Properties of Logarithms Video Lecture

Section 5.5

Course Learning Objectives:
Demonstrate appropriate manipulation of exponential and logarithmic expressions. (Review from Math 940)

Weekly Learning Objectives:

1) Work with the properties of logarithms.
2) Write a logarithmic expression as a single logarithm.
3) Write a single logarithm as a sum or difference of logarithms.
4) Use the change of base formula.
5) Use a calculator to evaluate logarithms.

Properties of Logarithms

Properties of logarithms should parallel properties of exponents.

$x^m \cdot x^n =$ $\qquad$ $\dfrac{x^m}{x^n} =$ $\qquad$ $(x^m)^n =$

Properties of logarithms:
If a is a positive number, different from 1 and x & y are both greater than zero, and c is any real number, the following are true.

1. $\log_a xy = \log_a x + \log_a y$

2. $\log_a \dfrac{x}{y} = \log_a x - \log_a y$

3. $\log_a(x^c) = c \log_a x$

Proof for 1 :

Examples: Write each of the following as a single logarithm. Assume that variables represent positive real numbers:

1. $\log_2 9 + \log_2 3$

2. $\log_6(x^2+1) + \log_6 3 + \log_6 x$

3. $\log_7 20 - \log_7 4$

4. $\ln(a+b) + \ln(a-b) - 2\ln c$

If $\log_b 3 = .5$ and $\log_b 5 = .7$, find each of the following:

5. $\log_b 25$

6. $\log_b \frac{9}{5}$

7. $\log_b \sqrt[3]{\frac{5}{27}}$

Write each expression as a sum or difference of logarithms:

8. $\log_4 \frac{2}{9z}$

9. $\log_b \sqrt{\frac{3}{y}}$

10. $\log_b \frac{(x+5)^2}{x}$

11. $\ln \frac{z\sqrt[4]{x}}{\sqrt[3]{y^2+6y+17}}$

Change of base formula: $\log_b x = \dfrac{\log_a x}{\log_a b}$

How does $\log_a b$ compare with $\log_b a$?

Evaluate each of the following using your calculator:

12. $\log 27$

13. $\ln 142$

14. $\log_6 40$

15. $\log_8 100$

16. Find the exact value for $(\log_2 5)(\log_5 7)$