

Monday, Nov 2nd

## Homework corrections

$$12.(a) \log_c 48 - (\log_c 3 + \log_c 2) = \log_c 8$$

$$\log_c 48 - \log_c 3 - \log_c 2 = \log_c 8$$

$$\log_c \frac{48}{3 \cdot 2} = \log_c 8$$

$$\log_c 8 = \log_c 8$$

$$(b) 7 \log_c 4 = 14 \log_c 2$$

$$\log_c 4^7 = \log_c 2^{14}$$

$$\log_c (2^2)^7 = \log_c 2^{14}$$

$$\log_c 2^{14} = \log_c 2^{14}$$

$$7 \log_c 4 = 14 \log_c 2$$

$$7 \log_c 2^2 = 14 \log_c 2$$

$$14 \log_c 2 = 14 \log_c 2$$

$$\log_c 4^7 = \log_c 2^{14}$$

$$\log_c 16384 = \log_c 16384$$

$$13.(c) \frac{1}{2}(\log_c 2 + \log_c 6) = \log_c 2 + \log_c \sqrt{3}$$

$$\frac{1}{2} \log_c 2 + \frac{1}{2} \log_c 6 = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c 2^{1/2} + \log_c 6^{1/2} = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c 2^{1/2} \cdot 6^{1/2} = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c 12^{1/2} = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c \sqrt{12} = \log_c 2 + \log_c \sqrt{3}$$

$$\frac{1}{2}(\log_c 2 + \log_c 6) = \log_c 2 + \log_c \sqrt{3}$$

$$\frac{1}{2} \log_c 12 = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c 12^{1/2} = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c \sqrt{12} = \log_c 2 + \log_c \sqrt{3}$$

$$\log_c \sqrt{12} = \log_c \sqrt{12}$$

$$(d) \log_c (5c)^2 = 2(\log_c 5 + 1) \text{ OR}$$

$$2 \log_c 5c = 2(\log_c 5 + 1)$$

$$2(\log_c 5 + \log_c c) = 2(\log_c 5 + 1)$$

$$2(\log_c 5 + 1) = 2(\log_c 5 + 1)$$

$$\log_c (5c)^2 = 2(\log_c 5 + 1)$$

$$\log_c (5c)^2 = 2(\log_c 5 + \log_c c)$$

$$\log_c (5c)^2 = 2(\log_c 5c)$$

$$\log_c (5c)^2 = \log_c (5c)^2$$

## Example 1

Use the Laws of Logarithms to Expand Expressions

Write each expression in terms of individual logarithms of  $x$ ,  $y$ , and  $z$ .

a)  $\log_8 \frac{x}{y}$

b)  $\log_5 \sqrt{xy}$

c)  $\log_3 \frac{9}{\sqrt[3]{x^2}}$

d)  $\log_7 \frac{x^5 y}{\sqrt{z}}$

$$(b) \log_5 (xy)^{\frac{1}{2}}$$

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

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

$$(c). \log_3 \frac{9}{x^{\frac{2}{3}}}$$

$$\log_3 9 - \frac{2}{3} \log_3 x$$

$$(d). \log_7 \frac{x^5 y}{z^{\frac{1}{2}}}$$

$$5 \log_7 x + \log_7 y - \frac{1}{2} \log_7 z$$

$$(a) \log_6 x - \log_6 y$$

Example 2

Use the Laws of Logarithms to Evaluate Expressions

Use the laws of logarithms to simplify and evaluate each expression.

- a)  $\log_3 9\sqrt{3}$   $\longrightarrow \log_3 3^2 \cdot 3^{1/2} = \log_3 3^{5/2}$
- b)  $\log_5 1000 - \log_5 4 - \log_5 2$
- c)  $2 \log_3 6 - \frac{1}{2} \log_3 64 + \log_3 2$

(a)  $\log_3 9 + \frac{1}{2} \log_3 3$   
 $2 + \frac{1}{2}(1)$   
 $2 + \frac{1}{2}$   
 $\frac{4}{2} + \frac{1}{2} = \frac{5}{2}$

(b)  $\log_5 1000 - \log_5 4 - \log_5 2$   
 $\log_5 \left[ \frac{1000}{4(2)} \right]$   
 $\log_5 125$   
 $3$

(c)  $\log_3 \frac{6^2(2)}{64^{1/2}}$   
 $\log_3 \left[ \frac{36(2)}{8} \right]$   
 $\log_3 9$   
 $(2)$

## Review..

### logarithmic function

- a function of the form  $y = \log_c x$ , where  $c > 0$  and  $c \neq 1$ , that is the inverse of the exponential function  $y = c^x$

### logarithm

- an exponent
- in  $x = c^y$ ,  $y$  is called the logarithm to base  $c$  of  $x$

### common logarithm

- a logarithm with base 10

# Evaluating Logarithms (Change of Base)

Evaluate each logarithm using change of base.

$\log_2 1024$   $\xrightarrow{\text{Change base formula for calculator}}$   $\frac{\log 1024}{\log 2} = 10$

### General Rule

$$\log_b a = \frac{\log_c a}{\log_c b}$$

For Calculator  
(base-10)

$$\log_b a = \frac{\log a}{\log b}$$

a)  $\log_4 64 = 3$  |  $\frac{\log 64}{\log 4} = 3$

$4^x = 64$   
 $= 3$

b)  $\log_{\frac{2}{3}} \frac{8}{27} = 3$

$\frac{\log(8/27)}{\log(2/3)} = 3$

c)  $\log_{\sqrt{2}} 2$

$\frac{\log 2}{\log \sqrt{2}} = 2$

d)  $\log 100 = 2$

$\frac{\log 100}{\log 10}$

In parts (e - h), condense each expression to a single logarithm.

e)  $\frac{\log 5}{\log 25}$

$\log_{25} 5$

f)  $\frac{\log \sqrt{3}}{\log 3}$

$\log_3 \sqrt{3}$

g)  ~~$\frac{\log(\frac{1}{2})}{\log(\frac{1}{3})}$~~

h)  ~~$(\log_a x)(\log_x b)$~~

$$\log_5 80$$

$$\frac{\log 80}{\log 5}$$

$$2.722$$

$$\log_3 27 = 3$$

$$\log_4 128 = 3.5$$

→

$$4^x = 128$$

$$2^{2x} = 2^7$$

$$2x = 7$$

$$x = \frac{7}{2}$$

HW  
- pg. 416-417  
# 1-4

# 11-14