

6-6

Exponential
and Logarithmic
Equations
 PearsonRealize.com

 **MODEL & DISCUSS**

A store introduces two new models of fitness trackers to its product line. A glance at the data is enough to see that sales of both types of fitness trackers are increasing. Unfortunately, the store has limited space for the merchandise. The manager decides that the store will sell both models until sales of TrackSmart exceed those of FitTracker.



- A. Find an equation of an exponential that models the sales for each fitness tracker. Describe your method.
- B. Based on the equations that you wrote, determine when the store will stop selling FitTracker.

HABITS OF MIND

Look for Relationships How do you know that the sales data is modeled by an exponential function? © MP.7



EXAMPLE 1

**Try It!** Solve Exponential Equations Using a Common Base

1. Solve each equation using a common base.

a. $25^{3x} = 125^{x+2}$

b. $0.001 = 10^{6x}$

EXAMPLE 2

**Try It!** Rewrite Exponential Equations Using Logarithms

2. Rewrite the equation $5^x = 12$ using logarithms.

HABITS OF MIND

Communicate Precisely In order to set the exponents of two exponential expressions equal to each other, what must be true about the exponential expressions? © MP.6



**EXAMPLE 3** **Try It! Solve Exponential Equations Using Logarithms**

3. What is the solution to $2^{3x} = 7^{x+1}$?

EXAMPLE 4 **Try It! Use an Exponential Model**

4. About how many minutes does it take the fire to spread to cover 100 acres?

HABITS OF MIND

Use Structure Why is it useful to use logarithms to solve an exponential equation? © MP.7

EXAMPLE 5 **Try It! Solve Logarithmic Equations**

5. Solve each equation.

a. $\log_5(x^2 - 45) = \log_5(4x)$

b. $\ln(-4x - 1) = \ln(4x^2)$

EXAMPLE 6 **Try It! Solve Logarithmic and Exponential Equations by Graphing**

6. Solve each equation by graphing. Round to the nearest thousandth.

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

b. $\ln(3x - 1) = x - 5$

HABITS OF MIND

Generalize Summarize the procedure for solving a logarithmic equation. © MP.8



Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How do properties of exponents and logarithms help you solve equations?

2. **Vocabulary** Jordan claims that $x^2 + 3 = 12$ is an exponential equation. Is Jordan correct? Explain your thinking.

3. **Communicate Precisely** How can properties of logarithms help to solve an equation such as $\log_6 (8x - 2)^3 = 12$? © MP.6

Do You KNOW HOW?

Solve. Round to the nearest hundredth, if necessary. List any extraneous solutions.

4. $16^{3x} = 256^{x+1}$

5. $6^{x+2} = 4^x$

6. $\log_5 (x^2 - 44) = \log_5 (7x)$

7. $\log_2 (3x - 2) = 4$

8. $4^{2x} = 9^{x-1}$

9. A rabbit farm had 200 rabbits in 2015. The number of rabbits increases by 30% every year. How many rabbits are on the farm in 2031?

