Name _____ Date _____ Class _____

LESSON 7-5

Practice B

Exponential and Logarithmic Equations and Inequalities

Solve and check.

1. $5^{2x} = 20$

2. $12^{2x-8} = 15$

3. $2^{x+6} = 4$

4. $16^{5x} = 64^{x+7}$

5. $243^{0.2x} = 81^{x+5}$

6. $25^{x} = 125^{x-2}$

7. $\left(\frac{1}{2}\right)^{x} = 16^{2}$

8. $\left(\frac{1}{32}\right)^{2x} = 64$

9. $\left(\frac{1}{27}\right)^{x-6} = 27$

Solve.

10. $\log_4 x^5 = 20$

11. $\log_3 x^6 = 12$

12. $\log_4 (x-6)^3 = 6$

13. $\log x - \log 10 = 14$

14. $\log x + \log 5 = 2$

15. $\log (x+9) = \log (2x-7)$

16. $\log (x+4) - \log 6 = 1$

17. $\log x^2 + \log 25 = 2$

18. $\log (x-1)^2 = \log (-5x-1)$

Use a table and graph to solve.

19. $2^{x-5} < 64$

20. $\log x^3 = 12$

21. $2^x 3^x = 1296$

Solve.

22. The population of a small farming community is declining at a rate of 7% per year. The decline can be expressed by the exponential equation $P = C(1-0.07)^t$, where P is the population after t years and C is the current population. If the population was 8,500 in 2004, when will the population be less than 6,000?

LESSON 7-5

Practice A

Exponential and Logarithmic Equations and Inequalities

Solve and check.

1. $4^{2x} = 6$

$\log 4^{2x} = \log 6$

$2x \log 4 = \log 6$

$2x = \dfrac{\log 6}{\log 4} \approx$ 1.29

$x \approx 0.645$

2. $8^{2x-5} = 48$

$\log 8^{2x-5} = \log 48$

$(2x - 5) \log 8 = \log 48$

$x \approx 3.43$

3. $4^{x+2} = 20$

$\log 4^{x+2} = \log 20$

$x \approx 0.161$

4. $3^{5x} = 27^{2x+1}$

$x = -3$

5. $36^{x+2} = 6^{4x}$

$x = 2$

6. $5^{5x-6} = 50$

$x \approx 1.686$

7. $16^{3x} = 64^{x+9}$

$x = 9$

8. $81^{x} = 243^{x+2}$

$x = -10$

9. $\left(\frac{1}{2}\right)^{3x} = 8^{2}$

$x = -2$

Solve.

10. $\log_2 x^7 = 21$

$7\log_2 x = 21$

$\log_2 x = 3$

$x = 8$

11. $\log_5 x^3 = 15$

$x = 3125$

12. $\log_6 (x - 4)^2 = 2$

$x = 10$ (or $x = -2$)

13. $\log x - \log 9 = 3$

$x = 9000$

14. $\log x + \log 4 = 1$

$x = 2.5$

15. $\log (x + 6) = \log(5x - 2)$

$x = 2$

Solve.

16. Halle deposited $4000 into an account that earns 5% interest each year. The growth of her investment can be expressed by the exponential equation $A = 4000(1 + 0.05)^t$, where A is the amount in the account after t years. In how many years will her account exceed $10,000?

19 years

LESSON 7-5

Practice B

Exponential and Logarithmic Equations and Inequalities

Solve and check.

1. $5^{2x} = 20$

$x \approx 0.9307$

2. $12^{2x-8} = 15$

$x \approx 4.5449$

3. $2^{x+6} = 4$

$x = -4$

4. $16^{5x} = 64^{x+7}$

$x = 3$

5. $243^{0.2x} = 81^{x+5}$

$x \approx -6.67$

6. $25^{x} = 125^{x-2}$

$x = 6$

7. $\left(\frac{1}{2}\right)^{x} = 16^{2}$

$x = -8$

8. $\left(\frac{1}{32}\right)^{2x} = 64$

$x = -0.6$

9. $\left(\frac{1}{27}\right)^{x-6} = 27$

$x = 5$

Solve.

10. $\log_4 x^5 = 20$

$x = 256$

11. $\log_3 x^6 = 12$

$x = 9$

12. $\log_4 (x - 6)^3 = 6$

$x = 22$

13. $\log x - \log 10 = 14$

$x = 10^{15}$

14. $\log x + \log 5 = 2$

$x = 20$

15. $\log (x+9) = \log (2x-7)$

$x = 16$

16. $\log (x + 4) - \log 6 = 1$

$x = 56$

17. $\log x^2 + \log 25 = 2$

$x = \pm 2$

18. $\log (x-1)^2 = \log (-5x-1)$

$x = -1, -2$

Use a table and graph to solve.

19. $2^{x-5} < 64$

$x < 11$

20. $\log x^3 = 12$

$x = 10{,}000$

21. $2^x 3^x = 1296$

$x = 4$

Solve.

22. The population of a small farming community is declining at a rate of 7% per year. The decline can be expressed by the exponential equation $P = C(1 - 0.07)^t$, where P is the population after t years and C is the current population. If the population was 8,500 in 2004, when will the population be less than 6,000?

2009

LESSON 7-5

Practice C

Exponential and Logarithmic Equations and Inequalities

Solve.

1. $16^{3x} = 8^{x+6}$

$x = 2$

2. $\log_2 x^6 = 3$

$x \approx 1.414$

3. $12^{x-1} = 20^{2}$

$x \approx 3.4$

4. $9^{2x} = 27^{x+4}$

$x = 12$

5. $256^{0.5x} = 64^{2x+5}$

$x = -3.75$

6. $216^{\frac{x}{3}} = 36^{2x+3}$

$x = -2$

7. $\left(\frac{1}{9}\right)^{3x} = 27$

$x = -0.5$

8. $\left(\frac{1}{16}\right)^{x+5} = 8^{2}$

$x = -6.5$

9. $\left(\frac{2}{5}\right)^{8x} = \left(\frac{25}{4}\right)^{2}$

$x = -0.5$

10. $\log_5 (4x - 5)^2 = 6$

$x = 32.5$

11. $\log_4 (3x + 4)^5 = 15$

$x = 20$

12. $\log_3 (10x - 1)^5 = 10$

$x = 1$

13. $\log x - \log 8 = 3$

$x = 8000$

14. $\log 5x + \log 2 = 10$

$x = 10^9$

15. $\log (x^2 - 9) = \log (5x+5)$

$x = 7$ or $x = -2$

16. $\log (x^2 - 1) - \log 12 = 1$

$x = \pm 11$

17. $\log x^3 + \log 8 = 3$

$x = 5$

18. $\log (9x+1) - \log x^2 = 1$

$x = -0.1, 1$

Use a table and graph to solve.

19. $\log x^2 - \log 200 = \log 2$

$x = \pm 20$

20. $4^{x^2} \cdot 2^{5x} = 8$

$x = -3$, or $x = \frac{1}{2}$

21. $3^{x^2 - 4x} \geq \frac{1}{27}$

$x \leq 1$ or $x \geq 3$

Solve.

22. Lorena deposited $9000 into an account that earns 4.25% interest each year.

a. Write an equation for the amount, A, in the account after t years.

$A = 9000(1.0425)^t$

b. In how many years will her account exceed $20,000?

20 years

c. If she waits for 50 years how much will be in her account?

$72,118.34

LESSON 7-5

Review for Mastery

Exponential and Logarithmic Equations and Inequalities

An **exponential equation** contains an expression that has a variable as an exponent.

$5^x = 25$ is an exponential equation.

$x = 2$, since $5(2) = 25$.

Remember: You can take the logarithm of both sides of an exponential equation. Then use other properties of logarithms to solve.

If $x = y$, then $\log x = \log y$ $(x > 0$ and $y > 0)$.

Solve $6^{x+2} = 500$.

Step 1 Since the variable is in the exponent, take the log of both sides.

$6^{x+2} = 500$

$\log 6^{x+2} = \log 500$

Step 2 Use the Power Property of Logarithms: $\log a^p = p \log a$.

$\log 6^{x+2} = \log 500$

$(x + 2) \log 6 = \log 500$

"Bring down" the exponent to multiply.

Step 3 Isolate the variable. Divide both sides by log 6.

$(x + 2) \log 6 = \log 500$

$x + 2 = \dfrac{\log 500}{\log 6}$

Step 4 Solve for x. Subtract 2 from both sides.

$x = \dfrac{\log 500}{\log 6} - 2$

Step 5 Use a calculator to approximate x.

$x \approx 1.468$

Step 6 Use a calculator to check.

$6^{1.468+2} \approx 499.607$

Solve and check.

1. $4^{-x} = 32$

$\log 4^{-x} = \log 32$

$-x \log 4 = \log 32$

$x = -2.5$

$4^{-(-2.5)} = 32$

2. $3^{4x} = 90$

$\log 3^{4x} = \log 90$

$4x \log 3 = \log 90$

$x \approx 1.024$

$3^{4(1.024)} \approx 90.01$

3. $5^{x-3} = 600$

$\log 5^{x-3} = \log 600$

$(x - 3) \log 5 = \log 600$

$x \approx 6.975$

$5^{6.975-3} \approx 600.352$