Section 5.3 Guided Notebook

Section 5.3 Properties of Logarithms

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Section 5.3 Properties of Logarithms

Section 5.3 Objective 1 Using the Product Rule, Quotient Rule, and Power Rule for Logarithms

In Section 5.2, you learned the following properties of logarithms:

General Properties of Logarithms
For $b > 0$ and $b \neq 1$,

1. $\log_b b = 1$
2. $\log_b 1 = 0$

Cancellation Properties of Exponentials and Logarithms
For $b > 0$ and $b \neq 1$,

1. $b^{\log_b b} = b$
2. $\log_b b^x = x$

It is now time to learn some more properties of logarithms. Write down the 3 properties of logarithms seen in Objective 1 of your eText. (You should watch the video proof of each property to get an understanding as to why these properties are true.)

Properties of Logarithms
If $b > 0$ and $b \neq 1$, u and v represent positive real numbers and r is any real number, then

1.

2.

3.

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Work through the video that accompanies Example 1:

Use the product rule for logarithms to expand each expression. Assume $x > 0$.

a. $\ln(5x)$

b. $\log_2(8x)$

True or False: $\log_b(u+b) = \log_b u + \log_b v$

Work through the video that accompanies Example 2:

Use the quotient rule for logarithms to expand each expression. Assume $x > 0$.

a. $\log_5\left(\frac{12}{x}\right)$

b. $\ln\left(\frac{x}{e^5}\right)$

True or False: $\log_b(u-b) = \log_b u - \log_b v$

True or False: $\log_b u - \log_b v = \frac{\log_b u}{\log_b v}$

Work through the video that accompanies Example 3:

Use the power rule for logarithms to rewrite each expression. Assume $x > 0$.

a. $\log 6^3$

b. $\log_{1/2} \sqrt[4]{x}$

True or False: $\left(\log_b u\right)^r = r \log_b u$

Work through the video that accompanies Example 4:

Use properties of logarithms to evaluate each expression without the use of a calculator.

a. $7^{\log_7 6 + \log_7 3}$

b. $e^{2\ln 5 - \frac{1}{3}\ln 64 + \ln 1}$

Section 5.3 Objective 2 Expanding and Condensing Logarithmic Expressions

Work through the interactive video that accompanies Example 5:

Use properties of logarithms to expand each logarithmic expression as much as possible.

a. $\log_7\left(49x^3\sqrt[5]{y^2}\right)$

b. $\ln\left(\dfrac{\left(x^2-4\right)}{9e^{x^3}}\right)$

Work through the interactive video that accompanies Example 6:

Use properties of logarithms to rewrite each expression as a single logarithm.

a. $\dfrac{1}{2}\log(x-1)-3\log z+\log 5$

b. $\dfrac{1}{3}\left(\log_3 x-2\log_3 y\right)+\log_3 10$

Section 5.3 Objective 3 Solving Logarithmic Equations Using the Logarithm Property of Equality

Why are logarithmic functions one-to-one?

Write down the **Logarithm Property of Equality.**

Work through the interactive video that accompanies Example 7:

Solve the following equations:

a. $\log_7(x-1) = \log_7 12$

b. $2\ln x = \ln 16$

Explain why $x = -4$ is **not** a solution to $2\ln x = \ln 16$.

Section 5.3 Objective 4 Using the Change of Base Formula

Look at your scientific calculator and locate the [log] key and the [ln] key. If you are given an expression such as $\log 50$ or $\ln 319$, you can use your calculator to evaluate these expressions. See if you can use your calculator to evaluate these two logarithmic expressions. You should get $\log 50 \approx 1.69897$ and $\ln 319 \approx 5.76519$. How would you use your calculator to evaluate the expression $\log_3 10$? The answer is that you need to change the base from base 3 to base 10 or base *e*.

Write down the **Change of Base Formula.**

You have the skills necessary to prove the Change of Base Formula! Watch the video proof of the Change of Base Formula and write your notes here.

At the end of the video proof, see how to evaluate the expression $\log_3 10$.

$\log_3 10 =$

Work through Example 8:
Approximate the following expressions. Round each to four decimal places.

a. $\log_9 200$

b. $\log_{\sqrt{3}} \pi$

Work through the video that accompanies Example 9:

Use the change of base formula and the properties of logarithms to rewrite as a single logarithm involving base 2.

$$\log_4 x + 3\log_2 y$$

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Work through the video that accompanies Example 10:

Use the change of base formula and the properties of logarithms to solve the following equation:

$$2\log_3 x = \log_9 16$$

Write down the **Summary of Logarithm Properties** as seen on page 5.3-18.