Evaluate the logarithm. Use a calculator if necessary.

**6.** 
$$\log_{27} 3$$

9. WHAT IF? Use the function in Example 4 to estimate the wind speed near a tornado's center if its path is 150 miles long.

**INVERSE FUNCTIONS** By the definition of a logarithm, it follows that the logarithmic function  $g(x) = \log_h x$  is the inverse of the exponential function  $f(x) = b^x$ . This means that:

$$g(f(x)) = \log_b b^x = x$$
 and  $f(g(x)) = b^{\log_b x} = x$ 

# **EXAMPLE 5** Use inverse properties

Simplify the expression.

**a.** 
$$10^{\log 4}$$

**b.** 
$$\log_5 25^x$$

**Solution** 

**a.** 
$$10^{\log 4} = 4$$

$$b^{\log_b x} = x$$

**b.** 
$$\log_5 25^x = \log_5 (5^2)^x$$

Express 25 as a power with base 5.

$$=\log_5 5^{2x}$$

Power of a power property

$$=2x$$

$$\log_b b^x = x$$

# **EXAMPLE 6** Find inverse functions

Find the inverse of the function.

**a.** 
$$y = 6^x$$

**b.** 
$$y = \ln (x + 3)$$

### **REVIEW INVERSES**

For help with finding inverses of functions, see p. 437.

#### **Solution**

- **a.** From the definition of logarithm, the inverse of  $y = 6^x$  is  $y = \log_6 x$ .
- $y = \ln (x + 3)$  Write original function.

$$x = \ln(y + 3)$$
 Switch x and y.

$$e^{x} = y + 3$$

$$e^{x} - 3 = y$$

▶ The inverse of  $y = \ln(x + 3)$  is  $y = e^x - 3$ .

# **GUIDED PRACTICE**

### for Examples 5 and 6

Simplify the expression.

**10.** 
$$8^{\log_8 x}$$

11. 
$$\log_7 7^{-3x}$$
 12.  $\log_2 64^x$ 

**12.** 
$$\log_2 64^x$$

13. 
$$e^{\ln 20}$$

**14.** Find the inverse of 
$$y = 4^x$$
.

**15.** Find the inverse of 
$$y = \ln (x - 5)$$
.