

Simplifying Natural Logarithmic Expressions

Section 1 — Core Identities

Simplify:

1. $\ln(e^5)$
2. $e^{\ln 7}$
3. $\ln(e^{-3})$
4. $e^{\ln(1/4)}$
5. $e^{\ln x}$

Section 2 — Exponent Rules (Base e)

Simplify:

6. $e^x e^{-2x}$
7. $\frac{e^{-x}}{(e^x)^4}$
8. $e^{1-x} e^{3x}$
9. $(e^{2x})^3 e^{-5x}$
10. $e^{2\ln 4}$
11. $e^{-4\ln 4}$

Section 3 — Logarithm Laws

A. Write as a single logarithm, then simplify:

12. $\ln 3 + 2\ln 4 - \ln 48$
13. $\ln x + \ln y$
14. $2\ln x - \ln y$
15. $\ln(\sqrt{\pi}) - \ln e$

B. Expand:

16. $\ln(6x^2)$
17. $\ln\left(\frac{x^3}{y}\right)$

Section 4 — Exponential \leftrightarrow Log Conversion

Simplify completely:

18. $\ln(\sqrt{e^5})$
19. $e^{-2\ln 3 + 3\ln 2}$
20. $e^{-\ln(1/e)}$
21. $e^{\ln(5x)}$
22. $e^{\ln(x^2)}$
23. $\ln(e^{3x})$
24. $\ln(e^{\ln x})$
25. $e^{2\ln x - \ln(x-1)}$

Section 5 — Algebra with Exponentials

Expand, then simplify:

26. $3e^{2x}(1 - 6e^{-3x})$
27. $4e^{3x-2}(2 - 3e^{2x})$
28. $e^x(2 + e^{-x})$