3-3 Properties of Logarithms

$\log_a x = \frac{\log x}{\log a}$ change of base formula

$\log(u \cdot v) = \log u + \log v$ ~~$\log(u+v)$~~

$\log\left(\frac{u}{v}\right) = \log u - \log v$

$\log u^n = n \log u$

Ex. 1 Rewrite as a common logarithm and evaluate:

$\log_5 20 = \frac{\log 20}{\log 5} \approx 1.86$

$\log_3 50 = \frac{\log 50}{\log 3} \approx 3.56$

$\frac{\ln 50}{\ln 3}$

Ex 2 Rewrite each logarithm in terms of ln 2 and ln 5.

$\ln 10 = \ln(2 \cdot 5) = \ln 2 + \ln 5$

$\ln \frac{5}{32} = \ln\left(\frac{5}{2^5}\right) = \ln 5 - \ln 2^5$

$\ln 5 - 5 \ln 2$

Ex. 3 Expand each logarithmic expression:

$\log \frac{5x^3}{y^2} = \log 5 + \log x^3 - \log y^2$

$\log 5 + 3\log x - 2\log y$

$\log \sqrt{x^2 y} \longrightarrow \log (x^2 y)^{\frac{1}{2}} = \frac{1}{2}\log(x^2 y)$

$= \frac{1}{2}(\log x^2 + \log y)$

$= \frac{1}{2}(2\log x + \log y) = \log x + \frac{1}{2}\log y$

Ex. 4 Expand the logarithmic expression:

$$\log \frac{x^4}{y^2 z^5} = \log x^4 - (\log y^2 + \log z^5)$$

$$= 4\log x - (2\log y + 5\log z)$$

$$= 4\log x - 2\log y - 5\log z$$

Ex. 5 Condense the expression to a single logarithm:

$$2\ln 8 + 5\ln x$$

$$\ln 8^2 + \ln x^5$$

$$\ln(8^2 x^5)$$

Ex. 6 Condense the expression to a single logarithm:

$5 \log x - 2 \log y + 3 \log a$

$\log x^5 - \log y^2 + \log a^3$

$\log\left(\frac{x^5 a^3}{y^2}\right)$

Homework
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odds