

**TRANSLATIONS** You can graph a logarithmic function of the form  $y = \log_b(x - h) + k$  by translating the graph of the parent function  $y = \log_b x$ .

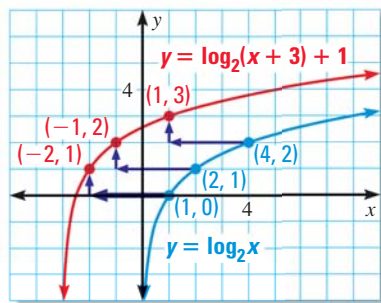
### EXAMPLE 8 Translate a logarithmic graph

Graph  $y = \log_2(x + 3) + 1$ . State the domain and range.

#### Solution

**STEP 1** Sketch the graph of the parent function  $y = \log_2 x$ , which passes through (1, 0), (2, 1), and (4, 2).

**STEP 2** Translate the parent graph left 3 units and up 1 unit. The translated graph passes through (-2, 1), (-1, 2), and (1, 3). The graph's asymptote is  $x = -3$ . The domain is  $x > -3$ , and the range is all real numbers.



### GUIDED PRACTICE for Examples 7 and 8

Graph the function. State the domain and range.

16.  $y = \log_5 x$

17.  $y = \log_{1/3}(x - 3)$

18.  $f(x) = \log_4(x + 1) - 2$

## 7.4 EXERCISES

### HOMEWORK KEY

= **WORKED-OUT SOLUTIONS**  
on p. WS1 for Exs. 13, 33, and 61

= **TAKS PRACTICE AND REASONING**  
Exs. 36, 61, 62, 64, and 65

### SKILL PRACTICE

1. **VOCABULARY** Copy and complete: A logarithm with base 10 is called a(n)     logarithm.

2. **WRITING** Describe the relationship between  $y = 5^x$  and  $y = \log_5 x$ .

**EXPONENTIAL FORM** Rewrite the equation in exponential form.

3.  $\log_4 16 = 2$

4.  $\log_7 343 = 3$

5.  $\log_6 \frac{1}{36} = -2$

6.  $\log_{64} 1 = 0$

7. **ERROR ANALYSIS** Describe and correct the error in rewriting the equation  $2^{-3} = \frac{1}{8}$  in logarithmic form.

$\log_2 -3 = \frac{1}{8}$

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

8.  $\log_{15} 15$

9.  $\log_7 49$

10.  $\log_6 216$

11.  $\log_2 64$

12.  $\log_9 1$

13.  $\log_{1/2} 8$

14.  $\log_3 \frac{1}{27}$

15.  $\log_{16} \frac{1}{4}$

16.  $\log_{1/4} 16$

17.  $\log_8 512$

18.  $\log_5 625$

19.  $\log_{11} 121$

**EXAMPLE 1**  
on p. 499  
for Exs. 3–7

**EXAMPLE 2**  
on p. 500  
for Exs. 8–19