

HW 3.0.2: Expand and Condense Logarithms

In Exercises 1 – 15, expand the given logarithm and simplify. Assume when necessary that all quantities represent positive real numbers.

1. $\ln(x^5 y^3)$

2. $\log_3\left(\frac{81}{x^2 + 5}\right)$

3. $\log_6\left(\frac{x}{216}\right)^4$

4. $\log(3.21 \times 10^{41})$

5. $\ln\left(\frac{\sqrt[3]{x}}{y\sqrt{z}}\right)$

6. $\log_8(x^2 - 64)$

7. $\frac{\ln(256)}{4}$

8. $\frac{\ln(64)}{2}$

9. $\frac{\ln(81)}{4}$

10. $\log_{\sqrt{3}}(9x^4)$

11. $\log_{\frac{1}{4}}(16z(x^3 - 27))$

12. $\log(100y^7 z^{10})$

13. $\log\left(\frac{10000\sqrt[3]{xy}}{\sqrt[3]{1000}}\right)$

14. $\ln\left(\sqrt[3]{\frac{ex}{yz}}\right)$

15. $\log_4\left(\frac{1024}{xy^2}\right)^2$



16. $\log\left(100^{\frac{4}{5}}x^2\sqrt[3]{y}\right)$

17. $\log_{\frac{1}{3}}\left(\frac{9\sqrt[5]{x}}{\sqrt[3]{yz}}\right)$

18. $\ln\left(\frac{\sqrt[3]{x}}{10\sqrt{yz}}\right)$

In Exercises 16-26, use the properties of logarithms to write the expression as a single logarithm.

19. $3\ln(y)+5\ln(z)$

20. $2\log_4(x)-\log_4(y)-\frac{1}{2}\log_4(z)$

21. $\log(10)-\log(5)$

22. $\log_5(x)+\frac{1}{3}\log_5(y)-4\log_5(z)$

23. $5\ln(z)-3\ln(x)-7\ln(y)$

24. $\frac{1}{2}\log(z)-\frac{1}{3}\log(y)+\frac{1}{5}\log(x)$

25. $\frac{1}{2}\ln(x)+\frac{1}{2}\ln(y)-\frac{1}{2}\ln(z)$

26. $4-\log_3(z)$

27. $\log(y)+4$

28. $\log_2(x^2)+\log_2(x-1)-4$

29. $\log_8(z)+\frac{1}{3}$



Answers:

1. $5\ln(x) + 3\ln(y)$

3. $4\log_6(x) - 12$

5. $\frac{1}{3}\ln(x) - \ln(y) - \frac{1}{2}\ln(z)$

7. $\ln(4)$

9. $\ln(3)$

11. $-2 + \log_{\frac{1}{4}}(z) + \log_{\frac{1}{4}}(x-3) + \log_{\frac{1}{4}}(x^2 + 3x + 9)$

13. $4 + \frac{1}{3}\log(x) + \log(y) - \frac{3}{5}$

15. $10 - 2\log_4(x) - 4\log_4(y)$

17. $-2 + \frac{1}{5}\log_{\frac{1}{3}}(x) - \frac{1}{3}\log_{\frac{1}{3}}(y) - \log_{\frac{1}{3}}(z)$

19. $\ln(y^3z^5)$

21. $\log(2)$

23. $\ln\left(\frac{z^5}{x^3y^7}\right)$

25. $\ln\left(\sqrt{\frac{xy}{z}}\right)$

27. $\log(10000y)$

29. $\log_8(2z)$