10, PageRank increases linearly by 1. The site kahoot.com (which is a game-based learning platform used in schools) has a PageRank of 5.89 whereas amazon.com has a PageRank of 8.68. Approximately how many times more popular is Amazon than Kahoot?

6. A new line of water bottles launched in 2009 . The table gives the number of units sold in the years from 2009 to 2020 .

Year	2009	2011	2012	2014	2016	2017	2018	2020
Units sold (in thousands)	98	110	113	119	123	125	126	128

- Describe how the number of units sold changed over time.
- Use your calculator to generate a logarithmic regression model of the form $f(x) = a + b \ln x$, where $f(x)$ gives the units sold (in thousands) of the new water bottle, x years after 2008(2009 corresponds to $x = 1$) .
- Based on the model, how many units are predicted to be sold in 2023 ? Round to the nearest unit.

7. Three thousand dollars is invested into an account compounding interest continuously. After 4 years, there is \$3315.51 in the account. Find the interest rate.

8. To test the effectiveness of lectures as an instructional model, students in a university course were asked to listen to a series of lectures and then take an exam. Every month for a year they were asked to come back to take the exam again, to see how much of the information they had retained. The average score (out of 100) can be modeled by the function $S(t) = 77 - 6\ln(t + 1)$ for $0 \leq t \leq 12$, where t is the time in months.

- a. What was the average score on the original exam ($t = 0$) ?

- b. What was the average score after 2 months?

- c. Does a student's score drop more significantly during the first two months of the experiment ($0 \leq t \leq 2$) or during the last two months ($10 \leq t \leq 12$) ?

- d. Examine the graph of the function S and explain how it supports your answer to part (c).

- e. Why do you think function S is an appropriate model for retaining information?

9. Frank Benford and Simon Newcomb noticed that in real-life sets of numerical data a greater proportion of numbers in the data set had a small leading digit (like 1 or 2) rather than a large leading digit (like 8 or 9). This is counter to the idea that all 9 digits are equally likely to appear, with each digit appearing as a leading digit approximately one out of nine or 11.1% of times. The Newcomb-Benford Law states that the proportion of numbers in any real data set beginning with the digit d can be modeled by $P(d) = \log(d + 1) - \log(d)$.

- a. According to their model, what proportion of numbers in a real data set should begin with the digit " 1 " ?

- b. According to their model, what proportion of numbers in a data set should begin with the digit " 9 " ?

- c. Use logarithm properties to write $P(d)$ as a single logarithm.

- d. The Newcomb-Benford Law has been used to detect falsified data in a data set. Suppose that a company submits all their financial data in a report. How might an auditor go about determining if the numbers had been tampered with?

10. The population of a midwestern city is roughly 470,000 people at the start of 2002 . Each year the population increases by approximately 2.5% of the previous year's population. Write a function that gives the number of years after 2002, $Y(p)$, until this city reaches a population of p people.