

Solving Exponential & Logarithmic Equations Practice Problems

Solve the following equations: Remember that the arguments of all logarithms must be greater than 0. Also exponentials in the form of a^x will be greater than 0. Be sure to check all your answers in the original equation.

1. $3^{x-1} = 81$ ① $3^{x-1} = 81$
 $3^{x-1} = 3^4$
 $x-1 = 4$
 $x = 5$ ② $3^{x-1} = 3^4$
 $\log_3 81 = x-1$
 $4 = x-1$
 $x = 5$
2. $8^x = 4$ ② $8^x = 4$
 $2^{3x} = 2^2$
 $3x = 2$
 $x = \frac{2}{3}$ ③ $8^x = 4$
 $\log_8 4 = x$
 $\frac{2}{3} = x$
3. $e^x = 5$ ③ $e^x = 5$
 $\log_e 5 = x$
 $\ln 5 = x$
 $x \approx 1.609$
4. $-14 + 3e^x = 11$ ④ $-14 + 3e^x = 11$
 $+14$
 $3e^x = 25$
 $e^x = \frac{25}{3}$
 $\ln\left(\frac{25}{3}\right) = x$
 $x \approx 2.120$
5. $-6 + \ln 3x = 0$ ⑤ $-6 + \ln 3x = 0$
 $+6$
 $\ln 3x = 6$
 $e^6 = 3x$
 $x \approx 134.476$
6. $\log(3x+1) = 2$ ⑥ $\log(3x+1) = 2$
 $10^2 = 3x+1$
 $100 = 3x+1$
 $99 = 3x$
 $x = 33$
7. $\ln x - \ln 3 = 4$ ⑦ $\ln x - \ln 3 = 4$
 $\ln\left(\frac{x}{3}\right) = 4$
 $e^4 = \frac{x}{3}$
 $3e^4 = x$
 $x \approx 163.794$
8. $2 \ln 3x = 4$ ⑧ $2 \ln 3x = 4$
 $\frac{2}{2} \ln 3x = \frac{4}{2}$
 $\ln 3x = 2$
 $e^2 = 3x$
 $\frac{e^2}{3} = x$
 $x \approx 2.463$
9. $5^{x+2} = 4$ ⑨ $5^{x+2} = 4$
 $\log_5 4 = x+2$
 $0.861 = x+2$
 $x \approx -1.139$
10. $\ln(x+2)^2 = 6$ ⑩ $\ln(x+2)^2 = 6$
 $e^6 = (x+2)^2$
 $\sqrt{e^6} = x+2$
 $\sqrt{e^6} - 2 = x$
 $x \approx 18.086$
11. $4^{-3x} = 0.25$ ⑪ $4^{-3x} = 0.25$
 $\log_4 0.25 = -3x$
 $-\frac{1}{2} = -3x$
 $x = \frac{1}{3}$
12. $2e^{2x} - 5e^x - 3 = 0$ ⑫ $2e^{2x} - 5e^x - 3 = 0$
 $(2e^x + 1)(e^x - 3) = 0$
 $2e^x + 1 = 0$ $e^x = -\frac{1}{2}$
 $e^x = 3$
 $\ln 3 = x$
 $x \approx 1.099$
13. $\log_7 3 + \log_7 x = \log_7 32$ ⑬ $\log_7 3 + \log_7 x = \log_7 32$
 $\log_7 (3x) = \log_7 32$
 $3x = 32$
 $x = \frac{32}{3}$
14. $2 \log_6 4x = 0$ ⑭ $2 \log_6 4x = 0$
 $\log_6 4x = 0$
 $6^0 = 4x$
 $1 = 4x$
 $x = \frac{1}{4}$
15. $\log_2 x + \log_2 (x-3) = 2$ ⑮ $\log_2 x + \log_2 (x-3) = 2$
 $\log_2 (x(x-3)) = 2$
 $2^2 = x(x-3)$
 $4 = x^2 - 3x$
 $0 = x^2 - 3x - 4$
 $0 = (x-4)(x+1)$
 $x = 4$ $x = -1$
16. $\log_2 (x+5) - \log_2 (x-2) = 3$ ⑯ $\log_2 (x+5) - \log_2 (x-2) = 3$
 $\log_2 \left(\frac{x+5}{x-2}\right) = 3$
 $2^3 = \frac{x+5}{x-2}$
 $8 = \frac{x+5}{x-2}$
 $8(x-2) = x+5$
 $8x-16 = x+5$
 $7x = 21$
 $x = 3$
17. $4 \ln(2x+3) = 11$ ⑰ $4 \ln(2x+3) = 11$
 $\ln(2x+3) = \frac{11}{4}$
 $e^{\frac{11}{4}} = 2x+3$
 $\frac{e^{\frac{11}{4}} - 3}{2} = x$
 $x \approx 6.321$
18. $\log x - \log 6 = 2 \log 4$ ⑱ $\log x - \log 6 = 2 \log 4$
 $\log\left(\frac{x}{6}\right) = \log 4^2$
 $\frac{x}{6} = 4^2$
 $\frac{x}{6} = 16$
 $x = 96$
19. $2^x = 64$ ⑲ $2^x = 64$
 $2^x = 2^6$
 $x = 6$
20. $5^x = 25$ ⑳ $5^x = 25$
 $5^x = 5^2$
 $x = 2$
21. $4^{x-3} = \frac{1}{16}$ ㉑ $4^{x-3} = \frac{1}{16}$
 $\log_4 \left(\frac{1}{16}\right) = x-3$
 $4^{x-3} = 4^{-2}$
 $x-3 = -2$
 $x = 1$