## 7.4 Find Logarithms and Graph Logarithmic Functions

*pp. 499–505*

**EXAMPLE**

**Evaluate the logarithm.**

**a.** $\log_5 625$ **b.** $\log 0.001$ **c.** $\log_{125} 5$ **d.** $\log_2 \frac{1}{64}$

To help you find the value of $\log_b y$, ask yourself what power of $b$ gives you $y$.

**a.** 5 to what power gives 625?
$5^{4} = 625$, so $\log_5 625 = 4$.

**b.** 10 to what power gives 0.001?
$10^{-3} = 0.001$, so $\log 0.001 = -3$.

**c.** 125 to what power gives 5?
$125^{1/3} = 5$, so $\log_{125} 5 = \frac{1}{3}$.

**d.** 2 to what power gives $\frac{1}{64}$?
$2^{-6} = \frac{1}{64}$, so $\log_2 \frac{1}{64} = -6$.

### EXERCISES

**EXAMPLES 2, 4, 7, and 8** on p. 500–503 for Exs. 17–24

**Evaluate the logarithm without using a calculator.**

**17.** $\log_3 243$ **18.** $\log_7 1$ **19.** $\log_{1/6} 216$ **20.** $\log_{125} \frac{1}{5}$

**Graph the function. State the domain and range.**

**21.** $y = \log_{1/6} x$ **22.** $y = \log_3 x - 4$ **23.** $f(x) = \ln (x - 1) + 3$

**24. BIOLOGY** Researchers have found that after 25 years of age, the average size of the pupil in a person's eye decreases. The relationship between pupil diameter $d$ (in millimeters) and age $a$ (in years) can be modeled by $d = -2.1158 \ln a + 13.669$. What is the average diameter of a pupil for a person 25 years old? 50 years old?

## 7.5 Apply Properties of Logarithms

*pp. 507–513*

**EXAMPLES**

**Expand the expression.**

$$\log_5 \frac{6x}{y^3} = \log_5 6x - \log_5 y^3$$
$$= \log_5 6 + \log_5 x - \log_5 y^3$$
$$= \log_5 6 + \log_5 x - 3 \log_5 y$$

**Condense the expression.**

$$3 \log_3 8 - \log_3 16 = \log_3 8^3 - \log_3 16$$
$$= \log_3 \frac{8^3}{16}$$
$$= \log_3 32$$

### EXERCISES

**EXAMPLES 2 and 3** on p. 508 for Exs. 25–31

**Expand the expression.**

**25.** $\log_8 3xy$ **26.** $\ln 10x^3y$ **27.** $\log \frac{8}{y^4}$ **28.** $\ln \frac{3y}{x^5}$

**Condense the expression.**

**29.** $3 \log_7 4 + \log_7 6$ **30.** $\ln 12 - 2 \ln x$ **31.** $2 \ln 3 + 5 \ln 2 - \ln 8$