MORE LOGARITHMS!

Do now!

Explain how the graph of $y=-2^{4-x}$ would look?

HW questions?

today we're going to see
why logarithms are useful.

we saw yesterday they made

large & small numbers

manageable:

log 102384≈5.010232093
log 0.00021≈-3.677780705

Today we're going to see another reason why they're useful...

Would you rather add or multiply two numbers?

Which is easier?

LOGARITHMS

turn

MULTIPLICATION 

into

ADDITION 

LOGARITHMS

turn

DIVISION ÷

into

SUBTRACTION −

$\log 10 = \log 5 + \log 2$
$\log 25 = \log 5 + \log 5$
$\log 21 = \log 3 + \log 7$

$$\log_a(MN) = \log_a M + \log_a N$$

check yo'self!

write as a **single log:**

(a) log(5)+log(3)
(b) log(2)+log(x)
(c) log(5)+log(6)+log(10)
(d) $\log_4(5)+\log_4(2)$

PROOF!

$$\log_a(MN)=\log_a M+\log_a N$$

PROOF!

$\log_a(MN)=\log_a M+\log_a N$

Let $\log_a(MN)=x$
$\log_a(M)=y$
$\log_a(N)=z$

We need to show that
$x=y+z$

So rewriting:
$a^x=MN$
$a^y=M$
$a^z=N$

So $a^x=a^y a^z=a^{y+z}$

So we can see that $x=y+z$.

$\log_a(M/N)=\log_a M-\log_a N$

CONVERT to TWO LOGARITHMS

(a) log(1/2)

(b) log(4/7)

CONVERT to a SINGLE LOGARITHM

(c) log(10)-log(100)

(d) log(100)-log(10)

(e) log(54)-log(1)

Lastly:

$$\log_a(M^p)=p\ \log_a(M)$$

in other words

$$\log_a(M^p)=p\ \log_a(M)$$

Check yo'self!

SIMPLIFY!

(a) $\log_5(6^{10})$

(b) $\log_4(4^3)$

(c) $\log_3(\sqrt[4]{10})$

PROOF OF...

$$\log_a(M^p)=p\ \log_a(M)$$

let's COMBINE OUR SKILLS!

CHECK YO'SELF! (simplify!)

$\log(ab/c)$

$\log(a^2b^6c^{-20})$

$\log(\sqrt{abc})$

$\log(ab/c^4)$

$\log(a^2+3)$

Express as a single logarithm:

$5 \log_b x - \log_b y + (1/4) \log_b x$

FINALLY:

a proof of the change of base formula!

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

FINALLY:

a proof of the change of base formula!

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

Let
- $x=\log_b M$
- $y=\log_a M$
- $z=\log_a b$

We want to show that $x=y/z$

Let's rewrite:

- $b^x=M$
- $a^y=M$
- $a^z=b$

Since we know $b=a^z$, and $b^x=a^y$, let's rewrite:
- $b^x=(a^z)^x=a^{xz}=a^y$

So we have $xz=y$, which we can rewrite:
- $x=y/z$

HOMEWORK!

Section 4.4#1-33(odd)

check your answers in the back of the book...