WARM-UP

Evaluate the expression.

1. $\log_4 4$

2. $\log_6 1$

3. $\log_2 32$

4. $\log_3 81$

5. $\log_5 25$

6. $\log_5 \sqrt[3]{25}$

7. $\ln e^3$

8. $\log \dfrac{1}{\sqrt{1000}}$

9. $\ln \sqrt[4]{e}$

Answers to Warm-up

1. $\log_4 4 = \boxed{1}$

2. $\log_6 1 = \boxed{0}$

3. $\log_2 32$

   $\log_2 2^5 = \boxed{5}$

4. $\log_3 81$

   $\log_3 3^4$

   $\boxed{4}$

5. $\log_5 25$

   $\log_5 5^2$

   $\boxed{2}$

6. $\log_5 \sqrt[3]{25}$

   $\log_5 (5^2)^{\frac{1}{3}}$

   $\log_5 5^{2/3}$

   $\boxed{\dfrac{2}{3}}$

7.) $\ln e^3$

$\log_e e^3$

$\boxed{3}$

8.) $\log \dfrac{1}{\sqrt{1000}}$

$\log \dfrac{1}{1000^{\frac{1}{2}}}$

$\log (1000)^{-\frac{1}{2}}$

$\log_{10} (10^3)^{-\frac{1}{2}}$

$\boxed{-\dfrac{3}{2}}$

9.) $\ln \sqrt[4]{e}$

$\log_e e^{\frac{1}{4}}$

$\boxed{\dfrac{1}{4}}$

3.3 Properties of Logarithmic Functions
   Part 1 - Expanding
   Part 2 - Condensing

Today you will use properties of logarithms to EXPAND logarithmic expressions.

Properties of Logarithms

(1.) $\log_a(uv) = \log_a u + \log_a v$

(2.) $\log_a\left(\frac{u}{v}\right) = \log_a u - \log_a v$

(3.) $\log_a u^n = n \log_a u$

EX1 Use the properties of logarithms to **Expand**

a.) $\log 2x^3$

$\log 2 + \log x^3$

$\boxed{\log 2 + 3\log x}$

b.) $\ln\left(\frac{\sqrt{x}}{y}\right)$

$\ln \sqrt{x} - \ln y$

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

$\boxed{\frac{1}{2}\ln x - \ln y}$

GP) Expand the expression

a.) $\ln x^2 yz$

$\ln x^2 + \ln y + \ln z$

$\boxed{2\ln x + \ln y + \ln z}$

b.) $\log_3 \left(\dfrac{xy}{z}\right)$

$\log_3 xy - \log_3 z$

$\left(\log_3 x + \log_3 y\right) - \log_3 z$

WARM-UP (Day 2)

Use properties to EXPAND each expression.

(1.) $\log_2 2xy^2$

$\log_2 2 + \log_2 x + \log_2 y^2$

$\boxed{1 + \log_2 x + 2\log_2 y}$

(2.) $\ln \left(\dfrac{\sqrt{x+5}}{y^2}\right)$

$\ln (x+5)^{\frac{1}{2}} - \ln y^2$

$\boxed{\dfrac{1}{2}\ln(x+5) - 2\ln y}$

(3.) Write the logarithm in terms of 2 and 3.

$\ln \left(\dfrac{2}{27}\right)$

$\ln 2 - \ln 27$

$\ln 2 - \ln 3^3$

$\boxed{\ln 2 - 3\ln 3}$

HW 3.3 Expanding

#5 $\log_8(xy^6)^3$

$\log_8(x^3y^{18})$

$\log_8 x^3 + \log_8 y^{18}$

$$\boxed{3\log_8 x + 18\log_8 y}$$

$\log_8(xy^6)^3$

$3\log_8(xy^6)$

$3(\log_8 x + \log_8 y^6)$

$3\log_8 x + 3\log_8 y^6$

$$\boxed{3\log_8 x + 18\log_8 y}$$

#11 $\log_8(w^4\sqrt[3]{u})$

$\log_8 w^4 + \log_8 u^{1/3}$

$$\boxed{4\log_8 w + \frac{1}{3}\log_8 u}$$

EX2) Use the properties to <u>CONDENSE</u>
(express as an expression with only one "log")

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

$\log x^2 - \log y^3 + \log\sqrt{z}$

$\log \dfrac{x^2}{y^3} + \log\sqrt{z}$

$$\log \dfrac{x^2\sqrt{z}}{y^3}$$

b.) $\frac{1}{3}\left(2\ln x - 4\ln y - \ln(z+2)\right)$

$\frac{1}{3}\left(\ln x^2 - \ln y^4 - \ln(z+2)\right)$

$\frac{1}{3}\left(\ln \dfrac{x^2}{y^4} - \ln(z+2)\right)$

$\frac{1}{3}\ln \dfrac{x^2}{y^4(z+2)}$

$$\ln \sqrt[3]{\dfrac{x^2}{y^4(z+2)}}$$

HW 3.3 Condensing

#6 $\quad 30 \log_7 2 + 6 \log_7 5 + 6 \log_7 11$

$$\log_7 2^{30} + \log_7 5^6 + \log_7 11^6$$

$$\boxed{\log_7 \left(2^{30} \cdot 5^6 \cdot 11^6\right)}$$