## Concept

The **Properties of Logarithms** are valid for logarithms of all valid base values. This includes the common logarithm ( $\log x$ ) and the natural logarithm ( $\ln x$ ).

Properties of Logarithms	
For any positive numbers $a, m, n, b$ $(b \neq 1), and$ $c$ $(c \neq 1)$ , the following properties hold.	
Power Property of Logarithms	$\log_b m^{\mathbf{n}} = \mathbf{n} \cdot \log_b m$
Product Property of Logarithms	$log_b m + log_b n = log_b (m \cdot n)$
Quotient Property of Logarithm	$log_b m - log_b n = log_b \left(\frac{m}{n}\right)$
Definition-Based Properties	$\log_b b = 1, \log_b 1 = 0, \log_b b^m = m$
Change of Base Property of Logarithms	$log_{c}a = \frac{log_{b}a}{log_{b}c}$



Ex) Use the properties of logarithms to simplify as much as possible. Show your work.

$$\frac{1}{2}\log 16 + 2\log 5$$

$$\log 16 + 2\log 5$$

$$\log 16 + \log 5^{2}$$

$$\log 16 + \log 5^{2}$$

$$\log 16 + \log 5^{2}$$

$$\log 4 + \log 5^{2}$$

$$\log 4 + \log 25$$

$$\log 4 + \log 25$$

$$\log 6 + \log 25$$

$$\log 6 + \log 6$$

$$\log 100$$

$$\log 100$$

$$\log 100$$

$$\log 100$$

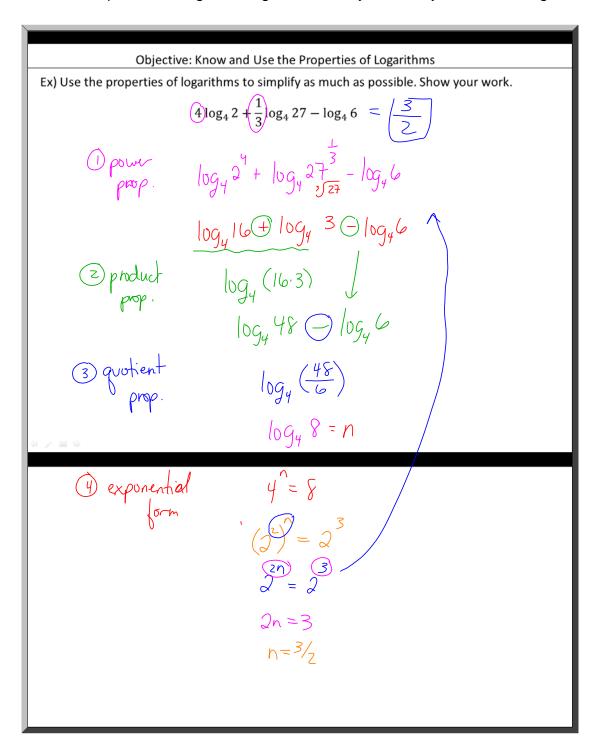
$$\log 10$$

Ex) Use the properties of logarithms to simplify as much as possible. Show your work.

$$log_327 \bigcirc log_381$$

Ex) Use the properties of logarithms to simplify as much as possible. Show your work.

$$ln 10 + 3 ln 2$$



Practice) Use the properties of logarithms to simplify as much as possible. Show your work.

$$3 \ln 2 - \frac{4}{3} \ln 8 + \ln 2$$

$$= \ln 2^3 - \ln 8^{\frac{4}{3}} + \ln 2$$
 power property of logarithms

$$= \ln 8 - \ln 16 + \ln 2$$
 simplify

$$= \ln\left(\frac{8}{16}\right) + \ln 2$$
 quotient property of logarithms

$$= \ln\left(\frac{1}{2}\right) + \ln 2$$
 simplify

$$= \ln\left(\frac{1}{2} \cdot 2\right)$$
 product property of logarithms

$$= ln(1)$$
 simplify

$$= \boxed{0}$$
 definition-based property:  $\log_b 1 = 0$ 

