

2.14 Logarithmic Function Context and Data Modeling

2.14 Practice

AP Precalculus

Calculator Active: Instructions: Use the data provided to find a regression equation and answer the questions. Round to nearest thousandth.

- 1) Mr. Bean started learning Chinese in hopes of translating all his videos one year. He created some data to find a model for the number of days studying as a function of the number of words he learned that day.

# of Words Learned	10	32	79	197	400
# of days studying	1	6	10	14	17

- a) What's a logarithmic regression equation that could model this situation?

$$f(x) = -9.031 + 4.350 \ln x$$

- b) How many days would it take for Mr. Bean to learn 1000 words?

$$f(1000) = -9.031 + 4.350 \ln 1000 = 21.021 \approx 21 \text{ days}$$

- c) How many words would he learn if he studied for 2 months (60 days)?

$$60 = -9.031 + 4.35 \ln x$$

$$69.031 = 4.35 \ln x \Rightarrow$$

$$15.869 = \ln x$$

$$e^{15.869} = x$$

$$7796,577 = x$$

words

- 2) Mr. Sullivan recently decided (with the help from his doctor) that he needed to start a diet. Each week he collects data on the amount of weight he loses that week. He wants to find a regression equation that models the pounds lost on a particular week as a function of the week number.

Week #	1	2	6	9
Pounds Lost that week	9.5	8.5	6.5	5.5

- a) What's a logarithmic regression equation that could model this situation?

$$f(x) = 9.616 - 1.808 \ln x$$

- b) Which week number will Mr. Sullivan lose 2 pounds?

$$2 = 9.616 - 1.808 \ln x$$

$$-7.616 = -1.808 \ln x$$

$$4.212 = \ln x$$

$$e^{4.212} = x$$

$$67.5 = x$$

Week 68

- c) How many pounds will Mr. Sullivan lose during the 12th week?

$$f(12) = 9.616 - 1.808 \ln(12)$$

$$f(12) = 5.12 \text{ pounds}$$

- 3) The latest and greatest new tech firm, Math Geek Tech, is about to go public on the Stock Exchange. The market guys at Math Geek Tech want to create a regression model that shows the stock price (in dollars) as a function of the number of days on the market.

Days on Market	1	3	4	7
Stock Price(\$)	112	150.5	160.5	180.1

- a) What's a logarithmic regression equation that could model this situation?

$$f(x) = 112.012 + 34.994 \ln x$$

- b) How many days will it take for the stock price to be \$250?

$$250 = 112.012 + 34.994 \ln x$$

$$137.988 = 34.994 \ln x$$

$$3.943 = \ln x$$

$$e^{3.994} = x$$

$$51.582 = x$$

52 days

- c) What would the stock price be after the first two weeks on the market (14 days)?

$$f(14) = 112.012 + 34.994 \ln 14$$

$$f(14) = \$204.36$$

Calculator Active: Instructions: Use the information given to answer the questions. Round to nearest thousandth.

- 4) People can use the formula below to determine future populations ($N(t)$) of cities. N_0 represents the initial population, r is the rate of population growth, and t is the time in years.

$$N(t) = N_0 e^{rt}$$

- a) What would the population be of Cleveland, Ohio be in 10 years if there are currently 275,000 people, with a population growth rate of 2.5%.

$$N(10) = 275,000 (e^{0.025(10)})$$

$$= 353,107 \text{ people}$$

- b) What growth rate would Cleveland, Ohio need to achieve a population of 400,000 people in 20 years?

$$400,000 = 275,000 e^{20r}$$

$$1.455 = e^{20r}$$

$$\frac{\ln 1.455}{20} = \frac{20r}{20}$$

$$0.0188 = r$$

or 1.88%

- 5) Forensics often use Newton's Law of Cooling to determine the elapsed time since a person has died. The formula is $t = -10 \ln \left(\frac{T-R}{98.6-R} \right)$, where T stands for the body's temperature in degrees Fahrenheit, R is the temperature of the room and t is the elapsed time since death in hours.
- a) How many hours had elapsed if the temperature of the room was 75° and the body's temp was 85 hours?

$$t = -10 \ln \left(\frac{85-75}{98.6-75} \right)$$

$$t = 8.5 \text{ hours}$$

- b) Suppose a body found 5 hours after death (neighbor heard thud) in a room that was 65° . What was the temperature of the body?

$$5 = -10 \ln \left(\frac{T-65}{98.6-65} \right)$$

$$-\frac{1}{2} = \ln \left(\frac{T-65}{33.6} \right)$$

$$e^{-1/2} = \frac{T-65}{33.6}$$

$$33.6(e^{-1/2}) = T-65$$

$$33.6(e^{-1/2}) + 65 = T$$

$$85^\circ$$

2.14 Logarithmic Function Context and Data

2.14 Test Prep

- 6) The table presents values for a function, f , at selected values of x . A logarithmic regression is used to model the data. What is the value of $f(4.5)$?

- (A) 35.225
 (B) 34.987
 (C) 54.639
 (D) 54.012

$$f(x) = 44.932 - 6.454 \ln x$$

x	$F(x)$
1	44.9
3	37.9
7	32.4
9	30.7