

Ch 5.5

Solve equations exactly except where precision is specified

1. $e^x = 17$

2. $10^x = 119$

3. $\ln(x) = 17$

4. $10^x = 17$

5. $\ln(x) = 1703$

6. $\ln(x) = 1505$

7. $\ln(x) = 15$

8. $2 \cdot 10^{3x-5} + 9 = 17$

9. $\frac{10^{2x+9}}{3} + 5 = 12$

10. $\frac{e^{3x+1} + 7}{3} = 12$

11. $\frac{10^{(x+9)/2}}{4} + 5 = 7$

12. $7 \cdot 10^{5x-4} + 3 = 17$

13. $2 \cdot 10^{3x-5} + 9 = 17$

14. $\frac{10^{2x+9}}{3} + 5 = 12$

15. $\frac{e^{3x+1} + 7}{3} = 12$

16. $\frac{10^{(x+9)/2}}{4} + 5 = 7$

17. $2 \cdot 10^{x-5} + 9 = 17$

18. $3 \cdot 10^{5x-3} + 7 = 19$

19. $\frac{e^{7x+1} + 5}{2} = 4$

20. $\frac{10^{2x-7}}{3} - 2 = 4$

21. $\frac{10^{2x+5}}{2} + 3 = 7$

Exponential and Logarithmic Equations

22. $\frac{10^{7x+3}}{2} + 5 = 12$

23. $7 \cdot 10^{5x+3} = 11$

24. $e^{3x+7} = e^{8x-5}$

25. $e^{5x+9} = e^{11x-7}$

26. $e^{2x+1} = e^{7x-3}$

27. $e^{5x-7} = e^{9x+11}$

28. $e^{5x+7} = e^{3x-5}$

29. $e^{6x+9} = e^{4x-5}$

30. $e^{5x+7} = e^{3x-5}$

31. $e^{5x-7} = e^{9x+11}$

32. $e^{3x+7} = e^{8x-5}$

33. $e^{5x+9} = e^{11x-7}$

34. $e^{2x+1} = e^{7x-3}$

35. $e^{5x-7} = e^{9x+11}$

36. $e^{5x+7} = e^{3x-5}$

37. $e^{6x+9} = e^{4x-5}$

38. $e^{5x+9} = e^{11x-7}$

39. $e^{2x+1} = e^{7x-3}$

40. $e^{6x+9} = e^{4x-5}$

41. $e^{7x-3} = e^{11x+12}$

42. $10^{5x-1} = e^{3x-2}$

43. $10^{2x+1} = e^{5x-3}$

44. $10^{2x+1} = 2^x$

45. $10^{5x+1} = 2^{3x}$

46. $10^{5x+3} = 2^{3x}$

47. $10^{2x} = 2^{3x-5}$

48. $10^{3x} = 2^{2x-5}$

49. $10^x = 2^{3x-5}$

50. $10^{5x-7} = e^{3x}$

51. $\log(x-1) + \log(x+4) = 1$

Ch 5.5

52. $\log(x + 4) - \log(x - 1) = 1$
53. $\log(x) + \log(x - 21) = 2$
54. $\log(x + 4) - \log(x - 1) = 1$
55. $\log(x + 2) - \log(x - 5) = 3$
56. $\log(3x + 7) - \log(2x - 3) = 2$
57. $\log(7x + 1) - \log(3x - 4) = 2$
58. Solve $\log(x + 1) + \log(x - 5) = 2$ with 4 significant digits precision.
59. $\log(x+5) - \log(x - 7) = 2$
60. Solve $\log(x - 2) + \log(x + 4) = 1$ with four significant digits precision.
61. Solve $\log(x - 2) + \log(x + 4) = 2$ with four significant digits precision.
62. $\log(x + 7) - \log(x - 5) = 1$
63. $\log(x + 2) - \log(x - 5) = 1$
64. $\log(x + 7) - \log(x - 3) = 1$
65. $\log(x - 1) - \log(x + 4) = 2$
66. Solve $\log(x + 1) + \log(x - 5) = 2$. Give answer with 4 significant digits precision.
67. $\log(x+5) - \log(x - 7) = 2$
68. Solve $\log(x - 2) + \log(x + 4) = 1$ with four significant digits precision.
69. Solve $\log(x - 2) + \log(x + 4) = 2$ with four significant digits precision.
70. $\log(x + 7) - \log(x - 5) = 1$
71. Approximate x to four decimal places: $2^{3x+5} = 7$
72. Approximate x to four decimal places: $2^{2x+9} = 800$
73. Approximate x to four decimal places: $2^{30x} = 7$
74. Approximate x to four decimal places: $2^{30x} = 7$

Answers:

1. $\ln(17)$
2. $\log(119)$
3. e^{17}
4. $\log(17)$
5. e^{1703}

Ch 5.5

6. e^{1505}

7. e^{15}

8. $\frac{\log(4) + 5}{3}$

9. $\frac{\log(21) - 9}{2}$

10. $\frac{\ln(29) - 1}{3}$

11. $2\log(8) - 9$

$$12. 10^{5x-4} = 2 \quad 5x - 4 = \log(2) \quad x = \frac{4 + \log(2)}{5}$$

13. $\frac{\log(4) + 5}{3}$

14. $\frac{\log(21) - 9}{2}$

15. $\frac{\ln(29) - 1}{3}$

16. $2\log(8) - 9$

17. $2 \cdot 10^{x-5} + 9 = 17$

$$10^{x-5} = (17 - 9)/2 = 4$$

$$x = 5 + \log(4)$$

18. $3 \cdot 10^{5x-3} + 7 = 19$

$$3 \cdot 10^{5x-3} = 12$$

$$10^{5x-3} = 4$$

$$5x - 3 = \log(4)$$

$$5x = \log(4) + 3$$

$$x = \frac{(\log(4) + 3)}{5}$$

19. $\frac{e^{7x+1} + 5}{2} = 4$

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

$$x = \frac{\ln(3) - 1}{7}$$

Ch 5.5

$$20. \frac{10^{2x-7}}{3} - 2 = 4$$

$$10^{2x-7} = 18$$

$$2x - 7 = \log(18)$$

$$x = (\log(18) + 7)/2$$

$$21. \frac{10^{2x+5}}{2} + 3 = 7$$

$$x = \frac{\log(8) - 5}{2}$$

$$22. \frac{10^{7x+3}}{2} + 5 = 12$$

$$x = \frac{\log(14) - 3}{7}$$

$$23. 7 \cdot 10^{5x+3} = 11$$

$$x = \frac{\log(11/7) - 3}{5}$$

$$24. 12/5$$

$$25. 16/6 \text{ or } 8/3$$

$$26. 4/5$$

$$27. -18/4 \text{ or } -9/2$$

$$28. -6$$

$$29. -7$$

$$30. e^{5x+7} = e^{3x-5}$$

$$5x + 7 = 3x - 5$$

$$2x = -12 \quad x = -6$$

$$31. e^{5x-7} = e^{9x+11}$$

$$5x - 7 = 9x + 11$$

$$4x = -18 \quad x = -9/2$$

$$32. 12/5$$

$$33. 16/6 \text{ or } 8/3$$

$$34. 4/5$$

$$35. -18/4 \text{ or } -9/2$$

$$36. -6$$

$$37. -7$$

$$38. x = 8/3$$

$$39. e^{2x+1} = e^{7x-3}$$

$$2x + 1 = 7x - 3$$

$$4 = 5x$$

$$x = \underline{\underline{4/5}}$$

Ch 5.5

40. $e^{6x+9} = e^{4x-5}$

$$2x = -14$$

$$x = -7$$

41. $e^{7x-3} = e^{11x+12}$

$$7x - 3 = 11x + 12 \quad -15 = 4x \quad x = -15/4$$

42. $10^{5x-1} = e^{3x-2}$

$$5x - 1 = (3x - 2)\log(e) = 3x \cdot \log(e) - 2 \cdot \log(e)$$

$$5x - 3x \cdot \log(e) = 1 - 2 \cdot \log(e)$$

$$x(5 - 3 \cdot \log(e)) = 1 - 2 \cdot \log(e)$$

$$x = \frac{1 - 2\log(e)}{5 - 3\log(e)}$$

43. $\frac{-3\log(e) - 1}{2 - 5\log(e)}$

44. $10^{2x+1} = 2^x$

$$\log(10^{2x+1}) = \log(2^x)$$

$$2x + 1 = x\log(2)$$

$$2x - x\log(2) = -1$$

$$x(2 - \log(2)) = -1$$

$$x = \underline{\underline{-1/(2 - \log(2))}}$$

45. $10^{5x+1} = 2^{3x}$

$$5x + 1 = 3x\log(2)$$

$$5x - 3x\log(2) = -1$$

$$x(5 - 3\log(2)) = -1$$

$$x = \frac{-1}{5 - 3\log(2)} = \frac{1}{3\log(2) - 5}$$

46. $10^{5x+3} = 2^{3x}$

$$5x + 3 = 3x\log(2)$$

$$5x - 3x\log(2) = -3$$

$$x = \frac{-3}{5 - 3\log(2)} = \frac{3}{3\log(2) - 5}$$

Ch 5.5

47. $10^{2x} = 2^{3x-5}$

$$x = \frac{-5\log(2)}{2-3\log(2)} = \frac{5\log(2)}{3\log(2)-2}$$

$$2x = (3x - 5)\log(2)$$

$$2x - 3x\log(2) = -5\log(2)$$

$$(2 - 3\log(2))x = -5\log(2)$$

48. $10^{3x} = 2^{2x-5}$

$$3x = (2x - 5)\log(2)$$

$$3x - 2x\log(2) = -5\log(2)$$

$$(3 - 2\log(2))x = -5\log(2)$$

$$x = \frac{-5\log(2)}{3-2\log(2)} = \frac{5\log(2)}{2\log(2)-3}$$

49. $10^x = 2^{3x-5}$

$$x = (3x - 5)\log(2) = 3x \log(2) - 5\log(2)$$

$$x - 3x\log(2) = -5\log(2)$$

$$x(1 - 3\log(2)) = -5\log(2)$$

$$x = \frac{-5\log(2)}{1-3\log(2)}$$

50. $10^{5x-7} = e^{3x}$

$$5x - 7 = \log(e^{3x}) = 3x\log(e)$$

$$5x - 3x\log(e) = 7$$

$$(5 - 3\log(e))x = 7$$

$$x = \frac{7}{5 - 3\log(e)}$$

51. $\frac{-3 \pm \sqrt{65}}{2}$

52. 14/9

53. 25

54. 14/9

55. 5002/999

Ch 5.5

56. 307/197

57. 401/293

58. $x = (4 \pm \sqrt{(4^2 - 4 \cdot 1 \cdot -105)})/2 = \textcircled{12.44} - 8.44$

59. 705/99

60. 3.3588

61. 9.4403

62. 57/9

63. $\log(x + 2) - \log(x - 5) = 1$

$$\log\left(\frac{x+2}{x-5}\right) = 1$$

$$\frac{x+2}{x-5} = 10^1 = 10$$

$$x + 2 = 10(x - 5) = 10x - 50$$

$$52 = 9x$$

$$x = 52/9$$

64. $\log(x + 7) - \log(x - 3) = 1$

$$\log\left(\frac{x+7}{x-3}\right) = 1 \quad \frac{x+7}{x-3} = 10 \quad x + 7 = 10(x - 3) = 10x - 30 \quad 37 = 9x$$

$$x = \underline{\underline{37/9}}$$

65. $\log(x - 1) - \log(x + 4) = 2$

$$\log\left(\frac{x-1}{x+4}\right) = 2$$

$$\frac{x-1}{x+4} = 10^2 = 100$$

$$x - 1 = 100(x + 4) = 100x + 400$$

$$99x = -401$$

$$x = -401/99$$

NO SOLUTION

66. Solve $\log(x + 1) + \log(x - 5) = 2$. Give answer with 4 significant digits precision.

$$\log[(x + 1)(x - 5)] = 2$$

$$\log[x^2 - 4x - 5] = 2$$

$$x^2 - 4x - 5 = 10^2 = 100$$

Ch 5.5

$$x^2 - 4x - 105 = 0$$

$$x = (4 \pm \sqrt{4^2 - 4 \cdot 1 \cdot (-105)})/2 = \textcircled{12.44}, -8.44$$

67. $\log(x+5) - \log(x-7) = 2$

$$\log\left(\frac{x+5}{x-7}\right) = 2$$

$$\frac{x+5}{x-7} = 10^2$$

$$x+5 = 100(x-7) = 100x - 700$$

$$705 = 99x \qquad x = 705/99 \approx 7.1212 > 7$$

68. Solve $\log(x-2) + \log(x+4) = 1$ with four significant digits precision.

$$\log(x-2)(x+4) = 1$$

$$x^2 + 2x - 8 = 10$$

$$x^2 + 2x - 18 = 0$$

$$x = (-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot (-18)})/2$$

$$x = \underline{3.3588, -5.3588}$$

69. Solve $\log(x-2) + \log(x+4) = 2$ with four significant digits precision.

$$\log(x-2)(x+4) = 1$$

$$x^2 + 2x - 8 = 100$$

$$x^2 + 2x - 108 = 0$$

$$x = (-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot (-108)})/2$$

$$x = \underline{9.4403, -11.4403}$$

70. $\log(x+7) - \log(x-5) = 1$

$$\log\left(\frac{x+7}{x-5}\right) = 1$$

$$\frac{x+7}{x-5} = 10$$

$$x+7 = 10(x-5)$$

$$x+7 = 10x-50$$

$$57 = 9x \qquad x = 57/9$$

71. -0.7309

MAC 1105

Exponential and Logarithmic Equations

Instr: Jamieson

Ch 5.5

72. -0.73088

73. 1.547952

74. Approximate x to four decimal places: $2^{30x} = 7$

$$\log(2^{30x}) = \log(7)$$

$$30x \cdot \log(2) = \log(7)$$

$$x = \log(7)/(30\log(2)) =$$

$$x = \underline{0.09357}.$$