6.3

Represent Exponential Expressions

Student Text Pages
362–367

Suggested Timing
80 min

Tools
- graphing calculators

Optional
- computers with *The Geometer's Sketchpad®*

Related Resources
BLM 6-8 Section 6.3 Represent Exponential Expressions
BLM 6-9 Section 6.3 Achievement Check Rubric
BLM A-9 Communication General Scoring Rubric

Link to Prerequisite Skills

Students should complete all the Prerequisite Skills questions before proceeding with this section.

Warm-Up

1. Write each power as a power with base 2.
- **a)** 4
- **b)** 8
- **c)** 32
- **d)** 4^2

2. Which expressions are equal to 9? Explain your answers.
- **a)** 3^2
- **b)** $\sqrt{81}$
- **c)** $729^{\frac{1}{3}}$
- **d)** 9^0

Warm-Up Answers

1. a) 2^2
- **b)** 2^3
- **c)** 2^5
- **d)** $(2^2)^2 = 2^4$

2. a) Yes; $3^2 = 9$.
- **b)** Yes; $\sqrt{81} = 9$.
- **c)** Yes; $729^{\frac{1}{3}} = 9$.
- **d)** No; $9^0 = 1$.

Teaching Suggestions

Warm-Up

- Display the Warm-Up questions. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

- Ask students what types of games they play on the Internet. Ask if students play any word search games. Some examples are Scramble, SCRABBLE®, Lexulous, and Pathwords.

Investigate

- In this Investigate, students model and solve a problem involving two exponential relationships. Students may need some prompts to help them explain the equations. Have them reread the introduction to the Investigate if they have trouble.
- The system of two equations is similar to the linear systems students have been solving since grade 9. The point of intersection represents the day and score when the two friends are evenly matched.

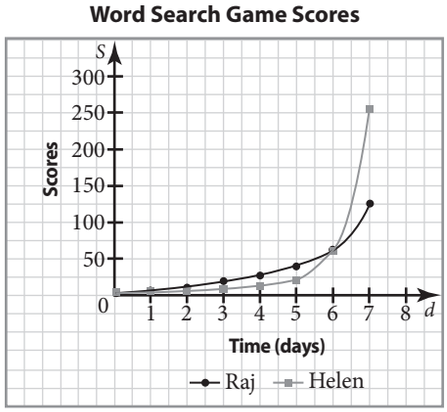
Investigate Answers (pages 362–363)

1. a) Raj's score doubles after every day.

b) Helen's score quadruples after every day.

c) Helen started playing three days after Raj, so the -3 in her equation represents a score of one on the day that she starts playing.

2.



3. a) six days

b) 64 points

c) This is the point where the two graphs intersect.

4. Answers may vary. For example: Use algebra. Set Raj's equation to equal Helen's, $2^d = 4^{d-3}$, and solve for the variable d.

Examples

- Example 1 provides a required scaffolding skill, which is to write a given power in terms of a different base. These questions are slightly more challenging than the Warm Up questions.
- Example 2 extends this concept to writing both sides of an equation involving powers with different bases in terms of powers having the same base. This allows students to set the expressions in the exponents equal so they can solve for the variable. Students will need to use the exponent laws and other algebraic skills, such as the distributive property, to solve these types of problems.
- Example 3 shows an algebraic solution to the Investigate problem. It is important for students to see the connections between the graphic and algebraic representations of the same scenario.
- Other techniques for solving exponential expressions are explored in section 6.4.

Key Concepts

- Review the Key Concepts as a class. Have students provide examples to illustrate each concept.

Discuss the Concepts

- Have students work in pairs and use a think-pair-share strategy.

Discuss the Concepts Suggested Answers (page 365)

D1. True. $4^2 = 2^4 = 256^{\frac{1}{2}}$; $3^4 = 9^2 = 6561^{\frac{1}{2}}$.

D2. C. $4 = 22$. Applying the power of a power law gives:

$$\begin{aligned} 4^x &= (2^2)^x \\ &= 2^{2x} \end{aligned}$$

Practise (A)

- You may wish to have students work in pairs or small groups to complete the Practise questions.
- Encourage students to refer to the Examples before asking for assistance.
- Have students check their answers to **questions 1 to 4** using a calculator.
- Students can check their answers to **questions 5 to 7** using graphing technology by following these steps:
  - Enter the left side of the equation as one function.
  - Enter the right side of the equation as a second function.
  - Graph both functions on the same grid.
  - Use zoom, trace, and/or other features to locate the point of intersection.

Apply (B)

- **Question 8** is an Achievement Check question. You may wish to use **BLM 6-9 Section 6.3 Achievement Check Rubric** to assist you in assessing your students' responses.
- **Questions 10 and 11** provide opportunities to assess students' abilities to reason and communicate. You may wish to use **BLM A-9 Communication General Scoring Rubric** to assess students' understanding.

Extend (C)

- Assign the Extend questions to students who are not being challenged by the Apply questions.
- **Question 13** introduces techniques used in section 6.4.

Common Errors

- When rewriting a power using a different base, students have trouble determining the exponent of the new power.

R_x Have students do some of the questions using a calculator and systematic trial, until they gain confidence in performing this skill by inspection.

Accommodations

Memory—use simple equations to review the process of solving equations before starting this section

Perceptual—provide a series of equivalent expressions similar to those in **Example 1**. Have students check that the expressions are equal using a calculator. Then, have the students practise finding equivalent expressions for powers before introducing the process of solving exponential equations involving powers.

ESL—provide a partner to help students read and understand the Investigate, Examples, and Practise questions. Remind students to use the information on page 366 for **questions 8 and 9**. Ensure they understand what they are reading. Have students add new terms to their personal math dictionaries.

Achievement Check Answers (page 366)

8. a) 81 people

b) 729 people

c) Solve the equation.

$3^d = 9^{d-6}$

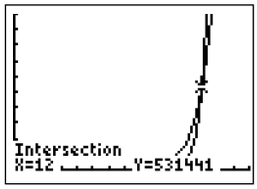
$3^d = (3^2)^{d-6}$

$3^d = 3^{2d-12}$

$d = 2d - 12$

$12 = d$

After 12 days, there will be an equal number of people who have heard both rumours.



Xmin = 0, Xmax = 15, Xscl = 1, Ymin = 0, Ymax = 1 000 000, Yscl = 100 000

The graph shows an intersection at the point (12, 531 441), which verifies that there will be an equal number of people who have heard both rumours after 12 days.

d) 531 441 people

e) Assume the models are still accurate after 12 days. This means that there are enough people available (more than half a million) to hear the rumours, which is not very reasonable.

Literacy Connect

- Allow students to work in pairs to provide support when completing the Investigate and the Practise questions.
- Encourage students to continue adding new terms to their personal math dictionaries.
- Have students discuss the meaning of each term in pairs or as a class.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	13
Reasoning and Proving	9–11, 13
Reflecting	5, 7, 8, 10–12
Selecting Tools and Computational Strategies	5–7, 11, 13
Connecting	11, 12
Representing	8, 11–13
Communicating	8–11, 13

Extra Practice

- Use **BLM 6-8 Section 6.3 Represent Exponential Expressions** for extra practice or remediation.