

## Written Assignment 5

2.5 points each

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### 6.1

#### Algebraic

For the following exercises, determine whether the equation represents exponential growth, exponential decay, or neither. Explain.

1.  $y = 12.25\left(\frac{2}{3}x\right)^3$

2.  $y = \left(\frac{7}{8}\right)^{0.75x} - 2$

For the following exercises, find the formula for an exponential function that passes through the two points given. Round results to 3 decimal places.

3. (0, 21) and (2, 38)

4. (-1, 5) and (4, 2)

For the following exercises, use the compound interest formula,  $A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$ .

5.

- After a certain number of years, the value of an investment account is represented by the equation  $15,500\left(1 + \frac{0.06}{6}\right)^{90}$ . What is the value of the account?
- What was the initial deposit made to the account in the previous exercise?
- How many years had the account from the previous exercise been accumulating interest?

#### Real-World Applications

6. In the year 1980, the median price for a house in New Hampshire was \$95,000. By the year 2000, the median house value had appreciated to \$133,300. What was the annual growth rate between 1980 and 2000 (state as a percent to one decimal place)? Assume that the value continued to grow by the same percentage. What will the median price for a house in New Hampshire in the year 2020? Round to the nearest hundred dollars.

## 6.2

### Graphical

For the following exercises, graph the function and its reflection about the y-axis on the same axes, and give the y-intercept.

7.  $f(x) = \frac{-2}{3}(1.25)^{3x}$

For the following exercises, graph  $f(x) = 3^x$  and its transformation on the same axes. Give the horizontal asymptote, the domain, and the range.

8.  $f(x) = 3^{x+1} - 2$

For the following exercises, start with the graph of  $f(x) = 1.9^x$ . Then write a function that results from the given transformation.

9.

- a. Shift  $f(x)$  3 units downward and right 2 units.
- b. Shift  $f(x)$  2.25 units up and left 1.5 units.
- c. Shift  $f(x)$  4 units right and reflected about the  $x$ -axis.

### Numeric

For the following exercises, evaluate the exponential functions for the indicated value of  $x$ . Round your result to 3 decimal places.

10.  $g(x) = \left(\frac{3}{4}\right)^{\frac{2x}{5}} - 3$  for  $g(5)$ .

### 6.3

### Algebraic

For the following exercises, rewrite each equation in exponential form.

11.  $\log_2(16) = b$

For the following exercises, rewrite each equation in logarithmic form.

12.  $\left(\frac{2}{3}\right)^c = \frac{8}{27}$

For the following exercises, solve for  $x$  by converting the logarithmic equation to exponential form.

13.  $\log_{16}(x) = 3$

For the following exercises, use the definition of common and natural logarithms to simplify. Round answer to 4 decimal places

14.  $4 \log(10000)$

### Numeric

For the following exercises, evaluate the base  $b$  logarithmic expression without using a calculator.

15.  $\log_{16}(0.0625)$

For the following exercises, evaluate the common logarithmic expression without using a calculator.

16.  $\log(0.01)$

For the following exercises, evaluate the natural logarithmic expression without using a calculator.

17.  $\ln(e^{-4}) - 2$

### Technology

For the following exercises, evaluate each expression using a calculator. Round to the nearest thousandth.

18.  $\log(0.2345)$

### Extensions

19. Is the following true:  $\frac{\log(10)}{\log(10^{3.45})} = \frac{1}{3.45}$  ? Verify the result.

### Real-World Applications

20. The intensity levels  $I$  of two earthquakes measured on a seismograph can be compared by the formula  $\log\left(\frac{I_1}{I_2}\right) = M_1 - M_2$  where  $M$  is the magnitude given by the Richter Scale. On April 7th, 2018, an earthquake of magnitude 4.6 hit near Perry OK, USA. On the same day an earthquake of magnitude 6.3 hit near Pongera Papua New Guinea. How many times greater was the intensity of the Papua New Guinea earthquake than the OK earthquake? Round to the nearest whole number. NOTE: Remember that the value of a log is an exponent. So  $M_1 - M_2$  represents the exponent for the base of the common log.

For the following exercises, state the domain, range, the vertical asymptote, x- and y-intercepts (if they exist, if they do not exist write DNE), and end behavior of the function.

21.  $f(x) = 2\log_8(4 - x)$

22.  $f(x) = \ln\left(3x - \frac{2}{9}\right) + 2$

For the following exercises, sketch the graph of the indicated function.

23.  $f(x) = \ln\left(3x - \frac{2}{9}\right) + 2$

For the following exercises, use a graphing calculator to find approximate solutions to each equation. If you do not have a graphing calculator then use the following site's online graphing calculator. You will want to use the "Intersection" function. Round results to 4 decimal places

[https://my.hrw.com/math06\\_07/nsmedia/tools/Graph\\_Calculator/graphCalc.html](https://my.hrw.com/math06_07/nsmedia/tools/Graph_Calculator/graphCalc.html)

24.  $\log(4x - 7) + 1 = -\log(4x - 7) - 4$

### Graphical

For the following problem, start with the graph of  $f(x) = \log(x)$ . Then write a function,  $g(x)$ , that results from the given transformation. Graph both  $f(x)$  and its transformation on the same axes.

25. Shift  $f(x)$  1 unit up, right 2 units, and reflected about the  $x$  axis.

## 6.5

### Algebraic

For the following exercises, expand each logarithm as much as possible. Rewrite each expression as a sum, difference, or product of logs.

26.  $\log_8 \left( \frac{3x}{5x-7} \right)$

For the following exercises, condense to a single logarithm if possible.

27.  $\frac{2}{3} \ln(x) - \ln(2y) + \ln(z)$

For the following exercises, use the properties of logarithms to expand each logarithm as much as possible. Rewrite each expression as a sum, difference, or product of logs.

28.  $\ln \left( \frac{x^3 \sqrt[4]{y^3}}{(2z)^4} \right)$

For the following exercises, rewrite each expression as an equivalent ratio of logs using the indicated base.

29.  $\log_8(24)$  to base 10

For the following exercises, suppose  $\log_3(7) = m$  and  $\log_3(5) = n$ . Use the change-of-base formula along with properties of logarithms to rewrite each expression in terms of  $m$  and  $n$ . Show the steps for solving.

30.  $\log_7(25)$

### Numeric

For the following exercises, use the change-of-base formula to evaluate each expression as a quotient of natural logs. Use a calculator to approximate each to five decimal places.

31.  $\log_{13}(68)$

### Extensions

32. Use the product rule for logarithms to find all  $x$  values such that  $\log_3(3x - 5) + \log_3(2x + 4) = 3$ . Show the steps for solving.

## 6.6

### Algebraic

For the following exercises, use like bases to solve the exponential equation.

33.  $7^{3x-1} = 7^{4x+5}$

For the following exercises, use logarithms to solve. Round your results to 4 decimal places.

34.  $5^{7x+1} = 8^{4x+5}$

For the following exercises, use the definition of a logarithm to solve the equation.

35.  $6 \log_9(3a) = 15$

For the following exercises, use the one-to-one property of logarithms to solve. Give an exact value for the result.

36.  $\log(7x + 3) = \log\left(\frac{5}{2x+3}\right)$

For the following exercises, solve each equation for  $x$ .

37.  $\ln(x - 5) = \ln(x - 7) + \ln(2x - 1)$

For the following exercises, solve for the indicated value.

38. An account with an initial deposit of \$10,500 earns 4.25% annual interest, compounded continuously. How long will it take until the account is worth twice the initial deposit? Round your answer to the nearest tenth. Use the formula

$$A(t) = Pe^{rt}$$

## 6.7

### Real-World Applications

39. A doctor prescribes 165 milligrams of a therapeutic drug that decays by about 36% each hour. Write an exponential model representing the amount of the drug remaining in the patient's system after  $t$  hours and use the model determine the half-life of the drug, round to the nearest tenth of an hour.

40. The half-life of Plutonium 238 is 87.75 years. What is the annual decay rate?  
Express the decimal result to four significant digits and the percentage to two significant digits.