

6.5**Solving Exponential Equations**

For use with Exploration 6.5

Essential Question How can you solve an exponential equation graphically?

1 EXPLORATION: Solving an Exponential Equation Graphically

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

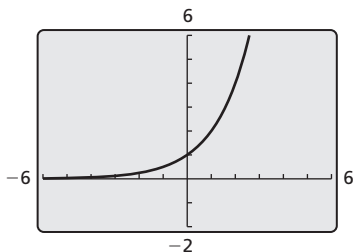
Work with a partner. Use a graphing calculator to solve the exponential equation $2.5^{x-3} = 6.25$ graphically. Describe your process and explain how you determined the solution.

2 EXPLORATION: The Number of Solutions of an Exponential Equation

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner.

- a. Use a graphing calculator to graph the equation $y = 2^x$.



- b. In the same viewing window, graph a linear equation (if possible) that does not intersect the graph of $y = 2^x$.
- c. In the same viewing window, graph a linear equation (if possible) that intersects the graph of $y = 2^x$ in more than one point.
- d. Is it possible for an exponential equation to have no solution? more than one solution? Explain your reasoning.

6.5 Solving Exponential Equations (continued)**3 EXPLORATION: Solving Exponential Equations Graphically**

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use a graphing calculator to solve each equation.

a. $2^x = \frac{1}{2}$

b. $2^{x+1} = 0$

c. $2^x = \sqrt{2}$

d. $3^x = 9$

e. $3^{x-1} = 0$

f. $4^{2x} = 2$

g. $2^{x/2} = \frac{1}{4}$

h. $3^{x+2} = \frac{1}{9}$

i. $2^{x-2} = \frac{3}{2}x - 2$

Communicate Your Answer

- How can you solve an exponential equation graphically?
- A population of 30 mice is expected to double each year. The number p of mice in the population each year is given by $p = 30(2^n)$. In how many years will there be 960 mice in the population?

6.5**Notetaking with Vocabulary**

For use after Lesson 6.5

In your own words, write the meaning of each vocabulary term.

exponential equation

Core Concepts**Property of Equality for Exponential Equations**

Words Two powers with the *same positive base* b , where $b \neq 1$, are equal if and only if their exponents are equal.

Numbers If $2^x = 2^5$, then $x = 5$. If $x = 5$, then $2^x = 2^5$.

Algebra If $b > 0$ and $b \neq 1$, then $b^x = b^y$ if and only if $x = y$.

Notes:

6.5 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–15, solve the equation. Check your solution.

1. $3^{4x} = 3^{12}$

2. $8^{x+5} = 8^{20}$

3. $6^{4x-5} = 6^{2x}$

4. $5^{6x-3} = 5^{-3+4x}$

5. $4^{2x+11} = 1024$

6. $8^{3-2x} = 512$

7. $4^{7-x} = 256$

8. $49^{x-2} = 343$

9. $36^{6x-1} = 6^{5x}$

10. $9^{x-4} = 81^{3x}$

11. $64^{x+1} = 512^x$

12. $6^{2x} = 36^{2x+1}$

6.5 Notetaking with Vocabulary (continued)

13. $\left(\frac{1}{7}\right)^x = 2401$

14. $\frac{1}{512} = 2^{3x-1}$

15. $25^{2-2x} = \left(\frac{1}{625}\right)^{x+1}$

In Exercises 16–21, use a graphing calculator to solve the equation.

16. $3^{x+3} = -9$

17. $\left(\frac{1}{4}\right)^{-x-1} = 18$

18. $3^x = -2^{-x+1}$

19. $2^{x+2} = 5^{x-3}$

20. $7^{-x+1} = -4^{x-1}$

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

22. You deposit \$1000 in a savings account that earns 5% annual interest compounded yearly.

a. Write an exponential equation to determine when the balance of the account will be \$1500.

b. Solve the equation.