Honors Math 3 Day 4: Expanding and Condensing Logarithms

key

Use the Laws of Logarithms to rewrite the expression in a form with no logarithm of a product, quotient, or a power.

1. $\log_5\left(\frac{x}{2}\right) = \log_5 x - \log_5 2$
2. $\ln \pi x = \ln \pi + \ln x$
3. $\log_6 \sqrt[4]{17} = \frac{1}{4}\log_6 17$
4. $\log_2 (xy)^{10}$ $10(\log_2 x + \log_2 y)$
5. $\log_a\left(\frac{x^2}{yz^3}\right) = \log_a x^2 - \log_a yz^3 = 2\log_a x - (\log_a y + 3\log_a z)$
6. $\ln \sqrt[3]{3r^2 s} = \frac{1}{3}(\ln 3 + 2\ln r + \ln s)$
7. $\log\left(\frac{a^2}{b^4\sqrt{c}}\right) = 2\log a - (4\log b + \frac{1}{2}\log c)$
8. $\log_5 \sqrt{\frac{x-1}{x+1}} = \frac{1}{2}(\log_5 (x-1) - \log_5 (x+1))$
9. $\ln\left(\frac{3x^2}{(x+1)^{10}}\right) = \ln 3 + 2\ln x - 10\ln(x+1)$
10. $\log\left(\frac{x}{\sqrt[3]{1-x}}\right) = \log x - \frac{1}{3}\log(1-x)$

Rewrite the expression as a single logarithm.

11. $\log 12 + \frac{1}{2}\log 7 - \log 2 = \log\left(\frac{12\sqrt{7}}{2}\right)$
12. $\log_5(x) - 2\log_5(y) = \log_5 \frac{x}{y^2}$
13. $3\ln(a) - 2\ln(b) - 4\ln c = \ln \frac{a^3}{b^2 c^4}$
14. $2(\log_5 x + 2\log_5 y - 3\log_5 z) = \log_5\left(\frac{xy^2}{z^3}\right)^2$

Evaluate using properties

15. $\log_5(25) + 2\log_2(4) = \log_5 25 + \log_2 16 = 2 + 4 = \boxed{6}$
16. $\log_5(1) + \log_5(125) = 0 + 3 = \boxed{3}$
17. $\log_3(243) - 2\log_3(9) = \log_3 243 - \log_3 81 = 5 - 4 = \boxed{1}$