

7.4 Find Logarithms and Graph Logarithmic Functions

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?

d. 2 to what power gives $\frac{1}{64}$?

$125^{1/3} = 5$, so $\log_{125} 5 = \frac{1}{3}$.

$2^{-6} = \frac{1}{64}$, so $\log_2 \frac{1}{64} = -6$.

EXERCISES

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.

$$\begin{aligned} \log_5 \frac{6x}{y^3} &= \log_5 6x - \log_5 y^3 \\ &= \log_5 6 + \log_5 x - \log_5 y^3 \\ &= \log_5 6 + \log_5 x - 3 \log_5 y \end{aligned}$$

Condense the expression.

$$\begin{aligned} 3 \log_3 8 - \log_3 16 &= \log_3 8^3 - \log_3 16 \\ &= \log_3 \frac{8^3}{16} \\ &= \log_3 32 \end{aligned}$$

EXERCISES

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. $2 \ln 3 + 5 \ln 2 - \ln 8$

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

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