

## Section 3.4 Solve Exponential and Log Equations

**Objective** Given an equation students will use the definition of logarithms to solve for the value of  $x$ .

Study Problems Page 254 # 3,9,15-60 (\*3) 81-95 odd

**Example** Find the value of  $x$ .

a.  $81^x = 27$

$$3^{4x} = 3^3$$

$$4x = 3$$

$$x = \frac{3}{4}$$

Describe how to evaluate an exponential expression.

b.  $36^{5x+2} = \left(\frac{1}{6}\right)^{11-x}$

$$6^{2(5x+2)} = 6^{-11+x}$$

$$\begin{array}{r} 10x+4 = -11+x \\ -x-4 = -11+x \end{array}$$

$$x = \frac{-15}{9}$$

$$x = -\frac{5}{3}$$

### Example

Find the value of  $x$ .

$$\log_b b = 1$$

a.  $27^{x-4} = 5$

$$\log_{27} 27^{x-4} = \log_{27} 5$$

$$x-4 = \log_{27} 5$$

$$x = \log_{27} 5 + 4$$

$$x \approx 4.49$$

If we had  $27^{x-4} = -5$ , what do you do first?

$$27^{x-4} = -1$$

NO soln b/c can't have a negative argument

### Example Find the value of $x$ .

a.  $e^x + 6 = 21$

$$\ln e^x = \ln 15$$

$$x = \ln 15$$

$$x \approx 2.71$$

Describe how to evaluate an exponential expression.

b.  $3(e^x) - 3 = 15$

$$\frac{3e^x}{3} = \frac{18}{3}$$

$$\ln e^x = \ln 6$$

$$x = \ln 6 \leftarrow \text{exact}$$

$$x \approx 1.79$$

**Example** Find the value of x.

a.  $\log_4 2 + \log_4 x = 2$

$$\log_4 2x = 2$$

$$2x = 4^2$$

$$2x = 16$$

$$\boxed{x = 8}$$

b.  $\ln x + \ln 5 = 25$

$$\ln 5x = 25$$

$$5x = e^{25}$$

$$x = \frac{e^{25}}{5} \text{ exact}$$

$$x \approx 1.44 \times 10^{10}$$

**Example** Find the value of x.

a.  $\log_2 x - \log_2 (x+4) = 1$

$$\log_2 \frac{x}{x+4} = 1$$

$$\frac{x}{x+4} = 2^1$$

$$2(x+4) = x$$

$$2x+8 = x$$

$$8 = -x$$

$$\underline{\underline{-8 = x}}$$

b.  $\log_4 x - \log_4 (x-2) = 2$

no soln

NO (-) argument