11-4 **Practice**

Logarithmic Functions

Write each equation in exponential form.

1. $\log_3 81 = 4$

$$3^4 = 81$$

2. $\log_8 2 = \frac{1}{3}$

$$8^{1/3} = 2$$

3. $\log_{10} \frac{1}{100} = -2$

$$10^{-2} = \frac{1}{100}$$

Write each equation in logarithmic form.

4. $3^3 = 27$

$$\log_3 27 = 3$$

5. $5^{-3} = \frac{1}{125}$

$$\log_5 \frac{1}{125} = -3$$

6. $\left(\frac{1}{4}\right)^{-4} = 256$

$$\log_{\frac{1}{4}} 256 = -4$$

Evaluate each expression.

7. $\log_7 7^3 = X$

$$7^x = 7^3$$

$$\boxed{X = 3}$$

8. $\log_{10} 0.001 = X$

$$10^x = \frac{1}{1000}$$

$$10^x = (1000)^{-1}$$

$$10^x = (10^3)^{-1}$$

$$10^x = 10^{-3}$$

$$\boxed{X = -3}$$

9. $\log_8 4096 = x$

$$8^x = 4096$$

$$8^x = 8^4$$

$$\boxed{X = 4}$$

10. $\log_4 32 = x$

$$4^x = 32$$

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

$$2x = 5 \quad \boxed{x = \frac{5}{2}}$$

11. $\log_3 1$

12. $\log_6 \frac{1}{216} = x$

$$6^x = 216^{-1}$$

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

$$\boxed{X = -3}$$

Solve each equation.

13. $\log_x 64 = 3$

$$x^3 = 64 \quad \boxed{X = 4}$$

$$x = 64^{1/3}$$

14. $\log_4 0.25 = x$

$$4^x = \frac{25}{100}$$

$$4^x = \frac{1}{4}$$

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

$$\boxed{X = -1}$$

15. $\log_4 (2x - 1) = \log_4 16$

$$2x - 1 = 16 \quad \boxed{X = \frac{17}{2}}$$

$$2x = 17$$

16. $\log_{10} \sqrt{10} = x$

$$10^x = 10^{1/2}$$

$$\boxed{X = \frac{1}{2}}$$

17. $\log_7 56 - \log_7 x = \log_7 4$

$$\log_7 \frac{56}{x} = \log_7 4$$

$$\frac{56}{x} = 4 \quad x = \frac{56}{4} = \boxed{14}$$

18. $\log_5 (x + 4) + \log_5 x = \log_5 12$

$$\log_5 (x+4)x = \log_5 12$$

$$x^2 + 4x = 12$$

$$x^2 + 4x - 12 = 0$$

$$(x+6)(x-2) = 0$$

$$\cancel{X = -6} \quad \text{extraneous}$$

$$\boxed{X = 2}$$

19. **Chemistry** How long would it take 100,000 grams of radioactive iodine, which has a half-life of 60 days, to decay to 25,000 grams? Use the formula $N = N_0\left(\frac{1}{2}\right)^t$, where N is the final amount of the substance, N_0 is the initial amount, and t represents the number of half-lives.

$$25000 = 100\,000 \left(\frac{1}{2}\right)^t$$

$$\frac{25000}{100000} = \frac{1}{2}^t$$

$$\log .25 = t \log \frac{1}{2} \quad t = 2 \quad 60(2) = \boxed{120 \text{ days}}$$

$$t = \frac{\log .25}{\log .5}$$