

## SECTION 3.5 EXERCISES

In Exercises 1–10, find the exact solution algebraically, and check it by substituting into the original equation.

1.  $36\left(\frac{1}{3}\right)^{x/5} = 4$

2.  $32\left(\frac{1}{4}\right)^{x/3} = 2$

3.  $2 \cdot 5^{x/4} = 250$

4.  $3 \cdot 4^{x/2} = 96$

5.  $2(10^{-x/3}) = 20$

6.  $3(5^{-x/4}) = 15$

7.  $\log x = 4$

8.  $\log_2 x = 5$

9.  $\log_4(x - 5) = -1$

10.  $\log_4(1 - x) = 1$

In Exercises 11–18, solve each equation algebraically. Obtain a numerical approximation for your solution and check it by substituting into the original equation.

11.  $1.06^x = 4.1$

12.  $0.98^x = 1.6$

13.  $50e^{0.035x} = 200$

14.  $80e^{0.045x} = 240$

15.  $3 + 2e^{-x} = 6$

16.  $7 - 3e^{-x} = 2$

17.  $3 \ln(x - 3) + 4 = 5$

18.  $3 - \log(x + 2) = 5$

In Exercises 19–24, state the domain of each function. Then match the function with its graph. (Each graph shown has a window of  $[-4.7, 4.7]$  by  $[-3.1, 3.1]$ .)

19.  $f(x) = \log[x(x + 1)]$

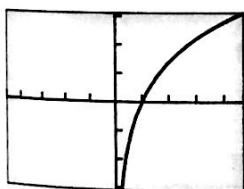
20.  $g(x) = \log x + \log(x + 1)$

21.  $f(x) = \ln \frac{x}{x + 1}$

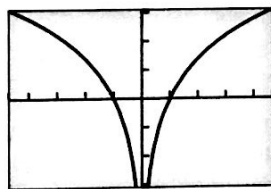
22.  $g(x) = \ln x - \ln(x + 1)$

23.  $f(x) = 2 \ln x$

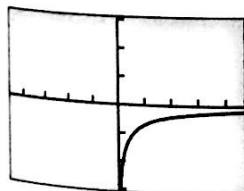
24.  $g(x) = \ln x^2$



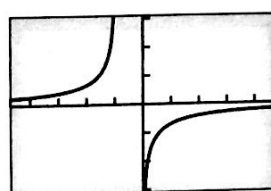
(a)



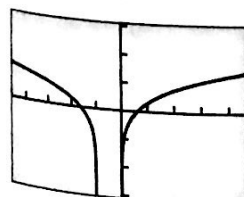
(b)



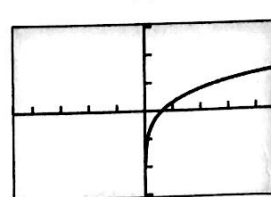
(c)



(d)



(e)



(f)

In Exercises 25–38, solve each equation by the method of your choice. Support your solution by a second method.

25.  $\log x^2 = 6$

26.  $\ln x^2 = 4$

27.  $\log x^4 = 2$

28.  $\ln x^6 = 12$

29.  $\frac{2^x - 2^{-x}}{3} = 4$

30.  $\frac{2^x + 2^{-x}}{2} = 3$

31.  $\frac{e^x + e^{-x}}{2} = 4$

32.  $2e^{2x} + 5e^x - 3 = 0$

33.  $\frac{500}{1 + 25e^{0.3x}} = 200$

34.  $\frac{400}{1 + 95e^{-0.6x}} = 150$

35.  $\frac{1}{2} \ln(x + 3) - \ln x = 0$

36.  $\log x - \frac{1}{2} \log(x + 4) = 1$

37.  $\ln(x - 3) + \ln(x + 4) = 3 \ln 2$

38.  $\log(x - 2) + \log(x + 5) = 2 \log 3$

In Exercises 39–44, determine how many orders of magnitude the quantities differ.

39. A \$100 bill and a dime

40. A canary weighing 20 g and a hen weighing 2 kg

41. An earthquake rated 7 on the Richter scale and one rated 5.5.

42. Lemon juice with pH = 2.3 and beer with pH = 4.1

43. The sound intensities of a riveter at 95 dB and ordinary conversation at 65 dB

44. The sound intensities of city traffic at 70 dB and rustling leaves at 10 dB

45. **Comparing Earthquakes** How many times more severe was the 1978 Mexico City earthquake ( $R = 7.9$ ) than the 1994 Los Angeles earthquake ( $R = 6.6$ )?46. **Comparing Earthquakes** How many times more severe was the 1995 Kobe, Japan, earthquake ( $R = 7.2$ ) than the 1994 Los Angeles earthquake ( $R = 6.6$ )?47. **Chemical Acidity** The pH of carbonated water is 3.9 and the pH of household ammonia is 11.9.

(a) What are their hydrogen-ion concentrations?

(b) How many times greater is the hydrogen-ion concentration of the carbonated water than that of the ammonia?

(c) By how many orders of magnitude do the concentrations differ?

48. **Chemical Acidity** Stomach acid has a pH of about 2.0, and blood has a pH of 7.4.

(a) What are their hydrogen-ion concentrations?