SOLVING EXPONENTIAL EQUATIONS Solve the equation.

12. $8^x = 20$ **13.** $e^{-x} = 5$ **14.** $7^{3x} = 18$

15. $11^{5x} = 33$ **16.** $7^{6x} = 12$ **17.** $4e^{-2x} = 17$

18. $10^{3x} + 4 = 9$ **19.** $-3e^{2x} + 16 = 5$ **20.** $0.5^x - 0.25 = 4$

21. $\frac{1}{3}(6)^{-4x} + 1 = 6$ **22.** $2^{0.1x} - 5 = 7$ **23.** $\frac{3}{4}e^{2x} + \frac{7}{2} = 4$

SOLVING LOGARITHMIC EQUATIONS Solve the equation. Check for extraneous solutions.

24. $\log_5 (5x + 9) = \log_5 6x$ **25.** $\ln (4x - 7) = \ln (x + 11)$

26. $\ln (x + 19) = \ln (7x - 8)$ **27.** $\log_5 (2x - 7) = \log_5 (3x - 9)$

28. $\log (12x - 11) = \log (3x + 13)$ **29.** $\log_3 (18x + 7) = \log_3 (3x + 38)$

30. $\log_6 (3x - 10) = \log_6 (14 - 5x)$ **31.** $\log_8 (5 - 12x) = \log_8 (6x - 1)$

EXPONENTIATING TO SOLVE EQUATIONS Solve the equation. Check for extraneous solutions.

32. $\log_4 x = -1$ **33.** $5 \ln x = 35$

34. $\frac{1}{3} \log_5 12x = 2$ **35.** $5.2 \log_4 2x = 16$

36. $\log_2 (x - 4) = 6$ **37.** $\log_2 x + \log_2 (x - 2) = 3$

38. $\log_4 (-x) + \log_4 (x + 10) = 2$ **39.** $\ln (x + 3) + \ln x = 1$

40. $4 \ln (-x) + 3 = 21$ **41.** $\log_5 (x + 4) + \log_5 (x + 1) = 2$

42. $\log_6 3x + \log_6 (x - 1) = 3$ **43.** $\log_3 (x - 9) + \log_3 (x - 3) = 2$

44. ★ **MULTIPLE CHOICE** What is the solution of $3 \log_8 (2x + 7) + 8 = 10$?

     A -1.5 **B** -1.179 **C** 4 **D** 4.642

ERROR ANALYSIS *Describe* and correct the error in solving the equation.

45.

$$3^{x+1} = 6^x$$
$$\log_3 3^{x+1} = \log_3 6^x$$
$$x + 1 = x \log_3 6$$
$$x + 1 = 2x$$
$$1 = x$$

46.

$$\log_3 10x = 5$$
$$e^{\log_3 10x} = e^5$$
$$10x = e^5$$
$$x = \frac{e^5}{10}$$

47. ★ **OPEN-ENDED MATH** Give an example of an exponential equation whose only solution is 4 and an example of a logarithmic equation whose only solution is -3.

CHALLENGE Solve the equation.

48. $3^{x+4} = 6^{2x-5}$ **49.** $10^{3x-8} = 2^{5-x}$

50. $\log_2 (x + 1) = \log_8 3x$ **51.** $\log_3 x = \log_9 6x$

52. $2^{2x} - 12 \cdot 2^x + 32 = 0$ **53.** $5^{2x} + 20 \cdot 5^x - 125 = 0$

○ = **WORKED-OUT SOLUTIONS**   ◆ = **TAKS PRACTICE AND REASONING**   ◆ = **MULTIPLE REPRESENTATIONS**