

# 7.6 Solve Exponential and Logarithmic Equations

TEKS

2A.11.A, 2A.11.C,  
2A.11.D, 2A.11.F

**Before**

You studied exponential and logarithmic functions.

**Now**

You will solve exponential and logarithmic equations.

**Why?**

So you can solve problems about astronomy, as in Example 7.



## Key Vocabulary

- exponential equation
- logarithmic equation
- extraneous solution, p. 52

**Exponential equations** are equations in which variable expressions occur as exponents. The result below is useful for solving certain exponential equations.

## KEY CONCEPT

*For Your Notebook*

### Property of Equality for Exponential Equations

**Algebra** If  $b$  is a positive number other than 1, then  $b^x = b^y$  if and only if  $x = y$ .

**Example** If  $3^x = 3^5$ , then  $x = 5$ . If  $x = 5$ , then  $3^x = 3^5$ .

## EXAMPLE 1 Solve by equating exponents

$$\text{Solve } 4^x = \left(\frac{1}{2}\right)^{x-3}.$$

$$4^x = \left(\frac{1}{2}\right)^{x-3}$$

Write original equation.

$$(2^2)^x = (2^{-1})^{x-3}$$

Rewrite 4 and  $\frac{1}{2}$  as powers with base 2.

$$2^{2x} = 2^{-x+3}$$

Power of a power property

$$2x = -x + 3$$

Property of equality for exponential equations

$$x = 1$$

Solve for  $x$ .

► The solution is 1.

**CHECK** Check the solution by substituting it into the original equation.

$$4^1 \stackrel{?}{=} \left(\frac{1}{2}\right)^{1-3}$$

Substitute 1 for  $x$ .

$$4 \stackrel{?}{=} \left(\frac{1}{2}\right)^{-2}$$

Simplify.

$$4 = 4 \checkmark$$

Solution checks.



## GUIDED PRACTICE for Example 1

Solve the equation.

1.  $9^{2x} = 27^{x-1}$

2.  $100^{7x+1} = 1000^{3x-2}$

3.  $81^{3-x} = \left(\frac{1}{3}\right)^{5x-6}$