CVIČENÍ V: EXPONENCIÁLNÍ A LOGARITMICKÉ ROVNICE

1. Exponenciální rovnice

Řešte následující rovnice v R:

1. $2^{2x-1} = 8$

2. $\sqrt{3^x} = \sqrt[3]{9}$

3. $2^{x-4} = \left(\sqrt{2}\right)^{2-3x}$

4. $3^{5m-8} = 9^{m-3}$

5. $9^{|3x-1|} = 3^{8x-2}$

6. $2^{6x} \cdot 2^{-(9+x)} = 2^{3x-5}$

7. $2^{x^2-6x-\frac{5}{2}} = 16\sqrt{2}$

8. $4 \cdot 2^{x^2} = 2^{3x}$

9. $9^{0,25x^2-2x-8} = \sqrt{3}$

10. $3^3 \cdot 27^{2x-3} = 81^{3x-5}$

11. $\sqrt{2^x} \cdot \sqrt{3^x} = 36$

12. $2^x \cdot 5^x = 0,1 \cdot \left(10^{x-1}\right)^5$

13. $32^{\frac{x+5}{x-7}} = 0,25 \cdot 128^{\frac{x+17}{x-3}}$

14. $16^{\frac{x}{x+3}} = 4 \cdot \left(\frac{2^x}{8}\right)^{\frac{1}{2x+5}}$

15. $256^{\frac{1}{x^2-4}} \cdot \left(\frac{4}{2^x}\right)^{\frac{1}{x+2}} = 4^{\frac{1}{x-2}}$

16. $\left(\frac{4}{9}\right)^x = \left(\frac{3}{2}\right)^3$

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

18. $\left(\frac{3}{7}\right)^{3x+7} = \left(\frac{7}{3}\right)^{7x-2}$

19. $\left(\frac{2}{3}\right)^{3x-7} = \left(\frac{3}{2}\right)^{7x-2}$

20. $\left(\frac{5}{8}\right)^{\frac{2x+1}{x-1}} = \left(\frac{512}{125}\right)^{3-x}$

21. $\left(1-\frac{5}{9}\right)^{\frac{2}{3-2x}} = \left(\frac{9}{4}\right)^{\frac{3}{x-5}}$

22. $\left(\frac{2}{3}\right)^x \cdot \left(\frac{9}{8}\right)^x = \frac{27}{64}$

23. $\left(\frac{4}{9}\right)^x \cdot \left(\frac{27}{8}\right)^{x-1} = \frac{2}{3}$

24. $\left(\frac{3}{4}\right)^{x-1} \cdot \left(\frac{4}{3}\right)^{\frac{1}{x}} = \frac{9}{16}$

25. $3^x + 2^x = \frac{13}{4} \cdot 2^x$

26. $3^x + 3^{x+1} = 108$

27. $2^{x+2} - 2^x = 96$

28. $3^{x+2} + 3^{x-1} = 28$

29. $5^{x+1} - 5^{x-1} = 24$

30. $7^{x+2} + 2 \cdot 7^{x-1} = 345$

31. $3 \cdot 2^x - 20 = 2^{x-1}$

32. $3^x + 3^{x+2} = \frac{10}{3}$

33. $5^x + 3 \cdot 5^{x-2} = 140$

34. $3^{x+2} - 3^x - 24 = 0$

35. $\frac{2^x \cdot 3^{x+2}}{6^{7-x} \cdot 8^{x-4}} = \frac{1}{3} \cdot 9^{x-2}$

36. $3^{2x-1} + 3^{2x-2} - 3^{2x-4} = 315$

37. $2^{x-1} + 2^{x-2} + 2^{x-3} = 448$

38. $2^{x+1} + 3 \cdot 2^{x-1} - 5 \cdot 2^x + 6 = 0$

39. $10 \cdot 2^{2x-1} - 7 \cdot 0,5^{-2x} = -2^{2x+2} + 16$

40. $4,5 \cdot 3^{5x-1} + 3^{5x+2} - \frac{5}{2} = 3^{5x+1}$

41. $1,5 \cdot 0,2^{x+1} + 0,8 \cdot 0,2^{x-1} = 0,172$

42. $4^x - 9 \cdot 2^x + 8 = 0$

43. $6^{x+1} + 6^{1-x} = 37$

44. $4^{2x+1} = 65 \cdot 4^{x-1} - 1$

45. $3^{2x-1} + 3 \cdot 3^x - 12 = 0$

46. $3^{2x} - 3^x = 702$

47. $\frac{8}{3} \cdot 3^{x-1} + 1 = 9^{x-1}$

48. $3^{x+1} + 9^x = 108$

49. $\frac{1}{2} \cdot 2^{x-1} = 4^{x-1}$

50. $7^{2x} + 7^x - 686 = 36 \cdot 7^x$

51. $3^{x+2} + 9^{x+1} - 810 = 0$

52. $2^{x^2} + 2^{13-x^2} = 528$

53. $3^{x^2+2x} - 3^{(x+3)(x-1)} = 26$

54. $7 \cdot 3^{x+1} - 5^{x+2} = 3^{x+4} - 5^{x+3}$

55. $4^x - 3^{x-\frac{1}{2}} = 3^{x+\frac{1}{2}} - 2^{2x-1}$

56. $2^{3x} \cdot 7^{x-2} = 4^{x+1}$

57. $3 \cdot 4^x + \frac{9^{x+2}}{3} = 6 \cdot 4^{x+1} - \frac{9^{x+1}}{2}$

Řešte následující rovnice v Z:

58. $4^{\sqrt{x+1}} = 64 \cdot 2^{\sqrt{x+1}}$

59. $\left[2 \left(2^{\sqrt{x}+3}\right)^{\frac{1}{2\sqrt{x}}} \right]^{\frac{2}{\sqrt{x}-1}} = 4$

60. $16\sqrt{(0,25)^{5-\frac{1}{4}x}} = 2^{\sqrt{x+1}}$

61. $2^{2x+2} = \sqrt[x]{4\,096}$

62. $5 \cdot \sqrt[x]{64} - 6 \cdot \sqrt[2x]{64} = 8$

63. $\sqrt[x]{64} - \sqrt[x]{2^{3x+3}} + 12 = 0$

64. $\sqrt[x+2]{27} = \sqrt[x+1]{9}$

Řešte následující rovnice v R:

65. $2^{3x-1} = 3^{2x-1}$ **66.** $\left(\frac{1}{2}\right)^{2-3x} = 3^x$ **67.** $2^x \cdot 3^{3x} = 4^{4x-1}$

68. $3^x + 2 = 3^{x+2}$ **69.** $3^x + 3^{x+1} + 3^{x+2} = 5^x + 5^{x+1} + 5^{x+2}$

70. $3^x \cdot (19 - 3^x) = 90$

71. $5 \cdot 5^{2x^2+10x+11} - \frac{26}{5} \cdot 5^{x^2+5x+7} + 25 = 0$ **72.** $2^{3x} - 3 \cdot 2^{2x} - 6 \cdot 2^x + 8 = 0$

73*. $x^{x^2+x-6} = 1$ **74*.** $x^{2x-4} = x^{x^2-3x+2}$

75*. $\left(3 + \sqrt{8}\right)^x + \left(3 - \sqrt{8}\right)^x = 34$ **76*.** $\left(\sqrt{4+\sqrt{15}}\right)^x + \left(\sqrt{4-\sqrt{15}}\right)^x = 8$

Řešte v R² soustavy rovnic:

77*. $4^{x+y} = 128$ **78*.** $2^{2x} + 3^y = 13$ **79*.** $8^{2x+1} = 32 \cdot 2^{4y-1}$
      $5^{3x-2y-3} = 1$ $2 \cdot 4^x - 3^y = -1$ $5 \cdot 5^{x-y} = \sqrt{25^{2y+1}}$

80*. $3^y \cdot 64^{\frac{1}{x}} = 36$ **81*.** $2^{\frac{x+y}{3}} + 2^{\frac{x+y}{6}} = 6$ **82*.** $x^{y^2-4y+4} = 1$
      $5^y \cdot 512^{\frac{1}{x}} = 200$ $x^2 + 5y^2 = 6xy$ $x + y = 6$

Výsledky (nezaručené !!!):
1. $x \in \{2\}$; **2.** $x \in \{\frac{4}{3}\}$; **3.** $x \in \{2\}$; **4.** $m \in \{\frac{2}{3}\}$; **5.** $x \in \{\frac{2}{7}\}$; **6.** $x \in \{2\}$; **7.** $x \in \{-1, 7\}$; **8.** $x \in \{1, 2\}$;
9. $x \in \{-3, 11\}$; **10.** $x \in \{\frac{7}{3}\}$; **11.** $x \in \{4\}$; **12.** $x \in \{1,5\}$; **13.** $x \in \{10\}$; **14.** $x \in \{-\frac{7}{3}, 3\}$; **15.** $x \in \{0\}$;
16. $x \in \{-\frac{3}{2}\}$; **17.** $x \in \{-5\}$; **18.** $x \in \{-\frac{1}{2}\}$; **19.** $x \in \{\frac{9}{10}\}$; **20.** $x \in \{\frac{2}{3}, 4\}$; **21.** $x \in \{-\frac{1}{4}\}$; **22.** $x \in \{3\}$;
23. $x \in \{2\}$; **24.** $x \in \{\frac{3-\sqrt{132}}{2}, \frac{3+\sqrt{13}}{2}\}$; **25.** $x \in \{2\}$; **26.** $x \in \{3\}$; **27.** $x \in \{5\}$; **28.** $x \in \{1\}$; **29.** $x \in \{1\}$;
30. $x \in \{1\}$; **31.** $x \in \{3\}$; **32.** $x \in \{-1\}$; **33.** $x \in \{3\}$; **34.** $x \in \{1\}$; **35.** $x \in \{5\}$; **36.** $x \in \{3\}$; **37.**
$x \in \{9\}$; **38.** $x \in \{2\}$; **39.** $x \in \{1,5\}$; **40.** $x \in \{-0,2\}$; **41.** $x \in \{2\}$; **42.** $x \in \{0, 3\}$; **43.** $x \in \{-1, 1\}$;
44. $x \in \{-2, 1\}$; **45.** $x \in \{1\}$; **46.** $x \in \{3\}$; **47.** $x \in \{2\}$; **48.** $x \in \{2\}$; **49.** $x \in \{0\}$; **50.** $x \in \{2\}$; **51.**
$x \in \{2\}$; **52.** $x \in \{-3, -2, 2, 3\}$; **53.** $x \in \{-3, 1\}$; **54.** $x \in \{-1\}$; **55.** $x \in \{\frac{3}{2}\}$; **56.** $x \in \{2\}$; **57.** $x \in \{-\frac{1}{2}\}$;
58. $x \in \{35\}$; **59.** $x \in \{9\}$; **60.** $x \in \{24\}$; **61.** $x \in \{2\}$; **62.** $x \in \{3\}$; **63.** $x \in \{3\}$; **64.** $x \in \{1\}$; **65.**
$x \in \{-15,213\}$; **66.** $x \in \{1,413\}$; **67.** $x \in \{-0,53\}$; **68.** $x \in \{-1,26\}$; **69.** $x \in \{-1,701\}$; **70.** $x \in \{2, 2,096\}$;
71. $x \in \{-1, -2, -3, -4\}$; **72.** $x \in \{0, 2\}$; **73.** $x \in \{-3, -1, 1, 2\}$; **74.** $x \in \{-1, 1, 2, 3\}$; **75.** $x \in \{-2, 2\}$;
76. $x \in \{-2, 2\}$; **77.** $[x, y] \in \{[2, 1,5]\}$; **78.** $[x, y] \in \{[1, 2]\}$; **79.** $[x, y] \in \{[\frac{3}{14}, \frac{1}{14}]\}$; **80.** $[x, y] \in \{[3, 2]\}$; **81.**
$[x, y] \in \{[3, 3], [5, 1]\}$; **82.** $[x, y] \in \{[1, 5], [4, 2]\}$;

2. Logaritmické rovnice

Řešte následující rovnice v R:

1. $\log(4,5 - x) = \log 4,5 - \log x$ **2.** $\log(0,5 + x) = \log 0,5 - \log x$

3. $\log(x + 2) - \log(x - 1) = 2 - \log 4$ **4.** $\log(x + 1) + \log(x - 1) - \log(x - 2) = \log 8$

5. $\log(x + 3) + \log(x - 3) = \log(x + 9)$ **6.** $\log(x - 3) - \log(2 - 3x) = 1$

7. $\log(x - 13) - \log(x - 3) = 1 - \log 2$ **8.** $\log(7x + 6) = 1 + \log(3x - 4)$

9. $\frac{\log(2x + 10)}{2} = \log(x + 1)$ **10.** $2\log(x - 2) = \log(14 - x)$

11. $\log(x - 2) - \log(4 - x) = 1 - \log(13 - x)$ **12.** $\log(54 - x^3) = 3\log x$

13. $\log x^2 + \log x^3 + \log x^4 + \log x^5 = 6$

14. $\log x^2 + \log \sqrt{x} - \log \dfrac{1}{x} = 10$

15. $10 \log x^2 + 4 \log x^5 + 3 \log x^3 + 2 \log \sqrt{x} = 98$

16. $5 \log \sqrt[3]{x} - 4 \log \sqrt[6]{x} + \dfrac{1}{2} \log x^8 = 9 - \log x^5$

17. $\log_2 x - \log_2 \sqrt{x} + \log_2 \dfrac{1}{x} = -1$

18. $\log 2x - \log \sqrt[3]{x} + \log x^2 = \log 2 - \log \dfrac{1}{x^3} + 1$

19. $\log(x - 9) + 2 \log \sqrt{2x - 1} = 2$

20. $\log \sqrt{x - 5} + \log \sqrt{2x - 3} + 1 = \log 30$

21. $\log \sqrt{3x - 5} + \log \sqrt{7x - 3} = 1 + \log \sqrt{0{,}11}$

22. $\log \sqrt{1 + x} + 3 \log \sqrt{1 - x} = \log \sqrt{1 - x^2} + 2$

23. $\dfrac{1}{2} \log(x - 9) + \log \sqrt{2x - 1} = 1$

24. $\log \sqrt{2x + 1} + \dfrac{1}{2} \log(x - 3) = 1 + \log 0{,}3$

25. $\dfrac{3 + \log x}{2 - \log x} = 4$

26. $\dfrac{\log(2x + 13)}{\log(x + 5)} = 2$

27. $\dfrac{\log \left(x^2 + 7 \right)}{\log(x + 7)} = 2$

28. $\dfrac{\log 7x}{\log(2x - 7)} = 2$

29. $\dfrac{\log(2x - 5)}{\log \left(x^2 - 8 \right)} = \dfrac{1}{2}$

30. $\dfrac{\log \left[(x + 1)^2 \cdot (x + 2) \right]}{\log(x + 3)} = 3$

31. $\log x + \dfrac{1}{\log x} = 2$

32. $1 + \log x^3 = \dfrac{10}{\log x}$

33. $\log \left(x^2 \right) \cdot \log \sqrt{x} - \log \dfrac{1}{x} = 2$

34. $\log x - \left(\log \sqrt[6]{x} \right)^{-1} = 1$

35. $\dfrac{1}{1 + \log x} + \dfrac{5}{3 - \log x} = 3$

36. $\log \left(\log x \right) + \log \left(\log x^2 - 1 \right) = 1$

37. $4 - \log x = 3 \sqrt{\log x}$

38. $\log \log \log x = 0$

39. $\log_3(x + 1) + \log_3(x + 3) = 1$

40. $\log_4(x + 3) - \log_4(x - 1) = 2 - \log_4 8$

41. $\log_5 \left(\dfrac{2 + x}{10} \right) = \log_5 \left(\dfrac{2}{x + 1} \right)$

42. $2 \log_3(x - 2) + \log_3(x - 4)^2 = 0$

43. $\log_5(2x + 9) + \log_5(4 - 3x) = 2 + \log_5(4 + x)$

44. $\log_{12}(2x + 4) - \log_{12}(x - 3) = \log_{12} 7$

45. $\log_{\frac{1}{3}}(x + 10) + \log_{\frac{1}{3}}(7 - 2x) = -4$

46. $2 \log_2 \dfrac{x - 7}{x - 1} + \log_2 = 1$

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

48. $\log_6 \sqrt{x - 2} + \dfrac{1}{2} \log_6(x - 11) = 1$

49. $\log_2 \left(2x^2 \right) \cdot \log_2(16x) = \dfrac{9}{2} \log_2^2 x$

50. $(\log_4 x - 2) \cdot \log_4 x = \dfrac{3}{2} (\log_4 x - 1)$

51. $\log_3 \left[2 + 2 \log_4(2x - 3) \right] = 1$

52. $\log_3(3^x - 8) = 2 - x$

53. $\log_3(4 \cdot 3^x - 1) = 2x + 1$

54. $\dfrac{\log_2(9 - 2^x)}{3 - x} = 1$

55. $\log_7(2^x - 1) + \log_7(2^x - 7) = 1$

56. $\log_2(4 \cdot 3^x - 6) - \log_2(9^x - 6) = 1$

57. $\log_2(2 \cdot 4^{x-2} - 1) + 4 = 2x$

58. $\log 2 + \log(4^{x-2} + 9) = 1 + \log(2^{x-2} + 1)$

59. $\log_3[1 + \log_3(2^x - 7)] = 1$

60. $\log_3 \left(3^{x^2 - 13x + 28} + \dfrac{2}{9} \right) = \log_5 0{,}2$

61. $\log 10 + \dfrac{1}{3} \log(3^{2\sqrt{x}} + 271) = 2$

62. $49^{\log x} = 2\,401$

63. $x^{\log x} = 10\,000$

64. $x^{\log x - 2} = 1\,000$

65. $\sqrt{x^{\log \sqrt{x}}} = 10$

66. $x^{2\log_x 10} = 10x$

67. $x^{\log x} = 1\,000x^2$

68. $x^{\log_2 x} = 4x$

69. $x^{1 - \frac{1}{4}\log x} = 10$

70. $x^{\frac{3}{8}\log^3 x - \frac{3}{4}\log x} = 1\,000$

71. $(\sqrt{x})^{\log^2 x - 1} = 1$

72. $x^{2\log^3 x - 1,5\log x} = \sqrt{10}$

73. $x^{3 + 2\log x} = 100x^{2 + \log x}$

74. $x^{\log x} + 10x^{-\log x} = 11$

75. $x^{3\log x - 5} = 38x^{4 - 7\log x}$

76. $x^{3\log x - \frac{1}{\log x}} = \sqrt[3]{10}$

77. $x^{\frac{1}{3}(\log x + 5)} = 10^{5 + \log x}$

78. $5^{\log x} - 3^{\log x - 1} = 3^{\log x + 1} - 5^{\log x - 1}$

79. $\log_2 x + \log_8 x = 8$

80. $2\log_2 x + \log_{\sqrt{2}} x + \log_{\frac{1}{2}} x = 9$

81. $\log_4 \log_3 \log_2 x = \frac{1}{2}$

82. $\log_{16} x + \log_4 x + \log_2 x = 7$

83. $\log_7 2 + \log_{49} x = \log_{\frac{1}{7}} \sqrt{3}$

84. $\log_5 x + \log_{25} x = \log_{\frac{1}{5}} \sqrt{3}$

85. $2\log_4(4 - x) = 4 - \log_2(-2 - x)$

86. $\log_3 x - 2\log_{\frac{1}{3}} x = 6$

87. $\frac{1}{6}\log_2(x - 2) - \frac{1}{3} = \log_{\frac{1}{8}} \sqrt{3x - 5}$

88. $\log_{\sqrt{2}}^2 x + 3\log_2 x + \log_{\frac{1}{2}} x = 2$

89. $\log_4(\log_2 x) + \log_2(\log_4 x) = 2$

90*. $\log_4\{2\log_3[1 + \log_2(1 + 3\log_2 x)]\} = \frac{1}{2}$

91. $\log_{x-1} 3 = 2$

92. $\log_{5-x}(x^2 - 2x + 65) = 2$

93. $\log_{x-2}(x^3 - 14) = 3$

94. $2(\log_x \sqrt{5})^2 - 3\log_x \sqrt{5} + 1 = 0$

95. $\log_x \sqrt{5} + \log_x(5x) - 2,25 = (\log_x \sqrt{5})^2$

96. $1 + 2\log_{x+2} 5 = \log_5(x + 2)$

97. $\log_x 2 - \log_4 x + \frac{7}{6} = 0$

98. $\log_5^2 x + \log_{5x} \frac{5}{x} = 1$

99. $\log_x(9x^2) \cdot \log_3^2 x = 4$

100. $\log_x 4 + \log_{x^2} 64 = 5$

101. $\log_x(125x) \cdot \log_{25}^2 x = 1$

102. $\log_x 3 + \log_3 x = \log_{\sqrt{x}} 3 + \log_3 \sqrt{x} + \frac{1}{2}$

103. $x^{\frac{\log x + 5}{3}} = 10^{5 + \log x}$

104. $3^{(\log_3 x)^2} + x^{\log_3 x} = 162$

Řešte následující soustavy v R²:

105. $\log x - \log y = 7$
$\log x + \log y = 5$

106. $3^x \cdot 2^y = 576$
$\log_{\sqrt{2}}(y - x) = 4$

107. $xy = 1\,000$
$x^{\log y} = 100$

108. $\log_3 x + \log_9 y = \frac{3}{2}$
$\log_x 3 + \log_y 9 = 3$

109. $\log_2 \log_3(x + y) = 1$
$\log x + \log y = 3\log 2$

110. $10^{y-x} = \frac{1}{1\,000}$
$2\log x - \log y = \log 12$

111. $\log x + \log y = -1$
$x + y = 10{,}01$

112. $2^x + 3^y = 11$
$4^x + 5 \cdot 9^y = 109$

113. $y^{x^2 + 7x + 12} = 1$
$x + y = 6$

114. $xy = 400$
$x^{\log y} = 16$

115. $(\log x)^2 + (\log y)^2 = \frac{5}{2}(\log 5)^2$
$xy = 5$

116. $3^{\log x} \cdot 2^{\log y} = \frac{9}{4}$
$\log x + \log y = 0$

117. Pro které hodnoty parametru m patří kořeny rovnice $x^2 - 2mx + m^2 - 4 = 0$ do intervalu $(p; q\rangle$, kde p je kořen rovnice

$$2^x + \left(\frac{1}{2}\right)^{x+2} = 1$$

a q kořen rovnice

$$\frac{\log x}{\log(2x - 4)} = 1 \ ?$$

Výsledky (nezaručené !!!):
1. $x \in \{3; 1{,}5\}$. **2.** $x \in \{\frac{1}{2}\}$. **3.** $x \in \{\frac{9}{8}\}$. **4.** $x \in \{3, 5\}$. **5.** $x \in \{\frac{1+\sqrt{73}}{2}\}$. **6.** $x \in \emptyset$. **7.** $x \in \emptyset$. **8.** $x \in \{2\}$.
9. $x \in \{3\}$. **10.** $x \in \{5\}$. **11.** $x \in \{3\}$. **12.** $x \in \{3\}$. **13.** $x \in \{2{,}6827\}$. **14.** $x \in \{719{,}68\}$. **15.** $x \in \{91{,}202\}$.
16. $x \in \{7{,}9433\}$. **17.** $x \in \{4\}$. **18.** $x \in \{0{,}001\}$. **19.** $x \in \{13\}$. **20.** $x \in \{6\}$. **21.** $x \in \{2\}$. **22.** $x \in \emptyset$.
23. $x \in \{13\}$. **24.** $x \in \{4\}$. **25.** $x \in \{10\}$. **26.** $x \in \{-2\}$. **27.** $x \in \{-3\}$. **28.** $x \in \{7\}$. **29.** $x \in \{3, \frac{11}{3}\}$.
30. $x \in \emptyset$. **31.** $x \in \{10\}$. **32.** $x \in \{\frac{1}{100}, \sqrt[3]{10^5}\}$. **33.** $x \in \{10, 0{,}01\}$. **34.** $x \in \{0{,}01, 1\,000\}$. **35.** $x \in \{10^{-\frac{1}{3}}, 10\}$.
36. $x \in \{10^{\frac{5}{2}}\}$. **37.** $x \in \{10\}$. **38.** $x \in \{10^{10}\}$. **39.** $x \in \{0\}$. **40.** $x \in \{5\}$. **41.** $x \in \{3\}$. **42.** $x \in \{3, 3 + \sqrt{2}\}$.
43. $x \in \{-2\}$. **44.** $x \in \{5\}$. **45.** $x \in \{-5{,}5, -1\}$. **46.** $x \in \{-17\}$. **47.** $x \in \{-1\}$. **48.** $x \in \{14\}$.
49. $x \in \{2^{-\frac{2}{5}}, 16\}$. **50.** $x \in \{2, 64\}$. **51.** $x \in \{2{,}5\}$. **52.** $x \in \{2\}$. **53.** $x \in \{-1, 0\}$. **54.** $x \in \{0\}$. **55.**
$x \in \{3\}$. **56.** $x \in \{1\}$. **57.** $x \in \{2\}$. **58.** $x \in \{2, 4\}$. **59.** $x \in \{4\}$. **60.** $x \in \{3, 10\}$. **61.** $x \in \{9\}$. **62.** $x \in \{100\}$.
63. $x \in \{100, 0{,}1\}$. **64.** $x \in \{\frac{1}{10}, 1\,000\}$. **65.** $x \in \{\frac{1}{100}, 100\}$. **66.** $x \in \{10\}$. **67.** $x \in \{1\,000, 0{,}1\}$. **68.**
$x \in \{\frac{1}{2}, 4\}$. **69.** $x \in \{100\}$. **70.** $x \in \{0{,}01, 100\}$. **71.** $x \in \{1, 10, 0{,}1\}$. **72.** $x \in \{0{,}1, 10\}$. **73.** $x \in \{10, 0{,}01\}$.
74. $x \in \{1, 10, 0{,}1\}$. **75.** $x \in \{11{,}23, 0{,}7073\}$. **76.** $x \in \{10^{-\frac{2}{3}}, 10^{\frac{2}{3}}\}$. **77.** $x \in \{10^{-5}, 10^3\}$. **78.** $x \in \{100\}$.
79. $x \in \{64\}$. **80.** $x \in \{8\}$. **81.** $x \in \{512\}$. **82.** $x \in \{16\}$. **83.** $x \in \{\frac{1}{12}\}$. **84.** $x \in \{\frac{1}{\sqrt[3]{3}}\}$. **85.** $x \in \{-4\}$.
86. $x \in \{9\}$. **87.** $x \in \{3\}$. **88.** $x \in \{\sqrt{2}, \frac{1}{2}\}$. **89.** $x \in \{16\}$. **90.** $x \in \{2\}$. **91.** $x \in \{1 + \sqrt{3}\}$. **92.**
$x \in \{-5\}$. **93.** $x \in \{1 + \sqrt{2}\}$. **94.** $x \in \{\sqrt{5}, 5\}$. **95.** $x \in \{\sqrt[5]{5}, 5\}$. **96.** $x \in \{-\frac{9}{5}, 23\}$. **97.** $x \in \{2^{-\frac{2}{3}}, 8\}$. **98.**
$x \in \{1{,}5, \frac{1}{25}\}$. **99.** $x \in \{\frac{1}{9}, 3\}$. **100.** $x \in \{2\}$. **101.** $x \in \{5, 5^{-4}\}$. **102.** $x \in \{\frac{1}{3}, 9\}$. **103.** $x \in \{10^{-5}, 10^3\}$. **104.**
$x \in \{\frac{1}{9}, 9\}$. **105.** $[x, y] \in \{[10^6, \frac{1}{10}]\}$. **106.** $[x, y] \in \{[10, 100], [100, 10]\}$. **107.** $[x, y] \in \{[2, 6]\}$. **108.** $[x, y] \in$
$\in \{[3, 3], [\sqrt{3}, 9]\}$. **109.** $[x, y] \in \{[1, 8], [8, 1]\}$. **110.** $[x, y] \in \{[6, 3], \}$. **111.** $[x, y] \in \{[0{,}01, 10], [10, 0{,}01]\}$. **112.**
$[x, y] \in \left\{[3, 1], \left[\frac{\log 10{,}33}{\log 2}, \frac{\log 0{,}666\,6}{\log 3}\right]\right\}$. **113.** $[x, y] \in \{[5, 1], [-3, 9], [-4, 10], [7, -1]\}$. **114.** $[x, y] \in \{[4, 100], [100, 4]\}$.
115. $[x, y] \in \left\{\left[5\sqrt{5}, \frac{1}{\sqrt{5}}\right], \left[\frac{1}{\sqrt{5}}, 5\right]\right\}$. **116.** $[x, y] \in \{[100, 0{,}1]\}$. **117.** $m \in (1, 2\rangle$.