

## 4.4 Properties of Logarithms

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## Properties of Logarithms

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If  $x, y$ , and  $b > 0$ , then

$$\log_b(xy) = \log_b x + \log_b y$$

$$\log_b \frac{x}{y} = \log_b x - \log_b y$$

$$\log_b x^k = k \log_b x$$

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## Examples

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Use the properties of logarithms to expand each expression in terms of simpler logarithms. Assume that all variable expressions denote positive numbers.

1.  $\log_3 5x$

2.  $\log_4 \frac{x^2}{y^3}$

3.  $\log_8 \sqrt{6}$

4.  $\log \left( \frac{2x-1}{5xy} \right)$

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## Examples

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Combine into one logarithm and simplify. Assume all expressions are defined.

1.  $5 \log x + 2 \log(x + 6)$
2.  $2 \log y - 3 \log(y + 2) + \log 8$
3.  $3 \log_2 x - 2 \log_2 y + \log_2(x + 1)$

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## Example

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If  $\log_b 3 = .49162$  and  $\log_b 5 = 1.0847$ ,  
find  $\log_b 45$

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## Examples

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Solve for  $x$

1.  $\log_6 3 + \log_6 x = 2$
2.  $\log(x - 1) - \log 4 = 2$
3.  $3^x = 4$
4.  $5^{2x+3} = 18$

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## Compound Interest

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The amount accumulated in an account bearing interest compounded  $n$  times annually is

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

where  $P$  = principal invested

$r$  = interest rate (as a decimal)

$t$  = time in years

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## Example

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Suppose \$5000 is invested at an interest rate of 8%. Find the amount in the account after ten years if the interest is compounded

- annually
- semiannually
- daily

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