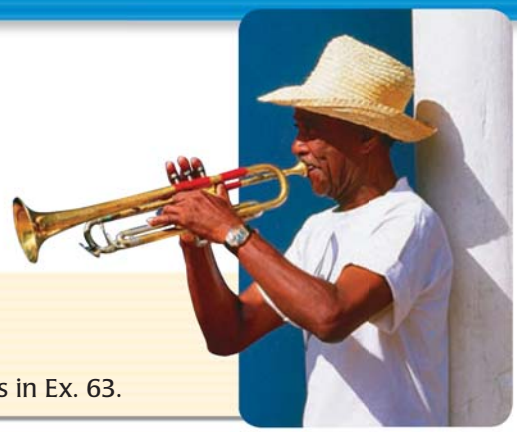
7.5 Apply Properties of Logarithms

TEKS a.2, 2A.2.A, 2A.11.C



Before You evaluated logarithms.

Now You will rewrite logarithmic expressions.

Why? So you can model the loudness of sounds, as in Ex. 63.

Key Vocabulary

- **base,** *p. 10*

KEY CONCEPT *For Your Notebook*

Properties of Logarithms

Let b, m, and n be positive numbers such that $b \neq 1$.

Product Property $\log_b mn = \log_b m + \log_b n$

Quotient Property $\log_b \frac{m}{n} = \log_b m - \log_b n$

Power Property $\log_b m^n = n \log_b m$

EXAMPLE 1 Use properties of logarithms

Use $\log_4 3 \approx 0.792$ and $\log_4 7 \approx 1.404$ to evaluate the logarithm.

AVOID ERRORS
Note that in general $\log_b \frac{m}{n} \neq \frac{\log_b m}{\log_b n}$ and $\log_b mn \neq (\log_b m)(\log_b n)$.

a. $\log_4 \frac{3}{7} = \log_4 3 - \log_4 7$ Quotient property

$\approx 0.792 - 1.404$ Use the given values of $\log_4 3$ and $\log_4 7$.

$= -0.612$ Simplify.

b. $\log_4 21 = \log_4 (3 \cdot 7)$ Write 21 as $3 \cdot 7$.

$= \log_4 3 + \log_4 7$ Product property

$\approx 0.792 + 1.404$ Use the given values of $\log_4 3$ and $\log_4 7$.

$= 2.196$ Simplify.

c. $\log_4 49 = \log_4 7^2$ Write 49 as 7^2.

$= 2 \log_4 7$ Power property

$\approx 2(1.404)$ Use the given value of $\log_4 7$.

$= 2.808$ Simplify.

GUIDED PRACTICE for Example 1

Use $\log_6 5 \approx 0.898$ and $\log_6 8 \approx 1.161$ to evaluate the logarithm.

1. $\log_6 \frac{5}{8}$ **2.** $\log_6 40$ **3.** $\log_6 64$ **4.** $\log_6 125$