33. $(\log_3 81)^x$

$\times (\log_3 81)$

$4x$

27) $\log_2 x^{1/2}$

$\frac{1}{2}\log_2 x$

39) $\ln 40 + \underline{2\ln\frac{1}{2}} + \ln x$

$\ln 40 + \ln\frac{1}{4} + \ln x$

$\ln\left(40 \cdot \frac{1}{4} \cdot x\right) = \ln 10x$

$3\log_4 6$

$\log_4 6^3$

$\log_4 216$

39.) $\ln 40 + 2\ln\frac{1}{2} + \ln x$

$\ln 40 + \ln\left(\frac{1}{2}\right)^2 + \ln x$

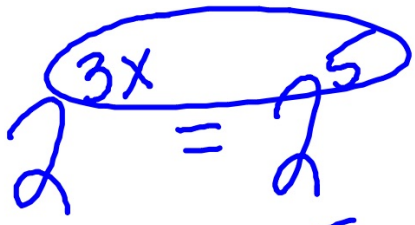
$\ln\left(40 \cdot \frac{1}{4} \cdot x\right)$

$\ln(10x)$

$\log_8 32 = \square$

$8^{\square} = 32$

$\frac{5}{3}$



$3x = 5$

$\log_{1/2} 8$

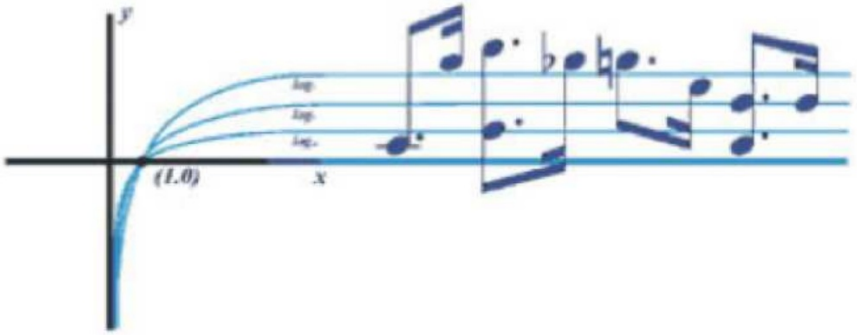
$\left(\frac{1}{2}\right)^{\square} = 8$

-3

$\log_4 128$

$\frac{7}{2}$

4.5 Properties of Logarithms - Cont.



LOGARITHM & Blues

REVIEW - Evaluate.

$\ln e = 1$ | $\ln 1 = 0$

a) $\log_5 125 = 3$

b) $\log_{27} 3 = 1/3$

$\log_2 \left(\frac{1}{8}\right)$

c) $\ln e^8$ 8

$8 \ln e$

d) $\log 1000 = 3$

e) $\log_5 1 = 0$

f) $\log_4 \left(\frac{1}{8}\right) = \frac{-3}{2}$

g) $7^{\log_7 15} = 15$

$\left(\log \frac{1}{100}\right)$

h) $3\log 0.01 - 2\ln e + (\log 1)^{10}$

$3(-2) - 2 + 0$

-8

ex: Between which two consecutive integers does each value lie?

a) $\log_2 7$

$\log_2 4 < \log_2 7 < \log_2 8$

$2 \qquad\qquad 3$

2 and 3

b) $\log 5$

$\log 1 < \log 5 < \log 10$

$0 \qquad\qquad 1$

0 and 1

REVIEW - Expand.

a) $\ln\left(\frac{x^5}{10y^4z^3}\right)$

$\ln x^5 - \ln 10 - \ln y^4 - \ln z^3$

$5\ln x - \ln 10 - 4\ln y - 3\ln z$

b) $\log_3 \sqrt{x^2+y^2}$

$\frac{1}{2}\log_3(x^2+y^2)$

c.) $\log_3 \sqrt{x^2-9}$

$\frac{1}{2}\log_3(x^2-9)$

$(x+3)(x-3)$

$\frac{1}{2}\left[\log_3(x+3)+\log_3(x-3)\right]$

REVIEW - Expand.

c) $\log_3 \sqrt{x^2 - 9}$

REVIEW - Condense.

a) $3\ln x - 5\ln(y+z) + 4\ln 20$

$\ln x^3 - \ln(y+z)^5 + \ln 20^4$

$\ln\left(\frac{x^3 \cdot 20^4}{(y+z)^5}\right)$

b) $\log_5 a - 4\log_5 b - 2$

$2 = \log_5 25$

$\log_5 a - \log_5 b^4 - \log_5 25$

$\log_5\left(\frac{a}{b^4 \cdot 25}\right)$

ex: Evaluate.

a) $\log_3 54 - \log_3 2$

b) $\log_4\left(\frac{32}{3}\right) + \log_4\left(\frac{3}{4}\right)$

ex: Evaluate.

c) $9^{\log_9 20 - \log_9 4}$

d) $9^{\log_3 5}$

e) $2^{\log_2 15 + \log_4 9}$

ex: Let

$$x = \log 2 \qquad y = \log 3 \qquad z = \log 7$$

Rewrite each expression in terms of x, y and z.

a) $\log 14 = \log 2 \cdot 7$

$= \log 2 + \log 7$

$x + z$

ex: Let

$x = \log 2$ $\quad y = \log 3$ $\quad z = \log 7$

* $1 = \log 10$ $\quad 2 = \log 100$

$3^5 = 243$

Rewrite each expression in terms of x, y and z.

b) $\log 243$

$\log 3^5$

$5 \log 3$

$5y$

c) $\log 30$

$\log(3 \cdot 10)$

$\log 3 + \log 10$

$y + 1$

d) $\log 5$

$\log \frac{10}{2}$

$\log 10 - \log 2$

$1 - x$

ex: Let $\log_2 2 = 1$ $\log_2 4 = 2$

$\log_2 3 \approx 1.585$ $\log_2 5 \approx 2.322$

Approximate each expression.

a) $\log_2 15$

$\log_2(3 \cdot 5)$

$\log_2 3 + \log_2 5$

3.907

b) $\log_2 20$

$\log_2 2^2 \cdot 5$

$\log_2 2^2 + \log_2 5$

$2 \log_2 2 + \log_2 5$

$2 + 2.322$

Change of Base Formula

$$\log_b x = \frac{\log_a x}{\log_a b}$$

a : any valid log base

Change of base formula is NOT used to expand or condense

ex: Rewrite using common or natural logarithms. Then evaluate on your calculator.

a) $\log_2 11 = \frac{\log 11}{\log 2}$

$\log_2 8 = \frac{\log 8}{\log 2}$

3.459

b) $\log_3 25 = \frac{\log 25}{\log 3}$ or $\frac{\ln 25}{\ln 3} = 2.930$

ex: Evaluate.

a) $\frac{\ln 8}{\ln 2}$ $\log_2 8 = 3$

b) $\frac{\log 64}{\log 2}$ $\log_2 64 = 6$

c) $\frac{\log_2 5}{\log_2 125}$ $\log_{125} 5 = \frac{1}{3}$

4.5 Extra Practice WKST