SECTION 3.5 EXERCISES

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

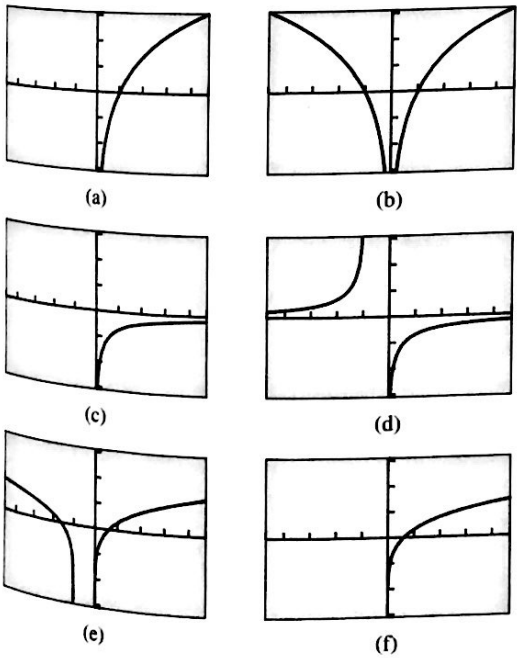
1. $36\left(\frac{1}{3}\right)^{x/5} = 4$
2. $32\left(\frac{1}{4}\right)^{x/3} = 2$
3. $2 \cdot 5^{x/4} = 250$
4. $3 \cdot 4^{x/2} = 96$
5. $2(10^{-x/3}) = 20$
6. $3(5^{-x/4}) = 15$
7. $\log x = 4$
8. $\log_2 x = 5$
9. $\log_4 (x - 5) = -1$
10. $\log_4 (1 - x) = 1$

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



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?