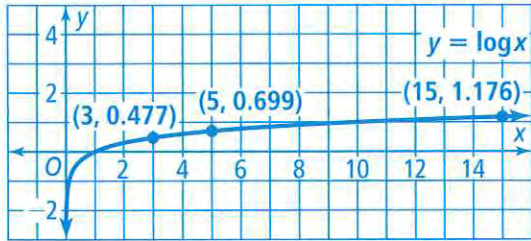


EXPLORE & REASON

Look at the graph of $y = \log x$ and the ordered pairs shown.



A. Complete the table shown.

x	3	5	15
$\log x$			

B. **Look for Relationships** What is the relationship between the numbers 3, 5, and 15? What is the relationship between the logarithms of 3, 5, and 15? © MP.7

C. What is your prediction for the value of $\log 45$? $\log 75$? Explain.

HABITS OF MIND

Generalize Do you think that the relationships you found in the Explore & Reason activity would also hold for natural logarithms? Give an example. © MP.8

EXAMPLE 1  **Try It!** Prove a Property of Logarithms

1. Prove the Quotient Property of Logarithms.

EXAMPLE 2  **Try It!** Expand Logarithmic Expressions

2. Use the properties of logarithms to expand each expression.

a. $\log_7\left(\frac{r^3t^4}{v}\right)$

b. $\ln\left(\frac{7}{225}\right)$

EXAMPLE 3  **Try It!** Write Expressions as Single Logarithms

3. Write each expression written as a single logarithm.

a. $5\log_2c - 7\log_2n$

b. $2\ln 7 + \ln 2$

HABITS OF MIND

Make Sense and Persevere Using the fact that $\log 2 \approx 0.3010$ and $\log 3 \approx 0.4771$, what is $\log 18$? Show how you know.  **MP.1**



Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How are the properties of logarithms used to simplify expressions and solve logarithmic equations?

2. **Vocabulary** While it is not necessary to change to base 10 when applying the Change of Base Formula, why is it common to do so?

3. **Error Analysis** Amanda claimed the expanded form of the expression $\log_4(c^2d^5)$ is $5\log_4 c + 5\log_4 d$. Explain the error Amanda made. © MP.3

Do You KNOW HOW?

4. Use the properties of logarithms to expand the expression $\log_6\left(\frac{49}{5}\right)$.

5. Use the properties of logarithms to write the expression $5 \ln s + 6 \ln t$ as a single logarithm.

6. Use the formula $\text{pH} = \log_{[H^+]}$ to write an expression for the concentration of hydrogen ions, $[H^+]$, in a container of baking soda with a pH of 8.9. © MP.4

