

16-2

## Expand &amp; Condense Logs

Properties of Logs

$$\log_a(xy) = \log_a x + \log_a y$$

$$\ln(xy) = \ln x + \ln y$$

$\ln = \log_e$   
or natural log

$$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$$

$$\ln\left(\frac{x}{y}\right) = \ln x - \ln y$$

$$\log_a x^y = y \log_a x$$

$$\ln x^y = y \ln x$$

Expanding:

1) Radicals turn into powers

2) Expand mult/div

3) Turn powers into coefficients

1)  $\log_5 \frac{\sqrt{x}}{y}$

$\log_5 x^{\frac{1}{2}} - \log_5 y$

$$\frac{1}{2} \log_5 x - \log_5 y$$

2)  $\log_4 \frac{x^3}{7y}$

$\log_4 x^3 - \log_4 7 - \log_4 y$

$$3 \log_4 x - \log_4 7 - \log_4 y$$

3)  $\ln \frac{5\sqrt[3]{x+1}}{yz^4}$

$\ln \frac{5(x+1)^{\frac{1}{3}}}{yz^4}$

$\ln 5 + \ln(x+1)^{\frac{1}{3}} - \ln y - \ln z^4$

$$\ln 5 + \frac{1}{3} \ln(x+1) - \ln y - 4 \ln z$$

Condensing:

1) Coefficients become powers

2) Condense Add/Subtr

3) Fraction powers become roots

1)  $\log_2 20 + 2 \log_2 x + \frac{1}{3} \log_2 y$

$\log_2 20 + \log_2 x^2 + \log_2 y^{\frac{1}{3}}$

$\log_2 20x^2 y^{\frac{1}{3}}$

$$\log_2 20x^2 \sqrt[3]{y}$$

2)  $\ln x + \frac{3}{2} \ln y - 4 \ln z$

$\ln x + \ln y^{\frac{3}{2}} - \ln z^4$

$\ln \frac{xy^{\frac{3}{2}}}{z^4}$

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

3)  $4 \log 2 + \frac{1}{2} \log a - 4 \log b - 3 \log c$

$\log 2^4 + \log a^{\frac{1}{2}} - \log b^4 - \log c^3$

$\log \frac{2^4 a^{\frac{1}{2}}}{b^4 c^3}$

$$\log \frac{16\sqrt{a}}{b^4 c^3}$$

CW/HW - Worksheet 9.2

AND CHECK