

BE - Alg. 2 | Monday

4-23-12

① Write in logarithmic form:

④ $5^3 = 125$ ⑥ $3^{-4} = \frac{1}{81}$

② Write in Exponential form:

④ $\log_6 216 = 3$ ⑥ $\log_{25} 5 = \frac{1}{2}$

③ Simplify and name the exponent rule:

④ $X^5 \cdot X^{14} = ?$

⑤ $\frac{X^{14}}{X^5} = ?$

⑥ $(X^{14})^5 = ?$

NOTE HOW THIS IS WRITTEN
DO NOT WRITE AS:

$\log_{25} 5 = \frac{1}{2}$

THIS SHOULD NOT LOOK
LIKE AN EXPONENT OF 25

① ④ $\log_5 125 = 3$

⑥ $\log_3 \left(\frac{1}{81} \right) = -4$

② ④ $6^3 = 216$

⑥ $25^{\frac{1}{2}} = 5$

TIP: USE PARENTHESES!

③ ④ X^{19} , MULT. RULE $\Rightarrow$ ADD EXPONENTS.

⑤ X^9 , DIVISION RULE $\Rightarrow$ SUBTRACT EXPONENTS

⑥ X^{70} , POWER-POWER RULE $\Rightarrow$ MULTIPLY EXPONENTS

Q: WHAT IS A LOGARITHM?

Ch. 10-3, Properties of Logarithms (Rules)

Covers 3 "logarithm rules" - these are
a direct result of the 3 "exponent rules"
(MR, DR, PP) we covered in the bell exercise.

This is reasonable, the logarithmic
function is the inverse of the
exponential function.

So you can think of these
3 LR's (logarithmic rules) as
"going backward" from the
ER's (exponential rules).

Remember $\Rightarrow$ the ER's assume
same base so WATCH OUT,
don't try to use LR's
with different bases!

$$\log_2 8 + \log_2 16 = ?$$

↑

↑

ADDING EXONENTS $\Rightarrow$ MULTIPLYING POWERS
WITH SAME BASE

$$\therefore \log_2 8 + \log_2 16 = \log_2 (8 \cdot 16)$$

True?

↓

↓

$$3 + 4 = \log_2 (128) = 7 \checkmark$$

(Since $2^7 = 128$)

AK $\Rightarrow$ When adding logarithms with the same base, multiply the powers

$$\boxed{\log_b M + \log_b N = \log_b MN}$$

$$\textcircled{\text{EX}} \log_3 8 + \log_3 6 = ?$$

$$\boxed{\log_3 48}$$

$$\textcircled{\text{EX}} \log_5 X + \log_5 Y = ?$$

$$\boxed{\log_5 X + \log_5 Y}$$

What about $\log_2 16 - \log_2 8 = ?$

Subtracting exponents $\Rightarrow$ dividing powers with the same base

$$\therefore \log_2 16 - \log_2 8 = \log_2 \left(\frac{16}{8} \right)$$

$$\begin{array}{ccc} \uparrow & - & \uparrow \\ 4 & - & 3 \end{array} \quad \stackrel{?}{=} \log_2 2$$

$$2^x = 2 \quad \boxed{x = 1} \checkmark$$

SR $\Rightarrow$ when subtracting logarithms with the same base, divide the powers.

$$\boxed{\log_b M - \log_b N = \log_b \left(\frac{M}{N} \right)}$$

(Ex) $\log_3 8 - \log_3 16 = \log_3 \left(\frac{8}{16} \right) = \boxed{\log_3 \left(\frac{1}{2} \right)}$

Recall: to find $\log_3 \left(\frac{1}{2} \right)$ on your calculator

$$\log_3 \left(\frac{1}{2} \right) \xleftarrow{\text{top}} \frac{\log \left(\frac{1}{2} \right)}{\log 3} \text{ or } \frac{\ln \left(\frac{1}{2} \right)}{\ln 3}$$

$\xleftarrow{\text{bottom}}$

(Ex) $\log_4 \frac{X}{Y} = ?$

$$\boxed{\log_4 X - \log_4 Y}$$

$$\sim -0.6309 \quad \text{or} \quad \frac{1}{3}^{-0.6309} \approx 0.5 \checkmark$$

Finally, look at $4 \log_2 8 = ?$

Multiplying exponents $\Rightarrow$ raising a power to a power

$$\therefore (4)(\log_2 8) = \log_2(8^4) \quad \text{NOT } (\log_2 8)^4 = 81$$

$$4 \cdot 3 \stackrel{?}{=} \log_2(4096) = 12 \checkmark$$

Since $2^{12} = 4096$

MR
for log

When multiplying a logarithm, raise the power by the term doing the multiplication (the multiplier)

$$N \log_b m = \log_b m^N$$

(EX)

$$2 \log_3 6 = ?$$

$$\log_3(6^2) = \log_3(36)$$

(EX)

$$\log_5 X^Y = ?$$

$$Y \log_5 X$$

The Biggie!
Very useful!!

Summary of 3 Logarithm Rules

$$ARL \Rightarrow \log_b m + \log_b n = \log_b (mn)$$

$$SRL \Rightarrow \log_b m - \log_b n = \log_b \left(\frac{m}{n}\right)$$

$$MRL \Rightarrow n \log_b m = \log_b m^n$$

Solving Equations using Logarithm Rules:

Ex 5 (A) $3 \log_5 X - \log_5 4 = \log_5 16$
Pg 543

$$\log_5 X^3 - \log_5 4 = \log_5 16$$

$$\log_5 \left(\frac{X^3}{4} \right) = \log_5 (16)$$

$$\therefore \frac{X^3}{4} = 16$$

$$X^3 = 64$$

$$\boxed{X = 4}$$

Since all the logs are base 5, start simplifying using LR's

$$\textcircled{b} \log_4 X + \log_4 (X-6) = 2$$

$$\log_4 (X)(X-6) = 2$$

$$\log_4 (X^2 - 6X) = 2$$

$$4^2 = X^2 - 6X$$

$$X^2 - 6X - 16 = 0$$

$$\text{Sum} \Rightarrow -6$$

$$\text{prod} \Rightarrow -16$$

$$\begin{array}{c} \wedge \\ +2 \quad -8 \end{array}$$

$$(X+2)(X-8) = 0 \quad \therefore X = -2, 8$$

$$\text{CK}_{X=-2} \log_4 (-2) + \dots$$

↑ CAN'T get A negative number
to base 4^x NO MATTER WHAT X IS
 $\therefore -2$ CANNOT be A solution
(EXTRANEUS)

$$\text{CK}_{X=8} \log_4 8 + \log_4 (8-6) = 2$$

$$\log_4 16 = 2 \quad \checkmark$$

Homework: ① Memorize
3LR
② Pg 544 #7-10