

GUIDED NOTES – 6.5 LOGARITHMIC PROPERTIES

LEARNING OBJECTIVES

In this section, you will:

- Use the product rule for logarithms.
- Use the quotient rule for logarithms.
- Use the power rule for logarithms.
- Expand logarithmic expressions.
- Condense logarithmic expressions.
- Use the change of base formula for logarithms.

USING THE PRODUCT RULE FOR LOGARITHMS

- Recall that the logarithmic and exponential functions “undo” each other. This means they have similar properties. Some important properties are:
 - $\log_b(1) = \underline{\hspace{2cm}}$
 - $\log_b(b) = \underline{\hspace{2cm}}$
 - Inverse property:

$$\log_b(b^x) = \underline{\hspace{2cm}} \text{ and } b^{\log_b(x)} = \underline{\hspace{2cm}}, x > 0$$

- One-to-One property:

$$\log_b M = \log_b N \text{ if and only if } M = N$$

Study the box in your textbook section titled “the product rule for logarithms”.

- The for logarithms can be used to simplify a logarithm of a product by rewriting it as a of individual logarithms.

$$\log_b(MN) = \underline{\hspace{3cm}} \text{ for } b > 0$$

- Write out the 2 step process for using the product rule of logarithms to write an equivalent sum of individual logarithms, given the logarithm of a product.
 - 1.
 - 2.

Try It: Read Example 1 in the text, then answer the following.

Expand $\log_b(8k)$.

USING THE QUOTIENT RULE FOR LOGARITHMS

Study the box in your textbook section titled “the product rule for logarithms.”

- The _____ for logarithms can be used to simplify a logarithm of a product by rewriting it as a _____ of individual logarithms.

$$\log_b\left(\frac{M}{N}\right) = \underline{\hspace{2cm}}$$

- Write out the 3 step process for using the quotient rule of logarithms to write an equivalent difference of individual logarithms, given the logarithm of a quotient.
 - 1.
 - 2.
 - 3.

Try It: Read Example 2 in the text, then answer the following.

Expand $\log_3\left(\frac{x+1}{x-2}\right)$.

USING THE POWER RULE FOR LOGARITHMS

Study the box in your textbook section titled “the power rule for logarithms”.

- The _____ for logarithms can be used to simplify a logarithm of a power by rewriting it as the _____ of the exponent times the logarithm of the _____.

$$\log_b(M^n) = \underline{\hspace{2cm}}$$

- Write out the 2 step process for using the power rule of logarithms to write an equivalent product of a factor and a logarithm, given the logarithm of a power.

1.

2.

Try It: Read Example 3 in the text, then answer the following.

Expand $\ln(x^2)$.

Try It: Read Example 4 in the text, then answer the following.

Expand $\ln\left(\frac{1}{x^2}\right)$.

Homework: You should now be ready to attempt problems 1-2 in “Homework – Section 6.5” on WeBWorK.

EXPANDING LOGARITHMIC EXPRESSIONS

Try It: Read Example 6 in the text, then answer the following.

Expand $\log\left(\frac{x^2y^3}{z^4}\right)$.

Try It: Read Example 7 in the text, then answer the following.

Expand $\ln(\sqrt[3]{x^2})$.

Try It: Read Example 8 in the text, then answer the following.

$$\text{Expand } \ln \left(\frac{(x-1)(2x+1)^2}{(x+3)(x-3)} \right).$$

Homework: You should now be ready to attempt problems 3-4 in “Homework – Section 6.5” on WeBWork.

CONDENSING LOGARITHMIC EXPRESSIONS

- Write out the 3 step process for writing an equivalent expression as a single logarithm, given a sum, difference, or product of a logarithm with the same base.

1.

2.

3.

Try It: Read Example 9 in the text, then answer the following.

$$\text{Condense } \log(3) - \log(4) + \log(5) - \log(6).$$

Try It: Read Example 10 in the text, then answer the following.

$$\text{Rewrite } \log(5) + 0.5 \log(x) - \log(7x - 1) + 3 \log(x - 1) \text{ as a single logarithm.}$$

Try It: Read Example 11 in the text, then answer the following.

Condense $4(3 \log(x) + \log(x + 5) - \log(2x + 3))$.

Homework: You should now be ready to attempt problems 5-8 in “Homework – Section 6.5” on WeBWork.

USING THE CHANGE-OF-BASE FORMULA FOR LOGARITHMS

Study the box in your textbook section titled “the change-of-base formula.”

- The change-of-base formula can be used to evaluate a logarithm with any _____. For any positive real numbers M , b , and n , where $n \neq 1$ and $b \neq 1$,

$$\log_b M = \underline{\hspace{2cm}}$$

- Write out the 2 step process for using the change-of-base formula to rewrite a logarithm as a quotient of logs with any positive base n , where $n \neq 1$, given a logarithm with the form $\log_b(M)$.

1.

2.

a.

b.

Try It: Read Example 13 in the text, then answer the following.

Change $\log_{0.5}(8)$ to a quotient of natural logarithms.

Homework: You should now be ready to attempt problems 9-10 in “Homework – Section 6.5” on WeBWork.