3 Powers and Exponents

General Outcomes

- Develop number sense.

Specific Outcomes

N1 Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by:
- representing repeated multiplication using powers
- using patterns to show that a power with an exponent of zero is equal to one
- solving problems involving powers.

N2 Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents.

N4 Explain and apply the order of operations, including exponents, with and without technology.

By the end of this chapter, students will be able to:

Section	Understanding Concepts, Skills, and Processes
3.1	✓ represent repeated multiplication with exponents
	✓ describe how powers represent repeated multiplication
	✓ build models of powers
	✓ evaluate powers with integral bases (excluding base 0) and whole number exponents
	✓ evaluate powers that include parentheses
3.2	✓ explain the exponent laws for multiplying or dividing powers with the same base
	✓ explain the exponent law for raising a power to an exponent
	✓ explain the exponent law for raising a product and a quotient to an exponent
	✓ explain the exponent law for powers with an exponent of zero
	✓ identify the error in a simplification of an expression involving powers
3.3	✓ use the order of operations on expressions with powers ✓ apply the laws of exponents
	✓ determine the sum of two powers ✓ determine the difference of two powers
	✓ identify the error in applying the order of operations in an incorrect solution
3.4	✓ solve problems by applying the order of operations
	✓ solve problems that require combining powers
	✓ use powers to solve problems that involve repeated multiplication

Assessment	Supporting Learning
Assessment *for* Learning	
Method 1: Use the Math Link introduction on page 91 in *MathLinks 9* to activate student prior knowledge about the skills and processes that will be covered in this chapter. **Method 2:** Have students develop a journal entry to explain what they personally know about exponents and powers. Also, ask what students know about formulas related to area and volume of cubes, cylinders, rectangular prisms, and triangular prisms.	• **BLM 3–1 Chapter 3 Math Link Introduction** provides scaffolding for the Math Link introduction. • Have students use the What I Need to Work On section of their Foldable to keep track of the skills and processes that need attention. They can check off each item as they develop the skill or process at an appropriate level. • Students who require activation of prerequisite skills may wish to complete the Get Ready materials available on **BLM 3–2 Chapter 3 Get Ready**, in the *MathLinks 9 Practice and Homework Book*, and at the www.mathlinks9.ca book site.
Assessment *as* Learning	
Literacy Link (page 89) At the beginning of the chapter, work with students to model the use of a spider map.	• After completing an introduction to the chapter, work with students to start the first leg of the spider map, entitled Using Exponents. This leg might include terms such as *base*, *power*, and *exponent*.
Chapter 3 Foldable As students work on each section in Chapter 3, have them keep track of any problems they are having in the What I Need to Work On section of their Foldable.	• As students complete each section, have them review the list of items they need to work on and check off any that have been handled.
Assessment *for* Learning	
BLM 3–3 Chapter 3 Warm-Up This BLM includes four warm-ups, one to be used at the beginning of each section. Each warm-up provides cumulative review questions for the entire student resource to that point, as well as mental math practice.	• As students complete questions from previous chapters, note which skills they are retaining and which ones may need additional reinforcement. • Use the warm-up to provide additional opportunities for students to demonstrate their understanding of the chapter material. • Have students share their strategies for completing mental math calculations.

Problems of the Week

Have all students try at least one of the problems on **BLM 3–4 Chapter 3 Problems of the Week**. Many of these problems require students to think outside the box and experiment with a variety of approaches. Some have definitive answers; others can be answered in more than one way.

Students can take the problems home and consult with parents or guardians, work with other students when their work is completed, or try them on their own. The questions take a varying amount of time to solve, depending on the particular student and the problem itself. You may wish to give out these problems at the beginning of the chapter and discuss the solutions at appropriate times throughout your work on the chapter.

Chapter 3 Planning Chart

Section/ Suggested Timing	Prerequisite Skills	Materials/Technology	Teacher's Resource Blackline Masters	Exercise Guide	Extra Support	Assessment		
						Assessment *as* Learning	Assessment *for* Learning	Assessment *of* Learning
Chapter Opener • 40–50 minutes (TR page 127)	Students should be familiar with • formulas for surface area and volume of rectangular prisms, cylinders, and triangular prisms	• six sheets of 8.5 × 11 paper • scissors • ruler • stapler	Master 17 Spider Map BLM 3–1 Chapter 3 Math Link Introduction BLM 3–2 Chapter 3 Get Ready BLM 3–4 Chapter 3 Problems of the Week		Online Learning Centre	TR page 126 Chapter 3 Foldable, TR page 126	TR page 126	
3.1 Using Exponents to Describe Numbers • 45–60 minutes (TR page 131)	Students should be familiar with • multiplying and dividing integers	• calculator	Master 2 Communication Peer Evaluation BLM 3–3 Chapter 3 Warm-Up BLM 3–5 Section 3.1 Extra Practice BLM 3–6 Section 3.1 Math Link	**Essential:** #1–3, 5, 6, 8, 11, 12, 14, Math Link **Typical:** #1–3, 5, 6, 8, 11, 12, 14, 16, Math Link **Extension/Enrichment:** #1–3, 12, 16–23	*MathLinks 9 Practice and Homework Book* *MathLinks 9 Solutions Manual*	Master 2 Communication Peer Evaluation TR pages 132, 138 Math Learning Log, TR page 138 Chapter 3 Foldable, TR page 138	TR pages 135, 138	
3.2 Exponent Laws • 50–60 minutes (TR page 139)	Students should be familiar with • multiplying and dividing integers	• calculator	Master 2 Communication Peer Evaluation BLM 3–3 Chapter 3 Warm-Up BLM 3–7 Section 3.2 Extra Practice	**Essential:** #1–4, 6, 7, 9, 11, 14, 17, 19 **Typical:** #1–4, 6, 7, 8, 9, 11, 14, 17, 19, 20, 21 **Extension/Enrichment:** #1–4, 13, 15, 17, 20–23, 25, 26	*MathLinks 9 Practice and Homework Book* *MathLinks 9 Solutions Manual*	Master 2 Communication Peer Evaluation TR pages 140, 147 Math Learning Log, TR page 147 Chapter 3 Foldable, TR page 147	TR pages 144, 147	
3.3 Order of Operations • 50–60 minutes (TR page 148)	Students should be familiar with • order of operations	• calculator • ruler (optional)	Master 2 Communication Peer Evaluation BLM 3–3 Chapter 3 Warm-Up BLM 3–8 Section 3.3 Extra Practice BLM 3–9 Section 3.3 Math Link	**Essential:** #1–8, 10, 11, 15, Math Link **Typical:** #1–8, 10, 11, 14, 15, 18, Math Link **Extension/Enrichment:** #1–4, 11, 12, 17–18	*MathLinks 9 Practice and Homework Book* *MathLinks 9 Solutions Manual*	Master 2 Communication Peer Evaluation TR pages 149, 154 Math Learning Log, TR page 154 Chapter 3 Foldable, TR page 154	TR pages 151, 154	
3.4 Using Exponents to Solve Problems • 50–60 minutes (TR page 155)	Students should be familiar with • the Pythagorean relationship • formulas for area and circumference of circles	• ruler (optional) • scissors (optional)	Master 2 Communication Peer Evaluation BLM 3–3 Chapter 3 Warm-Up BLM 3–10 Section 3.4 Extra Practice BLM 3–11 Section 3.4 Math Link	**Essential:** #1–3, 5, 7, 9, Math Link **Typical:** #1–3, 5, 7, 9, 11, Math Link **Extension/Enrichment:** #1, 2, 6, 9, 11	*MathLinks 9 Practice and Homework Book* *MathLinks 9 Solutions Manual*	Master 2 Communication Peer Evaluation TR pages 156, 161 Math Learning Log, TR page 161 Chapter 3 Foldable, TR page 161	TR pages 158, 161	
Chapter 3 Review • 40–50 minutes (TR page 162)		• calculator	BLM 3–5 Section 3.1 Extra Practice BLM 3–7 Section 3.2 Extra Practice BLM 3–8 Section 3.3 Extra Practice BLM 3–10 Section 3.4 Extra Practice	Have students do at least one question related to any concept, skill, or process that has been giving them trouble.	*MathLinks 9 Practice and Homework Book* *MathLinks 9 CAB*	Chapter 3 Foldable, TR page 163	TR page 163	
Chapter 3 Practice Test • 40–50 minutes (TR page 164)		• calculator	BLM 3–12 Chapter 3 Test	Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Minimum:** #1, 2, 4–6, 11	*MathLinks 9 CAB*		TR page 165	TR page 165 BLM 3–12 Chapter 3 Test
Chapter 3 Math Link: Wrap It Up! • 80–100 minutes (TR page 166)		• ruler • construction paper or other heavy paper • scissors • tape and/or glue • coat hangers, wire, fishing line • coloured pencils and markers • other materials for making a mobile	Master 1 Project Rubric BLM 3–1 Chapter 3 Math Link Introduction BLM 3–6 Section 3.1 Math Link BLM 3–9 Section 3.3 Math Link BLM 3–11 Section 3.4 Math Link BLM 3–13 Chapter 3 Math Link: Wrap It Up!		Online Learning Centre			TR page 167 Master 1 Project Rubric
Chapter 3 Challenge: Develop Your Own Online Tournament • 40–50 minutes (TR page 169)		• chips or counters (optional)	Master 1 Project Rubric		Online Learning Centre		TR page 171	TR page 171 Master 1 Project Rubric
Chapter 3 Challenge: Stopping the Spread of Harmful Bacteria • 40–50 minutes (TR page 173)		• calculator • poster paper • coloured pencils and markers • other materials for creating a poster • word-processing software (optional) • presentation software, such as PowerPoint (optional)	Master 1 Project Rubric		Online Learning Centre		TR page 174	TR page 174 Master 1 Project Rubric