

## Math 150 Lecture Notes

### Laws of Logarithms

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Let  $a$  be a positive number, with  $a \neq 1$ . Let  $A$ ,  $B$ , and  $C$  be any real numbers with  $A > 0$  and  $B > 0$ .

1.  $\log_a (AB) = \log_a A + \log_a B$
2.  $\log_a \left( \frac{A}{B} \right) = \log_a A - \log_a B$
3.  $\log_a (A^C) = C \log_a A$

#### Change of Base Formula

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

Example 1: Evaluate the expression.  $\log_3 100 - \log_3 18 - \log_3 50$

Example 2: Use the Laws of Logarithms to expand the expression:  $\log \left( \frac{a^2}{b^4 \sqrt{c}} \right)$

Example 3: Use the Laws of Logarithms to expand the expression:  $\ln \frac{3x^2}{(x+1)^{10}}$

Example 4: Use the Laws of Logarithms to combine (condense) the expression:

$$\log_5 (x^2 - 1) - \log_5 (x - 1)$$

Example 5: Use the Laws of Logarithms to combine (condense) the expression:

$$\frac{1}{3} \log(2x + 1) + \frac{1}{2} [\log(x - 4) - \log(x^4 - x^2 - 1)]$$

Example 6: Use the Change of Base Formula and a calculator to evaluate the logarithm, correct to four decimal places.

$$\log_6 92$$