

Write as the sum, difference, or multiple of logarithms:

1. $\ln \sqrt{a-1}$

2. $\ln [z(z-1)^2]$

3. $\log_b \left(\frac{x^2}{y^2 z^3} \right)$

4. $\ln \sqrt[3]{\frac{x}{y}}$

5. $\log_9 \left(\frac{x^4 \sqrt{y}}{z^5} \right)$

Write as a single logarithm:

6. $\log_3(x-2) - \log_3(x+2)$

7. $\ln x - 2[\ln(x+2) + \ln(x-2)]$

8. $\frac{1}{3}[2\ln(x+3) + \ln x - \ln(x^2-1)]$

9. $\frac{1}{3}[\ln y + 2\ln(y+4)] - \ln(y-1)$

10. $2\ln 3 - \frac{1}{2}\ln(x^2+1)$

Solve the given exponential equation:

11. $10^x = 42$

12. $3(10^{x-1}) = 2$

13. $e^x = 10$

14. $500e^{-x} = 300$

15. $3e^{\frac{3x}{2}} = 40$

16. $25e^{2x+1} = 962$

17. $e^{0.09t} = 3$

18. $3^{4-x} = 5$

Solve the given logarithmic equation:

19. $\ln x = 5$

20. $2\ln x = 7$

21. $2\ln 4x = 0$

22. $\log(z-3) = 2$

23. $\log x = 1 - \log(x-3)$

ANSWERS

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| 1. | $\frac{1}{2} \ln(a - 1)$ | 12. | $1 + \log_{\frac{2}{3}}$ |
| 2. | $\ln z + 2 \ln(z - 1)$ | 13. | $\ln 10$ |
| 3. | $2 \log_b x - [2 \log_b y + 3 \log_b z]$ | 14. | $\ln \frac{5}{3}$ |
| 4. | $\frac{1}{3} [\ln x - \ln y]$ | 15. | $\frac{2}{3} \ln \frac{40}{3}$ |
| 5. | $4 \log_9 x + \frac{1}{2} \log_9 y - 5 \log_9 z$ | 16. | $-\frac{1}{2} + \frac{1}{2} \ln \frac{962}{25}$ |
| 6. | $\log_3 \left(\frac{x - 2}{x + 2} \right)$ | 17. | $\frac{\ln 3}{0.09}$ |
| 7. | $\ln \left[\frac{x}{(x^2 - 4)^2} \right]$ | 18. | $4 - \frac{\ln 5}{\ln 3}$ |
| 8. | $\ln \sqrt[3]{\frac{x(x + 3)^2}{x^2 - 1}}$ | 19. | e^5 |
| 9. | $\ln \frac{\sqrt[3]{y(y + 4)^2}}{y - 1}$ | 20. | $e^{\frac{7}{2}}$ |
| 10. | $\ln \frac{9}{\sqrt{x^2 + 1}}$ | 21. | $\frac{1}{4}$ |
| 11. | $\log 42$ | 22. | 103 |
| | | 23. | 5 |