Key

**Unit 8 Review – Logarithmic and Exponential Functions**

## Converting Between Logarithmic and Exponential Forms

*Rewrite in logarithmic form.*

1. $6^3 = 216$ $\log_6 216 = 3$
2. $7^2 = 49$ $\log_7 49 = 2$

*Rewrite in exponential form.*

3. $\log_3 9 = 2$ $3^2 = 9$
4. $\ln 7 = 1.94$ $e^{1.94} = 7$

## Applying Properties of Logarithms

*Expand each logarithm.*

5. $\log\left(\frac{u^3}{v}\right)^2$ $6\log u - 2\log v$
6. $\log\sqrt[3]{\frac{x}{y^6 z^9}}$ $\frac{1}{3}\log x - 2\log y - 3\log z$

*Condense each logarithm.*

7. $\log 812 + \log 25$ $\log 20300$
8. $3\ln x + 2\ln y - \ln(x-1) - 2\ln z$ $\ln \frac{xy}{z^2(x-1)}$

## Evaluating Logarithms

9. $\log_2 8$ 3
10. $\log 56$ 1.748
11. $\log_4 0.25$ $-1$
12. $\ln 12$ 2.485

## Solving Logarithmic Equations

13. $\log_9 x = 2$ 81
14. $\log_3(2x+7) = 4$ 37
15. $\log_3(x-5) + \log_3(x+3) = 2$ 6
16. $\log_8(6x-4) = \log_8(2x+12)$ 4
17. $\ln(x+1) = 9$ $e^9 - 1$
18. $\ln(2x-8) = 3$ $\frac{e^3+8}{2}$
19. $\log_4 3x^2 + \log_4 2x = 4$ $\sqrt{\frac{128}{3}}$
20. $\log x^2 - \log 3x = 2$ 300

## Solving Exponential Equations

21. $5^x = 22$ $\frac{\ln 22}{\ln 5}$
22. $3^{2x} - 6 = 17$ $\frac{\log_3 23}{2}$
23. $2 \cdot 9^x = 100$ $\frac{\ln 50}{\ln 9}$
24. $e^{3x} = 11$ $\frac{\ln 11}{3}$
25. $7^{x+3} = 40$ $\log_7 40 - 3$
26. $10^x = 4^{2x-3}$ $\frac{3\ln 4}{2\ln 4 - \ln 10}$

## Growth and Decay

27. The number of bacteria present in a colony is 180 at 11 a.m. and the number of bacteria doubles every hour. How many will be present at 8 p.m.? 92,160 bacteria

28. If a gallon of milk costs \$3 now and the price is increasing by 10% each year, how long before milk costs \$10 per gallon? 12.63 yr.

29. Dinner at your grandfather's favorite restaurant now costs \$25.25 and has been increasing steadily at 4% per year. How much did it cost 50 years ago when he was dating your grandmother? \$3.55

30. A population of 10 zombies triples every week. How many zombies are there after 8 weeks? 65,610

31. The value of an iPod purchased for \$300 decreases by 6% each year. How long until the iPod is worth \$90? 19.46 yr.

## Compound Interest

32. How much money will be available in 7 years if \$400 is invested at 3% interest compounded continuously? \$493.47

33. How long will it take for \$600 to double if it is invested at 4% interest compounded monthly? 17.358 yr.

34. How much money must be invested at 6.5% interest compounded quarterly for \$50,000 to be available in 7 years? \$31,838.63

35. How long will it take to have \$1400 if \$900 is invested at 7% interest compounded continuously? 6.31 yr.

## Graphing Exponential and Logarithmic Functions

Graph each function as a transformation of its parent function. Fill in each blank.

36. $y = 3^x - 1$
Asymptote: $y = -1$
Domain: $(-\infty, \infty)$
Range: $(-1, \infty)$
Transformation(s): down 1

37. $y = (2)^{x-2} + 2$
Asymptote: $y = 2$
Domain: $(-\infty, \infty)$
Range: $(2, \infty)$
Transformation(s): up 2, right 2

38. $y = \log_4(x+1)$
Asymptote: $x = -1$
Domain: $(-1, \infty)$
Range: $(-\infty, \infty)$
Transformation(s): left 1