Pre-Calc 3.3a Properties of Logarithms

Change-of-Base Formula

You can use any base to convert. Most use base 10 and/or base e since buttons on a scientific calculator.
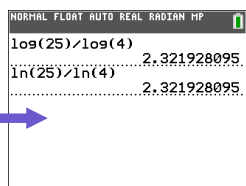
Base b: $\log_a x = \dfrac{\log_b x}{\log_b a}$

Base 10: $\log_a x = \dfrac{\log x}{\log a}$
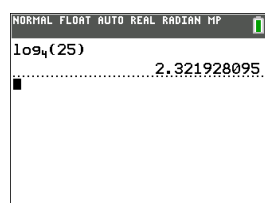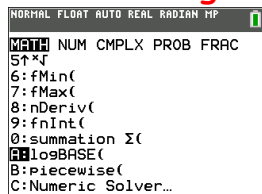
Base e: $\log_a x = \dfrac{\ln x}{\ln a}$

Example 1: Rewrite the log as a ration of common log and natural log then evaluate.

$\log_4 25 = \dfrac{\log 25}{\log 4} = \dfrac{\ln 25}{\ln 4} \approx 2.32$

```
NORMAL FLOAT AUTO REAL RADIAN MP
log(25)/log(4)
                    2.321928095
ln(25)/ln(4)
                    2.321928095
```

MATH-A:LogBASE

```
NORMAL FLOAT AUTO REAL RADIAN MP
MATH NUM CMPLX PROB FRAC
5↑×√
6:fMin(
7:fMax(
8:nDeriv(
9:fnInt(
0:summation Σ(
A:logBASE(
B:piecewise(
C:Numeric Solver…
```

```
NORMAL FLOAT AUTO REAL RADIAN MP
log_4(25)
                    2.321928095
```

*Graphing Calculators have

a change of base on them :)

Properties of Logarithms

Product Property: $\log_a (uv) = \log_a u + \log_a v$

$\ln(uv) = \ln u + \ln v$

Quotient Property: $\log_a \dfrac{u}{v} = \log_a u - \log_a v$

$\ln \dfrac{u}{v} = \ln u - \ln v$

Power Property: $\log_a u^n = n \log_a u$

$\ln u^n = n \cdot \ln u$

*These are directly from the exponential properties we learned in Algebra I.

Example 2: Write each log in terms of ln 2 and ln 3.

(a) ln 6 =

(b) $\ln \dfrac{2}{27} =$

Example 3: Use the properties of logs to rewrite and simplify the log expression.

(a) $\log_9 243$

(b) $\ln \dfrac{e^5}{7}$

Example 4:

Use properties of logs to expand the expressions as a sum, difference, and/or constant multiple of logs.

(a) $\log 100x$

(b) $\ln \sqrt[3]{x}$

(c) $\ln \dfrac{x}{\sqrt{x^2 + 1}}$

3.3a HW

p.207 #3-23odd,

37-43odd,47-63eoo