Exponents and Radicals

Opener

***Mathematics 10,* pages 150–151**

Suggested Timing

30–40 min

Blackline Masters

BLM 4–2 Chapter 4 Prerequisite Skills
BLM 4–4 Chapter 4 Foldable
BLM 4–5 Chapter 4 Unit 2 Project
BLM U2–2 Unit 2 Project Checklist

Key Terms

perfect square
perfect cube
prime factorization
radical
index
entire radical
square root
cube root
irrational number
radicand
mixed radical

What's Ahead

In this chapter, students extend their understanding of powers and exponents. They begin by learning more about square roots and cube roots. Students then apply the exponent laws to expressions involving rational numbers or variables as bases and integers and rational numbers as exponents. They are then introduced to irrational numbers and learn to convert between powers with rational exponents and radicals and between mixed radicals and entire radicals.

Planning Notes

Introduce the chapter by having students discuss what they know about powers and exponents from previous math and science classes. Then, as a class, read the chapter opener and direct students to the collage of visuals on pages 150 and 151 in the student resource.

Point out Plimpton 322, which has three columns listing Pythagorean triples. Explain that a Pythagorean triple consists of three whole numbers that form the sides of a right triangle. For example, 3, 4, and 5 form a Pythagorean triple because $3^2 + 4^2 = 5^2$. Some scholars say that the tablet is the oldest surviving work in number theory, while others say that the tablet was a notebook used to learn and teach the Pythagorean triples. The Babylonians were using the Pythagorean theorem as early as 1750 B.C.E.

Brainstorm what the other visuals might represent. Ask about any connections between the visuals and the use of powers (or repeated multiplication).

Explain to students that they will build on their knowledge of powers and exponents and learn how to model situations involving growth and decay, such as in nature and finance.

Note that the pine cone, sunflower, and pentagram represent irrational numbers.

Direct students to the information about artists. Ask them about careers in art that they are familiar with. Have students discuss what they know about the work that these artists do, and how math skills might be related to their work. Point out that crafts such as stained glass, basket weaving, iron work, and ceramics often involve mathematics.

Unit Project

You might take the opportunity to discuss the Unit 2 project described in the Unit 2 opener on TR page 107. Throughout the chapter, there are individual questions for the unit project. These questions are not mandatory but are recommended because they provide some of the research needed for the final report for the Unit 2 project assignment.

The Unit 2 project is integrated throughout the chapter. You will find questions related to the project in the section 4.4 Investigate and the Check Your Understanding for sections 4.1 and 4.4.

Foldables™ Study Tool

Discuss with students the benefits of keeping a summary of what they are learning in the chapter. If they have used Foldables before, you may wish to have them report on how useful they found various designs.

- What designs have they used?
- Which designs were the most useful?
- What disadvantages do Foldables have?
- Which, if any, designs were hard to use?

- What other method(s) could they use to summarize their learning?

Discuss the Foldable design on page 151 and how it might be used to summarize Chapter 4. Encourage students to suggest revisions for this Foldable, or to replace this Foldable with another design of their choice. Allowing personal choice in this way will increase student ownership in their work.

Give students time to develop the summary method they have chosen. Ask them to include some method of keeping track of what they need to work on; discuss the advantage of doing this.

As students progress through the chapter, provide time for them to keep track of what they need to work on. This will assist them in identifying and solving any difficulties with concepts, skills, and processes. Have them check off each item as they deal with it.

Meeting Student Needs

- Consider having students complete the questions on **BLM 4–2 Chapter 4 Prerequisite Skills** to activate the prerequisite skills for this chapter.
- Some students may find it useful to use **BLM 4–4 Chapter 4 Foldable**, which summarizes the exponent laws. Have students staple or tape a copy to the centre panel of their Foldable. Alternatively, students can use the centre panel of the Foldable to list the exponent laws. If they do so, they can use the back of the inserts for sections 4.2 and 4.3 to provide their own examples of integral and radical exponents for each exponent law. Consider having students staple or tape a copy of **BLM U2–2 Unit 2 Project Checklist** to the centre panel on the back of the Foldable. They can check off items as they complete them.
- Some students may find it useful to keep a taped or oral summary of what they are learning. Others may work best with a keyboarded version using software of their choice.
- To reinforce the Key Terms after they are introduced, post sheets of paper around the room, each labelled with one Key Term. Have student pairs respond to the following prompts for each term: definition, example, and facts. Have student pairs move around the room and use diagrams and words to contribute to each Key Term. Once each pair has contributed, have students review all the entries. As a class, debrief each sheet to conclude the activity. Leave the sheets on display throughout the chapter.
- Throughout the chapter, encourage students to use strategies such as making models and drawing diagrams to help them move from the concrete to the abstract level. Encourage students to "say their thinking." Look and listen for unorthodox, yet mathematically correct procedures as much as you observe for correcting mathematically unsound procedures.
- Consider allowing students to work with a partner on all Unit 2 project questions.
- Some students may benefit from completing all unit project questions.
- **BLM 4–5 Chapter 4 Unit 2 Project** includes all of the unit project questions for this chapter. These provide a beginning for the Unit 2 project report.

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- Work through each worked example and solution as a class, demonstrating the process of solving each problem. Have students work in pairs to complete the Your Turn questions.

Enrichment

- Encourage students to consider forms of art from their cultural heritage that involve math. For example, students might research Aboriginal artists. They might use bead work as a starting point. Ask them to provide a sample. As a class, discuss how the samples might use mathematics.
- Encourage students who are interested in artists, training and qualifications, employment, and job outlook to research and present a report on a category of artist in which they are interested. Have them address how math concepts and skills are important in their area of interest.

Gifted

- Have students speculate as to why exponents exist and in what situations exponents are useful.

Career Connection

Use the photograph and the text to highlight career opportunities for artists, including craft artists, fine artists, art directors, multimedia artists, and animators. Invite students to research different careers within the arts. They may find the related Web Link that follows helpful.

WWW Web Link

For information about careers within the arts, go to www.mhrmath10.ca and follow the links.