1. Definition $y = b^x$ if and only if $x = \log_b y$

Forward: **Solve for an exponent**

EX: Find the inverse for $y = 4^x$

Two steps to inverse: 1. Solve for x 2. Switch x/y

1. X = $\log_{base=4}$ (argument=y) by prop1
2. $Y^{-1} = \log_4(x)$

EX: The How long will it take for an investment to double at 5% interest per year? P=Qe^(RT)

$P = Qe^{RT}$

2Q=$\cancel{Q}$e^(.05T) so $\boxed{2=e^{.05T}}$ so by prop 1 .05T=ln(2)

By algebra T= ln(2)/.05 = 13.86 years

Math 0: Solver

0 = P - Qe^(RT)

P = 200

Q = 100

R = .05

T = 0<alpha><enter>

T = 13.86

$.05T = \log_e(2)$

$\frac{.05T}{.05} = \frac{\ln(2)}{.05}$

$T = \frac{\ln 2}{.05}$

Reverse: "**Get rid of a log**"

EX: $\boxed{\text{Find x if } 5 = \log(2x)}$ (base=10)

10

Want to GET RID OF LOG
Start with base 10 $^{\text{exponent}}$ = $10^5$ = 2x by prop1

10000=2x by algebra x=5000

Ex $3 - \log_2(x+1) = 7$
$-3 \qquad -3$

$-\log_2(x+1) = 4$
$\div -1 \qquad \div -1$

$\boxed{\log_2(x+1) = -4}$

Prop 1

$2^{-4} = x+1$

$x = 2^{-4} - 1$

2. Sum/Product Property

Forward: **Combine logs logA+logB=log(AB)**

EX: Find a single log for

ln2+ln5 = ln(10) by prop 2

log25+log4 = log(100) by prop 2 or 2

10

Reverse: **Find the components of a log**

EX: Use table of logs to find

TABLE

$1.1 \times 10^1$

log11= log(10*1.1)= log(10)+log(1.1)
=1+0.0414..= 1.0414

1 + .0414

log(12000)= log(1.2*10^5)= log(1.2)+log(10^5)
=5+0.0792..= 5.0792

| log | .1 | .2 | .3 | .4 |
|---|---|---|---|---|
| 0 | −1 | −.69.. | | |

3. "Ladder" Property $n\log_b x = \log_b x^n$

Forward: **Get rid of a coefficient**

EX: Find 3log4+2log5

= log $4^3$ + log $5^2$ by prop 3.
= log($4^3$*$5^2$) by prop 2

Reverse: **Get rid of an exponent inside a log**

EX: Find $\cancel{\log_2} 4^{50000}$

$=50000 \log_2 4$ by prop 3 = 50000*2 =100000

$\log_2 4 = x^2$

$2^x = 4$

Change of Base $\log_b x = \dfrac{\log_a x}{\log_a b}$

Forward: **Evaluate a old bases in terms of a new one**

EX: Find $\log_2 4$ = we have ln and log in calculator

$\log_2 4 = \dfrac{\log(4)}{\log(2)} = 2 = \dfrac{\ln(4)}{\ln(2)}$ By prop 4

$\log_2 4 = \log(4)/\log(2)$

$= \ln(4)/\ln(2)$

Reverse: **Divide logs of a same base to get a single log**

EX: Simplify ln(100)/ln10 = log(100) by prop4

5. Log of Both Sides $x = y$ iff $\log_b x = \log_b y$

Forward: **Take the log of both sides**

Reverse: **Drop the logs from both sides**

EX: If log x = log 40 find x.

Then x= 40 by prop 5

CLOSE WINDOW

**Converting between logarithmic and exponential equations**

Rewrite as a logarithmic equation.

$3^0 = 1$

$\boxed{0} = \log_{\boxed{3}} \boxed{1}$

For any numbers $a$, $b$, and $c$, with $a$ and $c$ positive ($a \neq 1$), we have

Your resources will appear

**Converting between natural logarithmic and exponential equations**

Rewrite as a logarithmic equation.

$e^{y} = 6$

$\boxed{y} = \log_{\boxed{e}} \boxed{6}$

$y = \ln 6$

**Evaluating a logarithmic expression**

Evaluate.

$\log_2 \frac{1}{4}$

$\log(1/4)/\log(2)$

Explain

$\log_2(2^{-2}) = x$

$2^{-2} = 2^{x}$ $x = 2$

**Graphing a logarithmic function: Basic**

Graph $g(x) = 1 + \log_2 x$ .

To graph the function, plot at least two points on the graph, draw all asymptotes, and then click on the graph icon.

$\log_2 4 = 2$

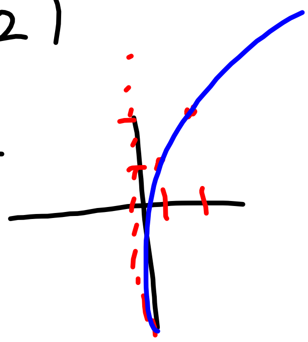
$\log_2 8 = 3$

$\boxed{Y=}$

$Y_1 = 1 + \log(X)/\log(2)$

TABLE

| | X | Y |
|---|---|---|
| | $2^0 = 1$ | 1 |
| | $2^1 = 2$ | 2 |
| | $2^2 = 4$ | 3 |



CLOSE WINDOW

**The graph, domain, and range of a logarithmic function**

Graph the function $g(x) = \log_4(x-3)$ and give its domain and range using interval notation.

Can't take log of anything that's not

$X - 3 > 0$

Domain $(3, \infty)$

Range $(-\infty, \infty)$

## Basic properties of logarithms

Fill in the missing values to make the equations true.

(a) $\log_3 4 - \log_3 11 = \log_3 \boxed{4}/11$

$\log_3 4 + \log_3 11^{-1}$

$\log_3 4 \cdot 11^{-1}$

$\log_3 (4/11)$

(b) $\log_7 9 + \log_7 \boxed{5} = \log_7 45$

$9 \cdot 5$

(c) $\log_6 32 = \boxed{\phantom{0}}\log_6 2$

$\log_6 2^5 = \boxed{5} \log_6 2$

## Writing an expression as a single logarithm

Write the expression as a single logarithm.

$$7\log_4 w - \frac{1}{5}\log_4 y + 2\log_4 z$$

P3

P3 $\log_4 w^7 + \log_4 y^{-1/5} + \log_4 z^2$

P2 $\log_4 (w^7 \cdot y^{-1/5} z^2)$

Ex $5 = 6^x$

Solve for $x$

P1 $x = \log_6 5 = \log(5)/\log(6)$

**Finding the time to reach a limit in a word problem on exponential growth or decay**

A laptop computer is purchased for $2700. Each year, its value is 80% of its value the year before. After how many years will the laptop computer be worth $900 or less? (Use the calculator provided if necessary.)

Write the *smallest possible* whole number answer.

$2700(.80) = 2160$

$2700(.80)^x = 900$

$Y_1 = 900$
$Y_2 = 2700(.80)^{\wedge}X$

$(.80)^x = \frac{900}{2700}$

$x = \log_{.80}\left(\frac{1}{3}\right)$

$x = \log(1/3)/\log(.8)$

$= 4.9$