Evaluate using the change of base formula.

1. $\log_{20}175$

$$\frac{\log 175}{\log 20} = \boxed{1.724}$$

2. $\log_4 .045$

$$\frac{\ln .045}{\ln 4}$$

$$= \boxed{-2.237}$$

Solve the equation for x.

3. $\log_5 5 = \log_5 x$

$$\boxed{X = 5}$$

4. $\log_4 4^3 = \log_4 x$

$$X = 4^3$$

$$\boxed{X = 64}$$

HWQ 3.1-3.3

1. Identify the asymptote and intercept for the function.
$$f(x) = 3^{x-2} + 1$$

2. Write the logarithmic equation in exponential form.
$$\log_3 27 = 3$$

3. Write the exponential equation in logarithmic form.
$$4^{-2} = \frac{1}{16}$$

4. Find the domain, vertical asymptote, and x-intercept.
$$y = \log_{10}(x-3)$$

More Properties of Logarithms:

1.) Product Property: $\log_a uv = \log_a u + \log_a v$

$$\ln uv = \ln u + \ln v$$

2.) Quotient Property: $\log_a \frac{u}{v} = \log_a u - \log_a v$

$$\ln \frac{u}{v} = \ln u - \ln v$$

3.) Power Property: $\log_a u^n = n \log_a u$

$$\ln u^n = n \ln u$$

Example 1: Use the properties of logarithms to expand the expression as a sum, difference, and/or constant.

a.) $\log_{12} 12x$

$\cancel{\log_{12} 12} + \log_{12} x$

$\boxed{1 + \log_{12} x}$

b.) $\log_5 \dfrac{k}{6}$

$\boxed{\log_5 k - \log_5 6}$

c.) $\log_2 x^4$

$\boxed{4\log_2 x}$

d.) $\ln \sqrt[4]{x}$

$\ln x^{\frac{1}{4}}$

$\boxed{\frac{1}{4} \ln x}$

Students will be able use the properties of logarithms to expand as a sum, difference, and/or constant.

e.) $\log_7 a^2 b^{-3} c$

$$\boxed{2\log_7 a + -3\log_7 b + \log_7 c}$$

f.) $\log_m \dfrac{x^2-9}{x^5}$

$$\log_m \frac{(x+3)(x-3)}{x^5}$$

$$\boxed{[\log_m(x+3)+\log_m(x-3)]-5\log_m x}$$

g.) $\log_3 \dfrac{g^4 d}{\sqrt{f}}$

$$\boxed{[4\log_3 g + \log_3 d] - \tfrac{1}{2}\log_3 f}$$

h.) $\ln \sqrt[4]{\dfrac{x^4}{y^3}}$

$$\ln x^{\frac{4}{4}} - \ln y^{\frac{3}{4}}$$
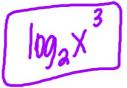
$$\boxed{\ln x - \tfrac{3}{4}\ln y}$$

Example 2: Use the properties of logarithms to condense the expression.

a.) $\ln 5 + \ln x$
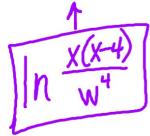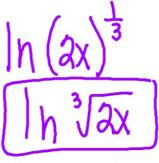
$$\boxed{\ln 5x}$$

b.) $\log_5 h - \log_5 3$

$$\boxed{\log_5 \frac{h}{3}}$$

c.) $3\log_2 x$

$$\boxed{\log_2 x^3}$$

d.) $\ln x - 4\ln(x-2)$

$$\boxed{\ln \frac{x}{(x-2)^4}}$$

e.) $\ln x + \ln(x - 4) - 4\ln w$

$$\ln \frac{x(x-4)}{w^4}$$

f.) $\frac{1}{3}\left[\ln x + \ln 2\right]$

$$\ln (2x)^{\frac{1}{3}}$$

$$\ln \sqrt[3]{2x}$$

g.) $\frac{1}{4}\left[4\ln(x - 1) + \ln x - \ln(x + 5)\right]$

$$\ln\left(\frac{x(x-1)^4}{x+5}\right)^{\frac{1}{4}}$$

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

h.) $6\log_6 x - \log_6(x - 7)$

$$\log_6 \frac{x^6}{x-7}$$

Example 3: Find the exact value of the logarithm without using a calculator.

a.) $\log_2 4$

$\log_2 2^2$

2

b.) $\log_3 9^{5.7}$

$\log_3 3^{2(5.7)}$

$2(5.7) = 11.4$

c.) $\log_5 25 - \log_5 5$

$\log_5 \frac{25}{5}$

$\log_5 5 = 1$

d.) $\ln e^8 - \ln e^6$

$\ln \frac{e^8}{e^6}$

$\ln e^2 = 2$

Turn-in:
p.207 (54, 62, 78, 90)

HW:
p.207 (47-63, 69-83, 89-101 odds)