

## Precalculus Unit 4: Review

### Exponential and Logarithmic Functions

1. Complete the statements to illustrate a property of logarithms.

a. Product rule:  $\log_3 5x =$  \_\_\_\_\_

b. Quotient rule: \_\_\_\_\_  $= \log y - \log 17$

c. Power rule:  $\ln 2^{-5} =$  \_\_\_\_\_

d. Change of base formula: \_\_\_\_\_  $= \frac{\log(3x)}{\log 4}$

2. Tell whether or not the equation is true or false. Assume that all variables are positive.

a.  $4 \log_3 3x = \log_3 81x^4$

b.  $\log_3 x = \frac{\log_{10} x}{\log_3 10}$

c.  $\log xy - \log yz = \log \frac{x}{z}$

d.  $(\log y)^{12} = 12 \log y$

e.  $\frac{\ln 5}{\ln c} = \ln 5 - \ln c$

f.  $(\log 5)(\log x) = \log(5 + x)$

g.  $\log_x 8 = \frac{\ln 8}{\ln x}$

h.  $\log 3x + \log(x + 8) = \log(3x^2 + 24x)$

3. Solve each of the following exponential equations:

a.  $e^{2x} = 75$

b.  $3^{x-3} = 5$

c.  $\frac{50}{4 + e^{2x}} = 11$

d.  $e^{2x} + 5e^x - 6 = 0$

4. Evaluate  $\log_7 15$  using your calculator. Round to the hundredths place.

5. Solve each of the following logarithmic equations.

a.  $\ln x = 5.4$

b.  $\log(x+2) + \log(x-1) = 1$

c.  $\log_3(x-2) + \log_3(x+5) = 8 \log_3 3$

d.  $17 - 4 \log x = 25$

6. Use the properties of logarithms to write the expression below as a sum, difference, or multiples of logarithms of  $x$ ,  $y$ , or constants. (Expand)

$$\log \sqrt[5]{\frac{3y}{x}}$$

7. Write  $4 \log x - 4 \log z + \log x$  as a single logarithm. (Multiple choice)

a.  $\log \frac{x^5}{z^4}$

b.  $4 \log(x-z) + x$

c.  $\log(x^4 - z^4 + x)$

d.  $\log(5x - 4z)$

8. Write the logarithmic expression that is equivalent to the exponential expression  $3^{a+1} = 4b$ . (Multiple choice)

a.  $a+1 = \ln(4b)$

b.  $4b = \ln(a+1)$

c.  $4b = \log_3(a+1)$

d.  $a+1 = \log_3(4b)$

9. Evaluate without using a calculator:

a.  $\log_3 81$

b.  $\log_2 32$

c.  $\log \sqrt[3]{10}$

10. The number of guppies in Susan's aquarium doubles every day. There are 4 guppies initially.

a. How many guppies are there after 4 days? After 1 week?

b. When will there be 2000 guppies?

11. The population  $P$  of deer after  $t$  years in Briggs State Park is modeled by the function

$$P(t) = \frac{1200}{1 + 99e^{-0.4t}}.$$

a. What was the initial population of deer?

b. When will there be 1000 deer?

c. What is the maximum number of deer planned for the park?

12. Find an exponential regression model for Illinois's population and use it to predict the population for 2010.

Population of Illinois (in millions)	
Year	Illinois
1900	4.8
1910	5.6
1920	6.5
1930	7.6
1940	7.9
1950	8.7
1960	10.1
1970	11.1
1980	11.4
1990	11.4
2000	12.4

Source: U.S. Census Bureau as reported in the *World Almanac and Book of Facts 2005*

