

Exponential Regression and Other Calculator Skills (2.5) Homework

As a reminder, to perform exponential regression in Desmos, click the + sign, add a table, input the points, click the regression symbol to the left of the table, select "Exponential Regression," and **check the "Log Mode" box**. On the AP exam, the "Log Mode" box will be checked by default.

All rounding on this homework should be to three decimal places, the standard rule for all of AP Precalculus.

1. Values of the function f at select x -values are shown in the table below. Use a graphing calculator to determine an exponential regression model for $f(x)$.

x	-2.4	1.5	3	4
$f(x)$	20.1	18.1	16.6	15.3

Predict $f(1)$ with this model.

2. The function f is of the form $f(x) = a(b)^x$. If $f(-3) = 4.8$ and $f(3) = 0.7$, find the value of a .
3. Every year, Mr. Green asks an expert to estimate the price of his car. He bought his car in 2018. The estimates he has gotten are shown below. The t values are given terms of how many years it has been since 2018. The estimates are given in thousands of dollars.

t (years since 2018)	1	2	3	4	5
Estimate (thousand \$)	20.1	18.1	16.6	15.3	14.1

Use a graphing utility to construct an exponential model of the estimated value of the car as a function of the number of years since 2018. Use that model to predict the car's initial value.

4. Consider the geometric sequence with $g_2 = 32.1$ and $g_7 = 0.3$.
- Find the value of the common ratio.
 - Find g_1 .
5. Mercury in the body has a half-life of about 65 days. That is to say, someone who was exposed to a high level of mercury (which can be very dangerous) can expect the mercury level in their body to decrease by 50% every 65 days.
- Colonel Mustard has 10 mcg of mercury in his body. Write a function that models the level of mercury remaining in his body after t days.
 - How much mercury remains in Colonel Mustard's body after 100 days?
 - Professor Plum was exposed to mercury. Thirty days later he has 19 mcg of mercury in his body. What level of mercury was initially present in his body?

6. Every year, Mrs. Peacock asks an expert to estimate the price of her rare orchid. She bought this orchid in 2015, and it is extremely valuable. The estimates she has gotten are shown below. The t values are given in terms of how many years it has been since January 1st, 2015 (e.g. $t = 2$ corresponds with January 1st, 2017). The estimates are given in thousands of dollars.

t (years since 2015)	1	2	3	4	5
Estimate (thousand \$)	2.2	3.6	5.7	9.2	14.7

Model the value of Mrs. Peacock's orchid with an exponential function. Predict the year that Mrs. Peacock's orchid will increase by more than \$20,000 for the first time.

7. Norepinephrine is a medication used to treat very low blood pressure of patients in some cases of septic or neurogenic shock. Norepinephrine has a biological half-life of 2 minutes meaning that it takes 2 minutes for the concentration of norepinephrine in the body to decrease by 50%.
- If a patient initially has 8 mcg of norepinephrine in their system, how much remains after 10 minutes?
 - If a patient initially has 8 mcg of norepinephrine in their system, how much remains after 7 minutes?
8. Mrs. White prepares some tea. Rather than drink it, she lets it sit on the counter in a mug and checks its temperature every minute for ten minutes. Odd, but she enjoys doing that, and we don't judge. The room temperature is 68°F and the tea starts off boiling (212°F). So initially the tea is 144°F warmer than the room temperature. After ten minutes, the tea is only 34°F warmer than the room temperature. The temperature difference at times in between is given below.

Time (minutes)	0	1	2	3	4	5	6	7	8	9	10
Difference in Temps (°F)	144	121	108	94	80	70	61	52	47	39	34

- Use a graphing utility to construct $D(t)$ a model of the temperature difference as a function of t , time since Mrs. White poured the tea. Using the model, predict the temperature difference at time $t = 11$.
 - According to the model, after how many minutes will the temperature difference be only 20°F?
9. Madame Rose deposits \$8000 in an interest bearing bank account. Each month, the amount of money in her account will increase by 1%. Which one of the following functions describes how much money Madame Rose will have in her account after t years?
- $A(t) = 8000(1.012)^t$
 - $A(t) = 8000(1.120)^t$
 - $A(t) = 8000(1.125)^t$
 - $A(t) = 8000(1.127)^t$

Exponential Regression and Other Calculator Skills (2.5) HW Answers

1. $f(x)$ can be modelled by $g(x) = 18.539(0.961)^x$
 $f(1) \approx g(1) = 17.807$
2. $a = 1.833$
3. The value of the car can be modelled by $V(t) = 21.740(0.916)^t$ thousand dollars.
The car's initial value can be predicted to be approximately $V(0) = 21.740 = \$21740$.
4.
 - a. $r = \sqrt[5]{\frac{0.3}{32.1}} = 0.393$
 - b. $g_1 = g_2 \cdot r^{-1} = 32.1 \cdot \left(\sqrt[5]{\frac{0.3}{32.1}}\right)^{-1} = 81.730$
5.
 - a. $f(t) = 10(0.5)^{\frac{t}{65}}$ mcg
 - b. $f(100) = 10(0.5)^{\frac{100}{65}} = 3.443$
 - c. 26.163 mcg
6. $f(t) = 1.380(1.606)^t$
 $f(5) = 14.7$ $f(6) = 23.677$ $f(7) = 38.023$ $f(8) = 61.063$
From January 1st of 2022 to January 1st of 2023, the value of the orchid increased by about \$23040. This was the first year with an increase of more than \$20000.
7. With an initial value of 8 and a half life of 2 minutes, the level of norepinephrine is modelled by
$$f(t) = 8(0.5)^{\frac{t}{2}}$$
 - a. $f(10) = 8(0.5)^5 = 0.25$ mcg
 - b. $f(7) = 8(0.5)^{3.5} = 0.707$ mcg
8. Analyzing a graph of the data and the context of the question, an exponential model seems appropriate.
 - a. $D(t) = 142.755(0.867)^t$
 $D(11) = 29.707$
 - b. $D(13.773) = 20$
13.773 minutes after pouring the tea, the temperature difference will only be 20°F
9. D
With t in months the amount of money would be $f(t) = 8000(1.01)^t$
But with t in years the amount of money would be $A(t) = 8000(1.01)^{12t} = 8000(1.01^{12})^t = 8000(1.127)^t$