Warm Up

1) $\frac{4e^2}{16e}$ $\frac{1e}{4}$

2) $(3e^5)^{-2}$ $\frac{1}{(3e^5)^2} = \frac{1}{9e^{10}}$

3) $e^4 e^x e^{-1}$ e^{x+3}

4) You deposit $2000 into a bank account that pays 5% interest compounded quarterly.

Equation: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

What is the balance after 5 years? $= 2000\left(1 + \frac{.05}{4}\right)^{4(5)}$ $\$2564.07$

When will the balance reach $5000?

$5000 = 2000\left(1 + \frac{.05}{4}\right)^{4t}$

$2.5 = 1.0125^{4t}$

$\log_{1.0125} 2.5 = 4t$

$y = 2 \cdot 3^{x-3} + 4$

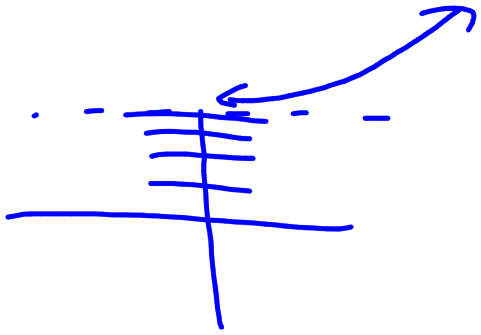
Shift 3 = Right 3

Up 4

D: $(-\infty, \infty)$

R: $(4, \infty)$

Asymptote $y = 4$



Exponential Models

Growth Model: $y=a(1+r)^t$

Decay Model: $y=a(1-r)^t$

Compound Interest: $A = P(1+\frac{r}{n})^{nt}$

Continuously Compounded: $A = Pe^{rt}$

Homework Questions

*word problem ws

DLT

7.4 Evaluating Logarithms

*What is a logarithm?

*How are logarithmic and exponential functions related?

*How do I evaluate and simplify logarithms?

7.4 Evaluating Logarithms

You know that $2^2=4$ and $2^3=8$.

However, for what value of x does $2^x=6$?

$\frac{\log 6}{\log 2}=2.58$ $\log_2 6 = x$

*Mathematicians define this x-value using a logarithm and write $x=\log_2 6$.

7.4 Evaluating Logarithms

KEY CONCEPT *For Your Notebo*

Definition of Logarithm with Base *b*

Let b and y be positive numbers with $b \neq 1$. The **logarithm of y with base** denoted by $\log_b y$ and is defined as follows:

exp.

$\log_2 6$ $\log_b y = x$ if and only if $b^x = y$

The expression $\log_b y$ is read as "log base b of y."

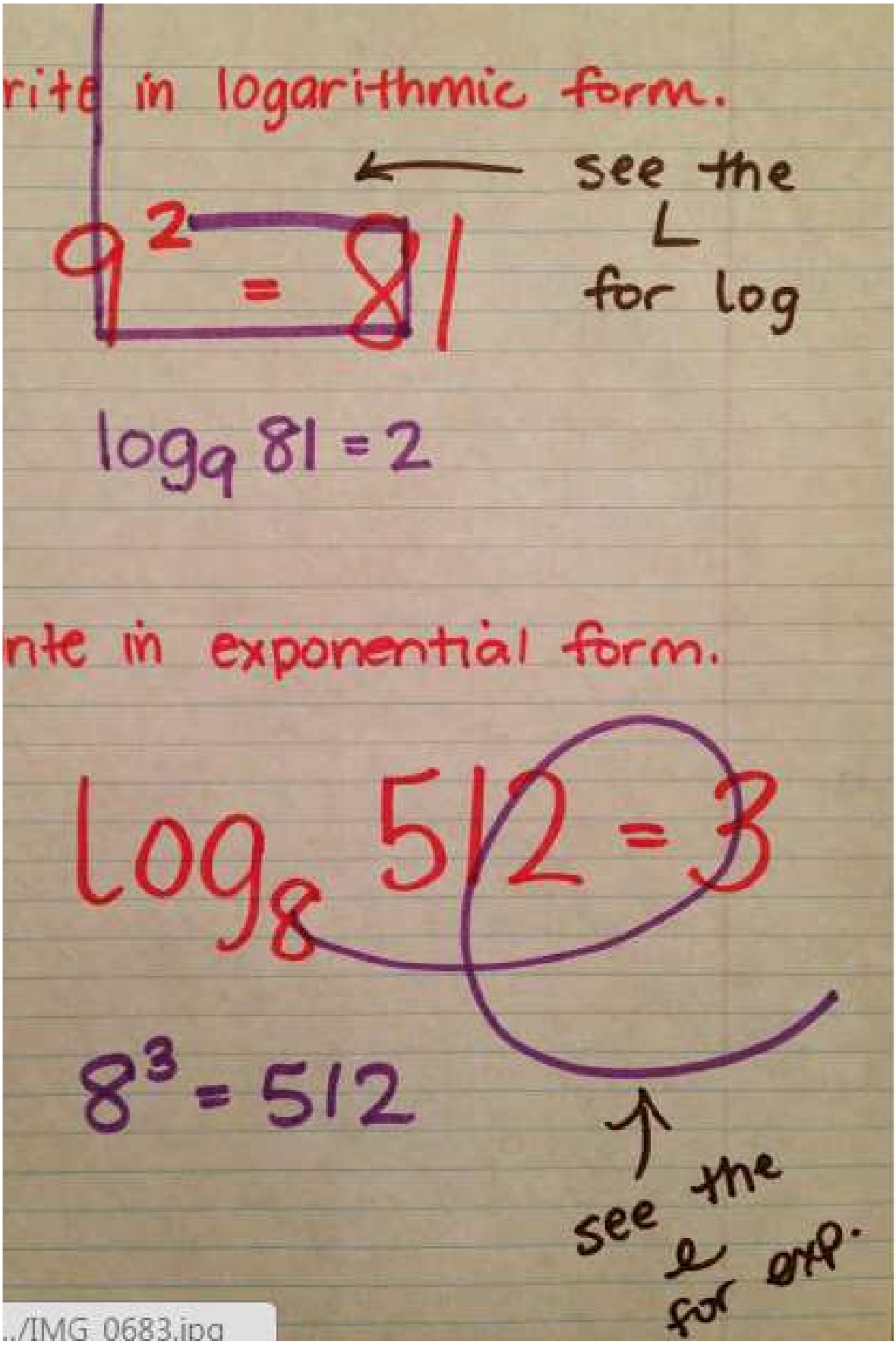
s definition tells you that the equations $\log_b y = x$ and $b^x = y$ are equivale
: first is in *logarithmic form* and the second is in *exponential form*.

7.4 Evaluating Logarithms

Logarithms & Exponentials

$\log_2 8 = 3$ (answer; base; exponent)

$2^3=8$


rite in logarithmic form.
see the L for log
$9^2 = 81$
$\log_9 81 = 2$
nte in exponential form.
$\log_8 512 = 3$
$8^3 = 512$
see the e for exp.
../IMG_0683.jpg

7.4 Evaluating Logarithms

To rewrite a logarithm in exponential form...

Ex) $\log_5 125 = x$

rewrite $5^x = 125$

evaluate 3

Ex 2) $\log_4 64 = x$

$4^x = 64$

3

Ex 3) $\log_5 625 = x$

Examples - Rewrite in exponential form

TOYO

$\log_4 1 = 0$

$4^0 = 1$

$\log_7 7 = 1$

$7^1 = 7$

$\log_{0.25} 4 = -1$

$\frac{1}{4}^{-1} \cdot 25^{-1} = 4$

$\log_{14} 1 = 0$

$14^0 = 1$

$\log_3 81 = 4$

$3^4 = 81$

Examples - Evaluate Logs

$\log_4 64 = x$

$4^x = 64$

3

$\log_5 (1/5) = x$

$\frac{5}{1}^x = \frac{1}{5}$

$5^{-1} = \frac{1}{5}$

$x = -1$

Try - Evaluate Logs

$\log_{1/5} 125 = x$

$\left(\frac{1}{5}\right)^x = 125$

-3

$\log_3 81 = x$

$3^x = 81$

4

$\log_{10} (1/1000)$

$10^x = \frac{1}{1000}$

-3

$\log_{36} 6 = x$

$36^x = 6$

$\frac{1}{2}$

$\sqrt{36}$

$\log_{1/4} 256$

$\left(\frac{1}{4}\right)^x = 256$

-4

1) Which of the following expressions is equivalent to $(-2x^5y^2)^4$?

a. ~~$-16x^{20}y^8$~~

b. ~~$-8x^{20}y^8$~~

c. ~~$-8x^9y^6$~~

d. $16x^9y^6$

e. $16x^{20}y^8$

$(-2)^4$

2) Which of the following is a value of x that satisfies $\log_x 36=2$?

a. 4

b. 6

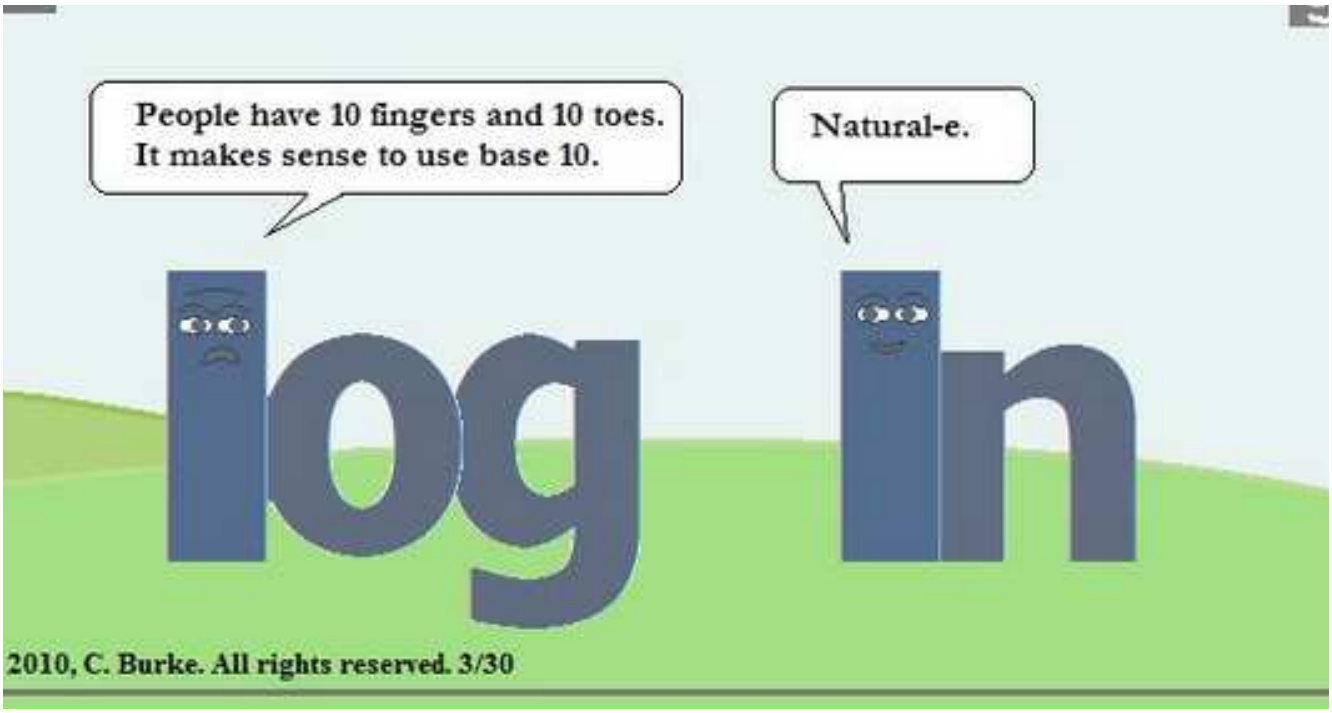
c. 8

d. 16

e. 18

$x^2 = 36$

http://ed.ted.com/lessons/steve-kelly-logarithms-explained


People have 10 fingers and 10 toes.
It makes sense to use base 10.
log
Natural-e.
ln
2010, C. Burke. All rights reserved. 3/30

Logarithm of 1

$\log_b 1 = 0$ because $b^0 = 1$.

$\log_7 1 = 0$

$7^0 = 1$

Logarithm of *b* with Base *b*

$\log_b b = 1$ because $b^1 = b$.

$\log_{10} 10 = 1$

$10^1 = 10$

Evaluating Log Practice

A) $\log_4 1 = x$ $4^x = 1$ 0

B) $\log_{(1/4)} 4$ $\left(\frac{1}{4}\right)^x = 4$ −1

C) $\log_3 81$ $3^x = 81$ 4

D) $\log_7 7$ $7^x = 7$ 1

E) $\log_{14} 1$ 0

F) $\log_5 (1/5)$ −1

G) $\log_{10} (1/1000)$ −3

H) $\log_{64} 2$ $\frac{1}{6}$

I) $\log_{(1/4)} 256$ −4

J) $\log_{36} 6$ $\frac{1}{2}$

War!

SPECIAL LOGARITHMS A **common logarithm** is a logarithm with base 1
denoted by $\log_{10}$ or simply by log. A **natural logarithm** is a logarithm wi
It can be denoted by $\log_e$, but is more often denoted by ln.

Common Logarithm

$\log_{10} x = \log x$

Natural Logarithm

$\log_e x = \ln x$ ln(x)

$e^{\ln x} = x$

log 100 - common log base 10

$\ln(e^x) = x$

~~ln~~ (e 4) natural log base e

4

INVERSE FUNCTIONS By the definition of a logarithm, it follows that the logarithmic function $g(x) = \log_b x$ is the inverse of the exponential function $f(x) = b^x$. This means that:

$$g(f(x)) = \log_b b^x = x \quad \text{and} \quad f(g(x)) = b^{\log_b x} = x$$

Simplify:

$10^{\log 4}$

$10^{\log_{10} 4}$

4

$\log_5 25^x$

$\log_5 5^{2x}$

$2x$

$e^{\ln 3}$

$= 3$

TOYO

A) $10^{\log_b 8}$

$\frac{1}{8}$

B) $\log_6 36^x$

$\log_6 6^{2x}$

$2x$

C) Rewrite $2^{-3}=(1/8)$

$\log_2 \frac{1}{8} = -3$

USING INVERSE PROPERTIES **Simplify the expression.**

28. $7^{\log_7 x}$ **29.** $\log_5 5^x$ **30.** $30^{\log_{30} 4}$ **31.** $10^{\log 8}$

32. $\log_6 36^x$ **33.** $\log_3 81^x$ **34.** $\log_5 125^x$ **35.** $\log_2 32^x$

33

$\log_3 81^x$

$\log_3 3^{4x}$

$4x$

HW: Page 503#3-19odd, 24-35

Quiz on Graphing and WP Monday/Tuesday!

Quiz on evaluating logs Wednesday/Thursday!