Name _____ Class _____ Date _____

3-1 Practice

Form K

Exponent/Logarithm Review

Without graphing, determine whether the function represents exponential growth or exponential decay.

1. $y = 3(7)^x$ **2.** $y = 4(2.5)^x$ **3.** $y = 5(0.75)^x$

For each annual rate of change, find the corresponding growth or decay factor.

4. 35% **5.** − 20% **6.** 62%

7. Identify the meaning of the variables in the exponential growth or decay function.

$$A(t) = a(1 + r)^t$$

a. a = _____

b. r = _____

c. t = _____

Use the graph of $y = e^x$ to evaluate each expression to four decimal places.

8. e^3 **9.** $e^{0.5}$ **10.** e^{-4}

Identify the meaning of the following variables in the formula for continuously compounded interest.

$$A(t) = P \cdot e^{rt}$$

11. P **12.** r **13.** t

Find the amount in a continuously compounded account for the given conditions.

14. principal: \$300
annual interest rate: 5%
time: 4 yr

15. principal: \$650
annual interest rate: 6.5%
time: 20 yr

Write each equation in logarithmic form.

16. $32 = 2^5$ **17.** $243 = 3^5$ **18.** $625 = 5^4$

Write each equation in exponential form.

19. $\log_3 9 = 2$ **20.** $\log_5 125 = 3$ **21.** $\log_8 512 = 3$

Evaluate each logarithm.

22. $\log_9 27$ **23.** $\log_8 256$ **24.** $\log_{125} \frac{1}{25}$

Name _____ Class _____ Date _____

3-2 Practice

Form K

Properties of Logarithms

Properties of Logarithms		
Product Property	**Quotient Property**	**Power Property**
$\log_b mn = \log_b m + \log_b n$	$\log_b \frac{m}{n} = \log_b m - \log_b n$	$\log_b m^n = n\log_b m$

Write each expression as a single logarithm.

1. $\log_3 9 + \log_3 24$

2. $\log_4 16^3$

3. $\log_2 7 - \log_2 9$

4. $\log_3 8^5$

5. $\log_4 x - \log_4 y$

6. $\log 5 + \log 7$

Expand each logarithm. Simplify if possible.

7. $\log_3 27x$

8. $\log\frac{3}{7}$

9. $\log_4 y^2z^3$

10. $\log_5 \frac{3^2}{x}$

11. $\log_3 15xy$

12. $\log 8xz^4$

13. Open-Ended Write three different logarithms. You should be able to expand each logarithm by one of the properties of logarithms.

Name _____ Class _____ Date _____

3-2 Practice (continued) *Form K*

Properties of Logarithms

Change of Base Formula

For any positive numbers m, b, and c, with $b \neq 1$ and $c \neq 1$,

$$\log_b m = \frac{\log_c m}{\log_c b}$$

Use the Change of Base Formula to evaluate each expression.

14. $\log_{32} 4$

$$\frac{\log_2 4}{\log_2 32} =$$

15. $\log_9 27$

16. $\log_4 12$

17. Error Analysis Your friend used the Change of Base Formula to evaluate the expression $\log_4 8$. Her answer was $\frac{2}{3}$. What error did your friend make? What is the correct answer?

Use the following formula to solve Exercise 18.

Formula for Loudness of a Sound (decibels)

$$L = 10 \log \frac{I}{I_0}$$

- I is the intensity of a sound in watts per square meter (W/m^2).
- I_0 is the intensity of a sound that can barely be heard.
- $I_0 = 10^{-12}$ W/m^2

18. Your classmate went to a rock concert. At the loudest point during the concert, the sound had an intensity of 2.35×10^{-3} W/m^2. What was the loudness of this sound in decibels?

Name _____ Class _____ Date _____

3-3 Practice

Form K

Exponential and Logarithmic Equations

Solve each equation. To start, rewrite each side with a common base.

1. $125^{2x} = 25$

$(5^3)^{2x} = 5^2$

$5^{6x} = 5^2$

$6x = 2$

$x =$

2. $2^{3x-3} = 64$

$2^{3x-3} = 2^6$

3. $81^{3x} = 27$

Solve each equation. Round to the nearest ten-thousandth. Check your answers. To start, take the logarithm of each side.

4. $6^{4x} = 234$

$\log 6^{4x} = \log 234$

$4x \log 6 = \log 234$

$x = \dfrac{\log 234}{4 \log 6}$

$x \approx$

5. $3^{5x} = 375$

$\log 3^{5x} = \log 375$

6. $7^{3x} - 24 = 184$

Graphing Calculator Solve by graphing. Round to the nearest ten-thousandth.

7. $3^{6x} = 2000$

Let $Y_1 = 3^{6x}$ and $Y_2 = 2000$.

$x \approx$

8. $8^{3x} = 154$

9. $12^{4x} = 4600$

Use the following formula for Exercise 10.

$$T(m) = a(1 + r)^m$$

- m = the number of minutes it takes for $\frac{3}{4}$ of the crowd to leave the stadium
- $T(m)$ = the number of people in the stadium after m minutes
- a = the number of people currently in the stadium
- r = the percent change in the number of people in the stadium

10. There are currently 100,000 people in a stadium watching a soccer game. When the game ends, about 3% of the crowd will leave the stadium each minute. At this rate, how many minutes will it take for $\frac{3}{4}$ of the crowd to leave the stadium?

Name _____ Class _____ Date _____

3-3 Practice (continued) *Form K*

Exponential and Logarithmic Equations

Convert from Logarithmic Form to Exponential Form to solve each equation.

Exponential and Logarithmic Form	
Logarithmic Form $\log_b x = y$	Exponential Form $b^y = x$

11. $\log (2x + 4) = 3$

$2x + 4 = 10^3$

$2x = 996$

$x =$

12. $\log 4z - 3 = 2$

$\log 4z = 5$

13. $\log (2x - 8) = 2$

Use the properties of logarithms to solve each equation.

Product Property	Quotient Property	Power Property
$\log_b mn = \log_b m + \log_b n$	$\log_b \frac{m}{n} = \log_b m - \log_b n$	$\log_b m^n = n \log_b m$

14. $2 \log x + \log 4 = 3$

$\log x^2 + \log 4 = 3$

$\log 4x^2 = 3$

$4x^2 = 10^3$

$x^2 = 250$

$x \approx$

15. $\log y - \log 4 = 2$

$\log \frac{y}{4} = 2$

16. $\log 10 + \log 2x = 3$

17. Error Analysis Your friend used the following steps to solve the equation $\log x + \log 6 = 4$. What error did he make? What is the correct answer?

$\log x + \log 6 = 4$

$\log \frac{x}{6} = 4$

$\frac{x}{6} = 10^4$

$x = 6000$

Name _____ Class _____ Date _____

3-4 Practice

Form K

Natural Logarithms

Write each expression as a single logarithm. The first expression is simplified for you.

1. $\ln 3 + \ln 4$

$\ln (3 \cdot 4)$

2. $3 \ln x - \ln 5$

$\ln x^3 - \ln 5$

3. $(\ln 3x + \ln 4) - \ln 8$

Solve each equation. Round your answers to the nearest tenth. The first equation is solved for you.

4. $\ln (3x + 1) = 4$

$3x + 1 = e^4$

$3x = e^4 - 1$

$3x \approx 53.6$

$x =$

5. $\ln (y - 2) = 3$

$y - 2 = e^3$

6. $3 \ln 2x = 3$

Use the following formula to complete Exercises 7 and 8.

Maximum Velocity of a Rocket

$$v = -0.0098t + c \ln R$$

- v = maximum velocity
- t = rocket's f ring time
- c = velocity of exhaust
- R = mass ratio of the rocket

7. A rocket has a mass ratio of 24. The rocket's exhaust has a velocity of 2.4 km/s. The rocket's firing time is 32 seconds. Approximately what is the rocket's maximum velocity? Round to the nearest tenth.

8. The rocket in Exercise 7 was changed to prepare it for a new mission. The new mass ratio is 26, and the new exhaust velocity is 2.3 km/s. Will these changes increase or decrease the rocket's maximum velocity? What is the difference between the maximum velocities?

Name _____ Class _____ Date _____

3-5 Practice (continued) Form K

Natural Logarithms

Solve each equation. Round your answers to the nearest thousandth.

9. $2e^{4x} - 4 = 10$

$2e^{4x} = 14$

$e^{4x} = 7$

$4x = \ln 7$

$x = 0.25 \ln 7$

$x \approx$

10. $e^{\frac{x}{2}} + 6 = 12$

$e^{\frac{x}{2}} = 6$

$\frac{x}{2} = \ln 6$

11. $e^{x-2} = 28$

12. $e^{\frac{x}{4}} - 3 = 21$

13. $e^{x+2} + 4 = 17$

14. $3e^{\frac{x}{2}} - 5 = 19$

15. Writing Explain the steps you would follow to solve the equation $4e^{3x} + 6 = 30$. What is the answer?

Use the following formula to complete Exercise 16.

Bacteria Culture Decline

$$H = \frac{1}{r}(\ln P - \ln A)$$

- H = number or hours
- r = rate of decline
- P = initial bacteria population
- A = reduced bacteria population

16. A scientist tests an antibiotic that causes a rate of decline of 0.18. About how long will it take this antibiotic to shrink a population of 4000 bacteria to 300? Round your answer to the nearest hundredth.