Mathematics for Economists I
Problems 3

Exponential and logarithmic equations

Find all real numbers x satisfying the given equation. Always specify the exact value (maybe as a mathematical expression), and if it is not an integer, write its approximate value rounded to three to four significant figures. You should determine all the solutions without a calculator, only to calculate the numerical value in Problem 3 you need a calculator.

1. $3^x = 81$

2. $2^x = \frac{1}{64}$

3. $5^x = 17$

4. $10^{x-2} = 1000$

5. $\log_2 x = 10$

6. $3^x + 3^{x+1} + 3^{x+2} + 3^{x+3} = \frac{40}{3}$

7. $3 \cdot (4^x + 9^{x+1}) = 2 \cdot (3 \cdot 4^{x+1} - \frac{9^{x+1}}{4})$

8. $\ln(x+3) - \ln(x-1) = \ln 5$

9. $\ln(x+1) + \ln(x-1) - \ln(x-2) = \ln 8$

10. $\ln(2x-3) + \ln(3x) = \ln(8x - 12)$

11. $3 \log_6(2) + \log_6(x+1) = 1 + \log_6(x+2)$

12. $\log_4(x+1) + \log_4(x+6) = 2 \log_4(x+3)$

13. $\sqrt[2x]{2^{3x+1}} = \sqrt[3]{32}$

14. $3^3 \cdot 27^{2x-3} = 81^{3x-5}$

15. $\log_{10}(x+5) - \log_{10}(x-1) = 1 - \log_{10} 2$

16. $\sqrt[(2x+4)]{4^{x+8}} = \sqrt[4]{64}$

Solutions:

1. 4. **2.** -6. **3.** $\log_5 17 = \frac{\ln 17}{\ln 5} \doteq 1,76$. **4.** 5. **5.** 1024. **6.** -1. **7.** $-\frac{1}{2}$. **8.** 2. **9.** $3; 5$. **10.** No solution because $\frac{3}{2}, \frac{4}{3}$ lie out of definition domain of some of the expressions. **11.** 2. **12.** 3. **13.** 3. **14.** $\frac{7}{3}$. **15.** 7. **16.** 10.