Chapter 2 Lesson Plans

MathLinks 9 Pre-Planning for Chapter 2

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

1. Before getting started with lesson planning for Chapter 2 Rational Numbers, you need to understand what skills students have already been exposed to.

- If students in your jurisdiction have *not* completed the Grade 8 WNCP (2006) curriculum, they should have some understanding of the following outcomes from the previous curriculum:
  Grade 8 (1995):
  - ☑ Define, compare and order any rational numbers.
  - ☑ Represent square roots concretely, pictorially and symbolically.
  - ☑ Distinguish between a square root and its decimal approximation as it appears on a calculator.
  - ☑ Add, subtract, multiply and divide fractions concretely, pictorially and symbolically.
  - ☑ Estimate, compute and verify the sum, difference, product and quotient of rational numbers, using only decimal representations of negative rationals.
  - ☑ Estimate, compute (using a calculator) and verify approximate square roots of whole numbers and of decimals.

- If students in your jurisdiction *have* completed the new Grade 8 WNCP (2006) curriculum, they should have some understanding of the following:
  Grade 7 (2006):
  - ☑ Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.
  - ☑ Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:
    - benchmarks
    - place value
    - equivalent fractions and/or decimals.

Grade 8 (2006):

- ☑ Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).
- ☑ Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).
- ☑ Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially and symbolically.

2. Note that not every section within each chapter is meant to be a stand-alone lesson. In order to allow students time to experience the depth and breadth of a concept, some sections may take two or three classes to complete. The Teacher's Resource suggests time lines.

3. Before starting Chapter 2, read through the **chapter opener** (p. 42), **Key Words** (p. 43), **Math Links** (pp. 45, 54, 62, 71, and 81), and **Math Link: Wrap It Up!** (p. 85). These sections will provide a sense of how the chapter concepts are tied together and how students will be asked to apply their learning.

4. The chapter begins with a **Literacy Link** showing a graphic organizer (p. 43) and a **Foldable** feature (p. 44).

a) The Frayer model helps students organize their learning and activate previously learned concepts. **Master 16 Frayer Model** provides a reproducible copy.

b) Foldables provide unique ways for students to:

- organize their learning
- keep track of key words and examples
- organize their thinking
- track what they need to work on in the particular chapter and use for review later in the course

5. As part of your pre-planning for the chapter, review the related material in:

- the Teacher's Resource for support in meeting the needs of all learners, a list of common errors, language learning skills, and rubric notes for the Math Link: Wrap It Up! questions,
- the Blackline Masters (BLMs) for additional questions, scaffolding of all Math Links, a chapter test, and assessment assistance,
- the *MathLinks 9 Practice and Homework Book* for additional exercises and scaffolding for concepts, and
- the Teacher Centre of the McGraw-Hill Ryerson Online Learning Centre for examples of student work for the Challenges and Tasks, scoring rubrics, additional Challenges for students, and final exams.

MathLinks 9 Chapter 2, Lesson 1

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Resources/Materials:
- *MathLinks 9*, pp. 42–45
- Master 16 Frayer Model
- BLM 2–1 Chapter 2 Math Link Introduction
- BLM 2–2 Chapter 2 Get Ready or *MathLinks 9 Practice and Homework Book*, pp. 14–15
- BLM 2–4 Chapter 2 Problems of the Week
- sample chapter Foldable
- sheet of 11 × 17 paper
- ruler
- three sheets of 11 × 17 paper
- scissors
- sheet of grid paper
- stapler

Teacher's Resource:
pp. 55–58

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Starting Chapter 2:
If you do not have access to the Teacher's Resource, tell students that in Chapter 2 they will develop an understanding of rational numbers by extending their knowledge of fractions and decimals to include those with negative signs. Students begin by comparing and ordering rational numbers. Students also learn

to perform operations on rational numbers, including negative decimals and negative fractions, and to solve problems that involve rational numbers in decimal form and fraction form. Students determine exact square roots of positive rational numbers that are perfect squares and determine approximate square roots of positive rational numbers that are non-perfect squares. For the chapter problem, students develop and play a game that involves operations with positive and negative rational numbers. The individual Math Links help students develop the skills needed to complete the Math Link: Wrap It Up!

Introduction:
Before working on Chapter 2, review the Get Ready and the Math Link (p. 45). Decide whether students will complete both of the activities or only one of them. The Get Ready assesses how well students know the prerequisite skills for this chapter. The Math Link also activates students' prior knowledge and skills related to Chapter 2 and, in addition, introduces the chapter problem. Some students may benefit from reactivating their skills and knowledge of the following concepts: operations with positive fractions; operations with integers; squares and square roots of whole numbers; the Pythagorean relationship; area of a square; converting fractions to decimals and decimals to fractions; equivalent fractions, and integers.

Read the chapter opener together (p. 42). Read through the What You Will Learn (p. 42) and the Key Words (p. 43). How many students can already define or describe the key words?

Use the opening paragraph to discuss students' favourite games. If they mention video games, encourage them to name popular board games. Ask what the playing pieces for the games are. You might discuss how numbers are used in playing these games. Explain that they will use what they will learn about rational numbers to create and play a game of their own design at the end of the chapter.

Procedures/Activities/Instruction:
1. Have students complete the Get Ready. Use **BLM 2–2 Chapter 2 Get Ready** or *MathLinks 9 Practice and Homework Book* (pp. 14–15).
2. Have students complete a Frayer model for the term *rational number* (see Teacher's Resource p. 56 for prompts). You may wish to hand out **Master 16 Frayer Model** as a template. Collect these from students before they leave the class to get a better idea of students' recall and comprehension.
3. Explain the purpose of a Foldable and show students the one you have made. Identify the materials they need to make their own. Make the Foldable together as a class or have students make their own following the instructions (p. 44). They could label it as shown or according to your directions. Explain that the Foldable will help them keep track of their learning throughout the chapter.

4. Have students complete the Math Link. Begin by reading the Math Link as a class. Before students solve the problems, discuss how squares and square roots can be modelled using the areas and side lengths of squares. Some students may benefit from using **BLM 2–1 Chapter 2 Math Link Introduction**, which provides scaffolding.
   Discuss and remediate any areas that students have difficulty with before beginning the next lesson.

Problems of the Week:
BLM 2–4 Chapter 2 Problems of the Week provides additional problems to encourage ongoing problem solving and opportunities for students to use personal strategies in mathematics. These problems require students to think from different perspectives and experiment with a variety of approaches. Students can take the problems home and consult with parents, or work with a partner in class. Encourage students to complete at least one problem in each chapter.

Assessment:
1. Get Ready (Assessment *for* Learning)
2. Frayer model (Assessment *as* Learning)
3. Math Link (p. 45) (Assessment *for* Learning). You might use **BLM 2–1 Chapter 2 Math Link Introduction**.
4. Foldable (Assessment *for* Learning)

Math Link:
Have students use the back of the Foldable to make notes under the heading What I Need to Work On, and their notebook to record ideas for the Math Link: Wrap It Up! As a class, consider reading through each Math Link (pp. 45, 54, 62, 71, and 81), and the Math Link: Wrap It Up! (p. 85) so students have a good understanding of the chapter problem. The individual Math Links in the chapter help develop the skills needed to complete the Math Link: Wrap It Up! Notes about the Math Links throughout the chapter will appear under Assessment.

Foldable Entry:
Encourage students to add the following terms from the Get Ready and Math Link to their Foldable. Have them use diagrams to show an example of adding and subtracting fractions using a common denominator. Also, have them show an example of multiplying and dividing fractions using a common denominator and multiplying by the reciprocal of the second fraction. Remind them to use their own words and examples.

fraction	square	square root

MathLinks 9 Chapter 2, Lesson 2

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:

- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicators:

- ☑ Order a given set of rational numbers in fraction and decimal form, by placing them on a number line, e.g., $\frac{3}{5}$, –0.666..., 0.5, $-\frac{5}{8}$.
- ☑ Identify a rational number that is between two given rational numbers.

Resources/Materials:

- *MathLinks 9*, pp. 46–51
- Master 4 Number Lines
- BLM 2–3 Chapter 2 Warm-Up
- ruler
- Foldable

Teacher's Resource:

pp. 59–67

***MathLinks 9* Adapted Resource:**

See corresponding chapter for adapted materials to support individual students.

Introduction:

As a class, read and discuss the paragraph about populations (p. 46). Have students use the information in the Did You Know? to identify if they live in an urban or a rural area. Discuss how the table shows increases and decreases in population. Point out the negative decimals and ask students where they have seen these before (e.g., temperature values).

In the Explore, students consider negative decimals and negative fractions for the first time.

Procedures/Activities/Instruction:

1. Have students complete the warm-up questions for section 2.1 on **BLM 2–3 Chapter 2 Warm-Up** to reinforce material learned previously.
2. Have students work in pairs to complete the Explore. Make **Master 4 Number Lines** available. For #3, direct students to the Literacy Link (p. 47) about equivalent rational numbers. Point out that a negative fraction can be written with the negative sign assigned either to the numerator or the denominator. You might ask students to write some examples of equivalent fractions by moving the negative sign. Check that they are clear about how the placement of a negative sign in a fraction affects the value. Ask how many negative signs are needed for a fraction to be a positive value and how many are needed for a negative value. Have students record a summary about equivalent rational numbers in their Foldable.
   Once complete, have students discuss Reflect and Check #5 as a class.
3. Work through Examples 1 to 3 (pp. 48–50), which model, respectively, comparing and ordering rational numbers, comparing rational numbers, and identifying a rational number between two given rational numbers.
   For Example 1, it may be helpful to have students recall the symbols for *less than* and *greater than*. Students who get confused may find it helpful to recall that the symbol for *less than* (<) looks like an L and means left and less than.
   For Example 2, discuss the added difficulty of using fraction form instead of decimal form on a number line. (It is necessary to express the fractions as equivalent fractions with a common denominator.) Students should realize that the common denominator determines the number of divisions needed on the number line. Direct students to the Literacy Link (p. 49), which explains that the quotient of two integers with unlike signs is negative. Check understanding by having students write two equivalent fractions for $-\frac{1}{10}$ (i.e., $\frac{-1}{10}, \frac{1}{-10}$). You may wish to provide a series of positive and negative fractions, decimals, and integers and ask students to order them on a number line.
   After each worked example, have students complete the related Show You Know before going on.
4. As a class, discuss the Key Ideas (p. 50). Have students compare the information in their Foldable and the Key Ideas and then add any additional notes to their Foldable. Challenge students to add any methods they used that are not described in the Key Ideas to their Foldable.
5. Assign and then collect all students' individual work for Communicate the Ideas #1 to 3 (p. 51).

Assessment:

1. Section 2.1 on **BLM 2–3 Chapter 2 Warm-Up** (Assessment *for* Learning)
2. Reflect and Check #4 and 5 (p. 47) (Assessment *as* Learning)
3. Show You Know (pp. 48–50) (Assessment *for* Learning)
4. Communicate the Ideas #1 to 3 (p. 51) (Assessment *as* Learning)

5. Math Learning Log (Assessment *as* Learning)

Foldable Entry:
Have students define the following terms in their Foldable and provide an example for each.

rational number	opposite rational number	equivalent numbers

Math Learning Log:
Have students complete the following statement: To compare fractions on a number line, a common denominator is necessary because ...

MathLinks 9 Chapter 2, Lesson 3

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:

- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicators:

- ☑ Order a given set of rational numbers in fraction and decimal form, by placing them on a number line, e.g., $\frac{3}{5}$, –0.666..., 0.5, $-\frac{5}{8}$.
- ☑ Identify a rational number that is between two given rational numbers.

Resources/Materials:

- *MathLinks 9,* pp. 51–54
- *MathLinks 9 Practice and Homework Book*, pp. 16–17
- Master 2 Communication Peer Evaluation
- Master 4 Number Lines
- BLM 2–5 Section 2.1 Extra Practice
- BLM 2–6 Section 2.1 Math Link
- ruler
- Foldable

Teacher's Resource:

pp. 67–70

***MathLinks 9* Adapted Resource:**

See corresponding chapter for adapted materials to support individual students.

Introduction:

Start the lesson by recalling the Key Ideas. You might reactivate students' learning by providing a set of values that include fractions and decimals and asking them to compare and order the values on a number line. Check for understanding by asking where points that represent positive and negative numbers are located in relation to zero on the number line.

Explain that students will apply their knowledge to practise comparing and ordering rational numbers.

Procedures/Activities/Instruction:

1. As a class, discuss the responses to the Communicate the Ideas questions. Have students use **Master 2 Communication Peer Evaluation** to assess another student's response to one of #1 to 3.
2. Assign questions as outlined in the Assessment section below. Ensure that students are successful with the Practise questions before proceeding to the Apply questions. Support for re-teaching or alternative approaches for students who are not successful with the Practise questions can be found in the Teacher's Resource under Assessment – Supporting Learning (p. 70).

Assessment:

1. Student assignments (Assessment *for* Learning)
   Essential: #4, 6, 8, 10, 12, 14a), b), 16a), b), 18, Math Link
   Typical: #4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 23, Math Link
   Extension/Enrichment: #20, 22, 25–30, Math Link
   Note: Some students may benefit from completing **BLM 2–5 Section 2.1 Extra Practice**, if they have not already done so.
   If students complete the assigned questions before the end of class, have them begin the Math Link (p. 54). **BLM 2–6 Section 2.1 Math Link** is available for students who may benefit from scaffolding to get started on the Math Link.
2. The *MathLinks 9 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
3. Literacy Link (Assessment *as* Learning)
4. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldable.

Literacy Link:

Have students develop a Frayer model showing what they already know about integers at the beginning of section 2.1. Have them revisit their Frayer model at the end of the section.

Math Learning Log:

Have students complete the following statements:

- The method I prefer for comparing rational numbers in fraction form is ... because ...
- To identify a rational number between $\frac{4}{5}$ and $\frac{4}{6}$, I would ...

MathLinks 9 Chapter 2, Lesson 4

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicator:

☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.

Resources/Materials:
- *MathLinks 9*, pp. 55–59
- Master 4 Number Lines
- BLM 2–3 Chapter 2.2 Warm-Up
- ruler
- integer chips (optional)
- hundred grids (optional)
- base ten blocks (optional)
- Foldable

Teacher's Resource:
pp. 71–79

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
As a class, read and discuss the information about temperature in Regina (p. 55). Students have previously performed operations with integers, but not with negative decimals, so they are likely to use integers to complete the estimates. It would be reasonable for the students to use the integers −13 and +26 to arrive at an estimate of 39 ºC. To assist students, you might ask:
- Which operation will you use?
- Is −12.6 closest to −11, −12, or −13?
- Would using values of +30 and −10 be a reasonable way to determine the estimate? Explain.

If students have difficulty with mental estimation, encourage them to use a vertical number line to model the estimation with integers.

In the Explore, students compare, multiply, and divide negative decimals for the first time.

Procedures/Activities/Instruction:

1. Have students complete the warm-up questions for section 2.2 on **BLM 2–3 Chapter 2 Warm-Up** to reinforce material learned previously. You may wish to review their work.
2. Collect, orally mark, or take up the previous lesson's homework. Remind students to note any questions they had difficulty with in the What I Need to Work On section of their Foldable.
3. Have students complete the Explore with a partner. Some students may benefit from using integer chips, hundred grids, or base ten blocks to multiply and divide the numbers. Have students complete Reflect and Check #3 and 4 (p. 55) individually, and attempt a solution to their problem for #4 before challenging their partner to solve it. Encourage students to discuss each other's solution and suggest improvements to each other's problem.
4. As a class, walk through Examples 1 to 3 (pp. 56–59). Examples 1 and 2 illustrate strategies, respectively, for adding and subtracting, and multiplying and dividing rational numbers in decimal form. It is important not to focus solely on algebraic approaches.
   For the estimate in Example 1, point out the number line in the thought bubble. Show students how to use a number line for adding and subtracting decimals in the same way as they did for integers in previous grades. Make **Master 4 Number Lines** available. Base ten blocks are an excellent means of modelling multiplication and division of decimals. The use of technology should be encouraged once students are comfortable and can accurately make estimates.
   For Example 2, point out the Literacy Link (p. 57) about parentheses and ask students to show another way to write the expression in part a) of the Show You Know.
   Example 3 models solving a problem involving temperature changes. Point out the Literacy Link about the order of operations for rational numbers. Emphasize that the order is the same as for whole numbers, integers, and decimals.
   After each Example, have students complete the related Show You Know questions and encourage them to solve the problems using more than one method. Refer to the Teacher's Resource (p. 78) for additional support for the Show You Know questions.
5. Assign and then collect all students' individual work for Communicate the Ideas #1 to 3 (p. 59).

Assessment:

1. Section 2.2 on **BLM 2–3 Chapter 2 Warm-Up** (Assessment *for* Learning)
2. Reflect and Check #3 and 4 (Assessment *as* Learning)
3. Show You Know (pp. 57, 59) (Assessment *for* Learning)
4. Communicate the Ideas #1 to 3 (p. 59) (Assessment *as* Learning)
5. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students record their own example of each operation with rational numbers in decimal form and use two different methods to solve each one.

Math Learning Log:

Have students write their own summary of the order of operations for rational numbers.

MathLinks 9 Chapter 2, Lesson 5

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicator:

☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.

Resources/Materials:
- *MathLinks 9*, pp. 59–62
- *MathLinks 9 Practice and Homework Book*, pp. 18–19
- Master 2 Communication Peer Evaluation
- Master 4 Number Lines
- BLM 2–7 Section 2.2 Extra Practice
- BLM 2–8 Section 2.2 Math Link
- ruler
- Foldable

Teacher's Resource:
pp. 77–82

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
As a class, discuss the responses to the Communicate the Ideas questions. Have students discuss the methods they used. Clarify any misunderstandings.

Tell students that they will apply what they have learned about operations with rational numbers in decimal form to solve problems.

Procedures/Activities/Instruction:

1. Have students use **Master 2 Communication Peer Evaluation** to assess another student's response to one of Communicate the Ideas #1 to 3.

2. Discuss the Key Ideas (p. 59). Check for understanding by asking students how the number line models the examples of addition and subtraction of decimals. Have them record their own examples of using a number line to model addition of decimals and base ten blocks to model multiplication of decimals. Ask volunteers to show an example of each on the board.
3. Assign questions as outlined in the Assessment section below. For #8 and 9, refer students to the Literacy Link (p. 60) about using square brackets for grouping. For #8c), ask students why the value −0.5 is in round brackets. Students should know from earlier work with integers that a negative number is written in brackets if it follows an operation symbol. Students may have already encountered square brackets as grouping symbols when applying the order of operations. Remind students that the order of operations applies to calculations involving both square and round brackets. For #14, use the Literacy Link to clarify the meaning of *share*. Ensure that students are successful with the Practise questions before proceeding to the Apply questions. Support for re-teaching or alternative approaches for students who are not successful with the Practise questions can be found in the Teacher's Resource under Assessment – Supporting Learning (p. 82).

Assessment:

1. Student assignments (Assessment *for* Learning)
   Essential: #4, 6, 8, 10, 12, Math Link
   Typical: #4, 6, 8, 10, 12, 13, 16, 18, 22, Math Link
   Extension/Enrichment: #16, 20, 22, 24–29, Math Link
   Note: Some students may benefit from completing **BLM 2–7 Section 2.2 Extra Practice**, if they have not already done so.
   Encourage students who work quickly to start the Math Link (p. 62). **BLM 2–8 Section 2.2 Math Link** is available for students who may benefit from scaffolding to get started on the Math Link.
2. The *MathLinks 9 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
3. Literacy Link (Assessment *as* Learning)
4. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldable.

Literacy Link:

Have students develop a Frayer model showing what they already know about decimal numbers at the beginning of section 2.2. Have them revisit their Frayer model at the end of the section.

Math Learning Log:

Have students complete the following statement: Two ways I can complete $-2.3 \times (-3.4)$ are …

MathLinks 9 Chapter 2, Lesson 6

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:

- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicator:

☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.

Resources/Materials:

- *MathLinks 9*, pp. 63–67
- Master 4 Number Lines
- BLM 2–3 Chapter 2 Warm-Up
- ruler
- Foldable

Teacher's Resource:

pp. 83–91

***MathLinks 9* Adapted Resource:**

See corresponding chapter for adapted materials to support individual students.

Introduction:

As a class, discuss the photograph and information (p. 63) about Cindy Klassen, which includes values expressed in time notation and in fraction form. Direct students to the Literacy Link about how to interpret the times expressed in time notation. Ask them to express a time of 2 min 12.75 s in time notation. Before students answer the first question in the opening paragraph, you might ask them to explain what mixed numbers are and to give two examples. Some students may give their answers to the first question incorrectly in the form 1:55 $\frac{27}{100}$, i.e., using minutes and seconds. If so, ask students to express the total number of seconds in 1:55.27 as a decimal before converting this total to a mixed number of seconds. The second question involves converting a fraction to the equivalent decimal.

In the Explore, students solve problems involving adding and subtracting rational numbers using both decimal form and fraction form.

Procedures/Activities/Instruction:

1. Have students complete the warm-up questions for section 2.3 on **BLM 2–3 Chapter 2 Warm-Up** to reinforce material learned previously.
2. Collect, orally mark, or take up the previous lesson's assessment questions. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldable.
3. Have students work independently to complete the Explore. Provide **Master 4 Number Lines** to help them model their thinking. Discuss the results as a class.
   Have students complete Reflect and Check #5 individually. Invite students to show their response on the board. Discuss the variety of strategies that students used. Encourage them to identify the strategies that are most efficient and reliable for them and record these strategies in their Foldable.
4. Work through Examples 1 to 3 (pp. 64–66) as a class. These Examples extend students' previous work on operations with fractions and mixed numbers to include negative rational numbers.
   Example 1 models adding and subtracting rational numbers in fraction form, while Example 2 models multiplying and dividing rational numbers in fraction form. Invite students to use their own methods (not necessarily algebraic methods) to answer the questions. For instance, some students may use paper folding to model multiplying and dividing rational numbers in fraction form. Encourage students to estimate their answers before solving.
   Example 3 models an application of operations with rational numbers in fraction form that involves more than one operation. You might challenge students to think of another method to solve the problem (Add the three negative fractions, add the total to 1 to determine the fraction of the money that was left, and multiply this fraction by 30). Encourage students to record the method they prefer.
   After each Example, have students complete the related Show You Know questions individually, compare their solutions with those of a partner, and then discuss the solutions as a class. Encourage students to solve the problems using more than one method. Refer to the Teacher's Resource (p. 91) for additional support for the Show You Know questions.
5. As a class, discuss the Key Ideas that summarize operations with rational numbers (p. 67). You might encourage students to use their Foldable to record their own example of each of the five categories that follow the number line in the Key Ideas. Encourage them to include at least one negative fraction in each example.
6. Assign the Communicate the Ideas (pp. 67–68) as outlined in the Assessment section below and then collect all students' individual work.

Assessment:

1. Section 2.3 on **BLM 2–3 Chapter 2 Warm-Up** (Assessment *for* Learning)
2. Reflect and Check #5 (p. 63) (Assessment *as* Learning)
3. Show You Know (pp. 65–66) (Assessment *for* Learning)
4. Communicate the Ideas (pp. 67–68) (Assessment *as* Learning)
   Essential: #1–3
   Typical: #1–4
   Extension/Enrichment: #1–4
5. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students explain how different brackets are used in solving operations on rational numbers in fraction form. Does the purpose of brackets differ for rational numbers in fraction form than for decimal form? Explain.

Math Learning Log:

Have students complete the following statement: What I find most difficult about solving operations on rational numbers in fraction form is … because …

MathLinks 9 Chapter 2, Lesson 7

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N3 Demonstrate an understanding of rational numbers by:

- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

Achievement Indicator:

☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.

Resources/Materials:

- *MathLinks 9*, pp. 67–69
- *MathLinks 9 Practice and Homework Book*, pp. 20–21
- Master 2 Communication Peer Evaluation
- Master 4 Number Lines
- BLM 2–9 Section 2.3 Extra Practice
- BLM 2–10 Section 2.3 Math Link
- Foldable

Teacher's Resource:

pp. 92–96

***MathLinks 9* Adapted Resource:**

See corresponding chapter for adapted materials to support individual students.

Introduction:

Discuss the responses to the Communicate the Ideas questions as a class. Clarify any misunderstandings. You may wish to use #4 to reinforce students' learning about using a positive common denominator or pose the following question: Why would you write $-\frac{1}{10}$ as $\frac{-1}{10}$ rather than $\frac{1}{-10}$ in a subtraction problem? (It is easier to use a positive common denominator. Show students the result of assigning a negative sign such as –10 as the common denominator. Consider a problem such as: $\frac{-4-1}{-10}=\frac{-5}{-10}$. The result is correct but there are

more negative signs to deal with.) Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldable.

Tell students that they will apply what they have learned about operations with rational numbers in fraction form to solve problems.

Procedures/Activities/Instruction:

1. Have students use **Master 2 Communication Peer Evaluation** to assess another student's response to one of Communicate the Ideas #1 to 3.
2. Assign questions as outlined in the Assessment section below. Remind students to include a summary statement for each of #9 and 10 and use estimation to check that their answer is reasonable in the context of the problem. Ensure that students are successful with the Practise questions before proceeding to the Apply questions. Support for re-teaching or alternative approaches for students who are not successful with the Practise questions can be found in the Teacher's Resource under Assessment – Supporting Learning (p. 96).

Assessment:

1. Student assignments (Assessment *for* Learning)
   Essential: #5, 7, 9, 12, 13, Math Link
   Typical: #5, 7, 9, 12, 13 *or* 14, 15, one of 16–18, 20, Math Link, History Link
   Extension/Enrichment: #17, 19 *or* 20, 21–27, History Link
   Note: Some students may benefit from completing **BLM 2–9 Section 2.3 Extra Practice**, if they have not already done so.
   Encourage students who work quickly to start the Math Link or the History Link depending on the assignment (p. 71). **BLM 2–10 Section 2.3 Math Link** is available for students who may benefit from scaffolding to get started on the Math Link.
2. The *MathLinks 9 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
3. Literacy Link (Assessment *as* Learning)
4. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldable.

Literacy Link:

Have students develop a Frayer model showing what they already know about fractions at the beginning of section 2.3. Have them revisit their Frayer model at the end of the section.

Math Learning Log:

Have students complete the following statement: Two ways to divide rational numbers that are mixed numbers are ... The method I prefer is ... because ...

MathLinks 9 Chapter 2, Lesson 8

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine whether or not a given rational number is a square number and explain the reasoning.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Identify the error made in a given calculation of a square root, e.g., Is 3.2 the square root of 6.4?
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a given rational number as shown on a calculator may be an approximation.
- ☑ Identify a number with a square root that is between two given numbers.

Resources/Materials:

- *MathLinks 9*, pp. 72–78
- Master 4 Number Lines
- BLM 2–3 Chapter 2 Warm-Up
- ruler

- grid paper or Master 8 Centimetre Grid Paper and Master 9 0.5 Centimetre Grid Paper
- calculator
- Foldable

Teacher's Resource:
pp. 97–105

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
Begin by referring students to the photographs (pp. 72–73) that show the Great Pyramid of Giza. The view from above (p. 73) shows the square base of the pyramid. Draw students' attention to the information in the Did You Know? that accompanies the photograph, which conveys a sense of the enormous size of the pyramid and the work required in manually pulling and carrying stone blocks for placement. Then, as a class, read the opening paragraph. Have students work in groups to complete the estimate, in which they compare the dimensions of the base of the pyramid with the dimensions of a football field. You might use some of the following prompts to encourage student discussion:

- Will you include the end zones in the length of the field? Explain.
- What are the dimensions of a football field?
- Are all football fields the same size? Explain.
- Should you estimate the dimensions of a football field, or do you need exact values? Explain.

As a bridge to the Explore, which includes a question on the area of the base of the Great Pyramid, you might ask students to use their estimates to compare the area of the base of the pyramid to the area of a football field. From the estimate, students might conclude that the base of the pyramid is about eight times the area of a football field. Some students may need to draw a diagram to make this comparison.

In the Explore, students extend their knowledge of square roots of whole numbers to include the square roots of rational numbers.

Procedures/Activities/Instruction:

1. Have students complete the warm-up questions for section 2.4 on **BLM 2–3 Chapter 2 Warm-Up** to reinforce material learned previously.
2. Collect, orally mark, or take up the previous lesson's assessment questions. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldable.
3. Have students complete the Explore with a partner. Before they begin, direct students to the Literacy Link (p. 72) to help them recall the term *square root*. You might ask how the meaning of *square root* compares with the meaning of

square. Ask how they could use a diagram to show the relationship between the number 3 and its square.

For the Explore, make **Master 8 Centimetre Grid Paper** and **Master 9 0.5 Centimetre Grid Paper** available.

Discuss Reflect and Check #3 as a class. You might ask students what strategies they prefer and why. Encourage them to record the strategies that they find helpful in their Foldable. Estimates and methods will vary for #4. Have student pairs compare their estimates with another student pair, before discussing the estimates as a class.

Have students note any concept they had difficulty with in the What I Need to Work On section of their Foldable.

4. Before students begin the Link the Ideas section, help students recall what they already know about squares and square roots by having them make a perfect squares table as follows: Make a table with three columns. In column 1, list the numbers 1 to 20. In column 2, list the square of each number in column 1. In column 3, list the square root of each number in column 2. Have students compare the values in the three columns. This activity could be extended to include the squares and square roots of rational numbers.

Remind students of the importance of estimating before calculating for each worked example. Encourage them to refer to the table of perfect squares to help them estimate a value that falls between two perfect squares.

Encourage students to model the estimate and the calculation for each worked example using grid paper and/or a number line.

Example 1 (p. 74) models how to estimate and calculate area given a side length. Direct students to the Tech Link to help them recall how to use a calculator for determining the square of a number. Have them check that they can obtain the correct answer using their own calculator.

Example 2 (p. 75) extends students' understanding of perfect squares (previously limited to square roots of whole numbers) to include fractions and decimals. Students determine whether a rational number is a perfect square. Direct students to the Literacy Link about perfect squares. Consider asking students to provide an additional example of a perfect square in decimal form and fraction form. Ask them to explain why each example is a perfect square.

Example 3 (p. 76) extends students' understanding of square roots of perfect squares (previously limited to square roots of whole numbers) to include square roots of fractions and decimals. Students determine the square root of a perfect square. Direct students to the Literacy Link about square roots of perfect squares. Consider asking students to provide an additional example of a square root of a perfect square in decimal form and fraction form. Ask them to explain why each example is the square root of a perfect square.

Example 4 (p. 77) extends students' understanding of square roots of non-perfect squares (previously limited to square roots of whole numbers) to include square roots of fractions and decimals. Students determine the square root of a non-perfect square. Direct students to the definition of a non-perfect square and the Did You Know? about the properties of a square root of a non-perfect square before they work through the solutions.

After each Example, have students complete the related Show You Know questions (pp. 74–77) individually and then compare their solutions.

5. As a class, discuss the Key Ideas (p. 77). Draw attention to the first two statements and have students record an example of an area that is a decimal and a perfect square in their Foldable. For the other three statements, ask students to create their own examples and include them in a summary of the Key Ideas in their Foldable. Encourage them to store the table of perfect squares in their Foldable.
6. Assign and then collect all students' individual work for Communicate the Ideas #1 to 4 (p. 78).

Assessment:

1. Section 2.4 on **BLM 2–3 Chapter 2 Warm-Up** (Assessment *for* Learning)
2. Reflect and Check #3 and 4 (p. 73) (Assessment *as* Learning)
3. Show You Know (pp. 74–77) (Assessment *for* Learning)
4. Communicate the Ideas #1 to 4 (p. 78) (Assessment *as* Learning)
5. Math Learning Log (Assessment *as* Learning)

Foldable Entry:

Have students define the following terms in their Foldable and provide an example for each. Have them add to their definition of a non-perfect square by listing the properties of a non-perfect square.

square	square root	perfect square	non-perfect square

Math Learning Log:

Have students complete the following statement: The method I prefer for estimating the square root of a non-perfect square is … because …

MathLinks 9 Chapter 2, Lesson 9

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine whether or not a given rational number is a square number and explain the reasoning.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a given rational number as shown on a calculator may be an approximation.
- ☑ Identify a number with a square root that is between two given numbers.

Resources/Materials:

- *MathLinks 9*, pp. 78–81
- *MathLinks 9 Practice and Homework Book*, pp. 22–23
- Master 2 Communication Peer Evaluation
- Master 4 Number Lines
- BLM 2–11 Section 2.4 Extra Practice
- BLM 2–12 Section 2.4 Math Link

- grid paper or Master 8 Centimetre Grid Paper and Master 9 0.5 Centimetre Grid Paper
- calculator
- Foldable

Teacher's Resource:
pp. 105–109

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
Discuss the responses to the Communicate the Ideas questions as a class. Clarify any misunderstandings. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldable. You may wish to reinforce students' learning by asking them to answer the following questions.

- $1.44 = \_\_ \times \_\_$
- $\sqrt{1.21} = \_\_$
- Estimate and calculate $\sqrt{1.56}$.

Tell students that they will apply what they have learned about squares and square roots of rational numbers.

Procedures/Activities/Instruction:

1. Have students use **Master 2 Communication Peer Evaluation** to assess another student's response to Communicate the Ideas #1.
2. Assign questions as outlined in the Assessment section below. Encourage students to solve the questions using more than one strategy and not to rely on technology only for calculating squares and square roots. Remind students to estimate before calculating. Make **Master 4 Number Lines**, **Master 8 Centimetre Grid Paper**, and **Master 9 0.5 Centimetre Grid Paper** available and encourage students to refer to their table of perfect squares.
   The solutions to #24, 28, 29, 31, and 34 involve substitution into a formula that includes a square root. Before students attempt any of these problems, direct them to the Literacy Link (p. 80) that follows #24. Check students' understanding by asking them to calculate $\sqrt{0.89 + 0.32}$ and $\sqrt{9 \div 4}$.
   Ensure that students are successful with the Practise questions before proceeding to the Apply questions. Support for re-teaching or alternative approaches for students who are not successful with the Practise questions can be found in the Teacher's Resource under Assessment – Supporting Learning (p. 109).

Assessment:

1. Student assignments (Assessment *for* Learning)
   Essential: #5–7, 9, 11, 13, 15, 16, Math Link
   Typical: #5–7, 9, 11, 13, 15, 16, two of 17–21, 26, 29, Math Link
   Extension/Enrichment: #17, 20, 23, 24, 29, 31–36
   Note: Some students may benefit from completing **BLM 2–11 Section 2.4 Extra Practice**, if they have not already done so.
   Encourage students who work quickly to start the Math Link (p. 81). The Math Link will likely be of interest to students as they may be familiar with Sudoku logic puzzles. **BLM 2–12 Section 2.4 Math Link** is available for students who may benefit from scaffolding to get started on the Math Link.
2. The *MathLinks 9 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
3. Literacy Link (Assessment *as* Learning)
4. Math Learning Log (Assessment *as* Learning)

Foldable Entry:
Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldable.

Literacy Link:
Have students develop a Frayer model showing what they already know about square roots at the beginning of section 2.4. Have them revisit their Frayer model at the end of the section.

Math Learning Log:
Have students comment on two or three items they feel they have improved on and explain how they have improved.

MathLinks 9 Chapter 2, Lesson 10

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Identify a rational number that is between two given rational numbers.
- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine whether or not a given rational number is a square number and explain the reasoning.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.

Resources/Materials:

- *MathLinks 9*, pp. 82–83
- *MathLinks 9 Practice and Homework Book*, pp. 24–27
- Master 4 Number Lines
- BLM 2–4 Chapter 2 Problems of the Week
- BLM 2–5 Section 2.1 Extra Practice
- BLM 2–7 Section 2.2 Extra Practice
- BLM 2–9 Section 2.3 Extra Practice
- BLM 2–11 Section 2.4 Extra Practice
- ruler
- calculator

- grid paper or Master 8 Centimetre Grid Paper and Master 9 0.5 Centimetre Grid Paper
- Foldable

Teacher's Resource:
pp. 110–111

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
Students are now at the chapter review, which serves as a self-assessment tool.

Procedures/Activities/Instruction:
1. Decide how you wish students to approach the Chapter 2 Review. The review is an opportunity for students to verify that they have mastered the concepts and identify any areas of weakness prior to any Assessment *of* Learning. There are a number of approaches that could be used, including:
   - Have students use the notes they made in the What I Need to Work On section of their Foldable to identify any areas of weakness and to help them select review questions.
   - Have students complete at least one related item from each section.
   - Have students review their assignments, identify areas of weakness, and select review questions accordingly.
   - As the teacher, you might select the questions to be completed by the class or individual students.
   - If students have the *MathLinks 9 Practice and Homework Book*, have them complete questions from the relevant sections. Additionally, you might have them complete the Chapter Link and the Vocabulary Link (pp. 24–25) to reinforce their learning. Note that the Chapters 1–2 Review (pp. 26–27) includes questions from Chapters 1 and 2. You may wish to use the Chapters 1–2 Review for review purposes before students write the chapter test. If you decide to include content from earlier chapters in the Chapter 2 Test, have students complete the entire cumulative review before writing the test.
   - You may wish to use questions from **BLM 2–5 Section 2.1 Extra Practice**, **BLM 2–7 Section 2.2 Extra Practice**, **BLM 2–9 Section 2.3 Extra Practice**, and **BLM 2–11 Section 2.4 Extra Practice**.

Assessment:
1. Chapter 2 Review (pp. 82–83) (Assessment *for* Learning). Make **Master 4 Number Lines**, **Master 8 Centimetre Grid Paper**, and **Master 9 0.5 Centimetre Grid Paper** available for students to use. Consider assigning #6, 7, 9, 11, 13a), b), 14 a), b), 16, 18, 21, and 25, which are the minimum questions that will meet the curriculum outcomes. Assignments should be completed within class time in order for students to get assistance.

Foldable Entry:
Encourage students to use the terminology in their Foldable. As they do the review, they could note what areas in the What I Need to Work On section they now understand. This is a good opportunity for students to note personal growth.

Problems of the Week:
This may be a good time to review students' responses to **BLM 2–4 Chapter 2 Problems of the Week**.

MathLinks 9 Chapter 2, Lesson 11

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Order a given set of rational numbers in fraction and decimal form, by placing them on a number line, e.g., $\frac{3}{5}$, –0.666..., 0.5, $-\frac{5}{8}$.
- ☑ Identify a rational number that is between two given rational numbers.
- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine whether or not a given rational number is a square number and explain the reasoning.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a given rational number as shown on a calculator may be an approximation.
- ☑ Identify a number with a square root that is between two given numbers.

Resources/Materials:

- *MathLinks 9*, pp. 84–85
- Master 4 Number Lines
- BLM 2–13 Chapter 2 Test

- ruler
- calculator
- grid paper or Master 8 Centimetre Grid Paper and Master 9 0.5 Centimetre Grid Paper
- Foldable

Teacher's Resource:
pp. 112–113

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
Students are now at the practice test. This could serve as a final self-assessment tool or as a summative tool (Assessment *of* Learning).

Procedures/Activities/Instruction:
1. Before assigning the Chapter 2 Practice Test, have students review their Frayer models for the terms *integer*, *decimals*, *fractions*, and *square roots,* if they have not already done so. Consider allowing students to use their Frayer models as a reference for the practice test.
2. Decide how you wish students to approach the practice test. Practice tests are opportunities for students to verify that they have mastered the concepts and identify any areas of weakness prior to Assessment *of* Learning. Provide students with a number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. Make **Master 4 Number Lines**, **Master 8 Centimetre Grid Paper**, and **Master 9 0.5 Centimetre Grid Paper** available.
3. You may wish to use **BLM 2–13 Chapter 2 Test** or items from the computerized assessment bank (CAB) as a summative assessment. For the chapter test, make **Master 4 Number Lines**, **Master 8 Centimetre Grid Paper**, and **Master 9 0.5 Centimetre Grid Paper** available for students.

Assessment:
1. Chapter 2 Practice Test (pp. 84–85) (Assessment *for* Learning). The essential questions to meet the curriculum requirements are #3–9, 11, and 13–17. Assignments should be completed within class time in order to allow students to get assistance.
2. **BLM 2–13 Chapter 2 Test** (Assessment *of* Learning)

Foldable Entry:
Encourage students to use their Foldable for terminology and to note areas of personal growth.

MathLinks 9 Chapter 2, Lesson 12

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.

Resources/Materials:

- *MathLinks 9*, p. 85
- Master 1 Project Rubric
- BLM 2–14 Chapter 2 Math Link: Wrap It Up!
- dice, coins, playing cards, and other materials for creating a game
- Foldable

Teacher's Resource:

pp. 114–115

***MathLinks 9* Adapted Resource:**

See corresponding chapter for adapted materials to support individual students.

Introduction:
Students will complete the chapter problem Math Link: Wrap It Up! (p. 85), which consolidates their work on the Math Links throughout the chapter. You may wish to provide materials in the classroom to help students design their game.

Procedures/Activities/Instruction:
1. Decide and communicate how much class time students will have to complete the Math Link: Wrap It Up! and how much needs to be completed at home.
2. Read through the Math Link: Wrap It Up! and clarify any misunderstandings. Tell students to refer to the Math Links that they completed throughout the chapter for ideas. For instance, they might modify one or more of their earlier games. Remind students to list the calculations involved in the game. The calculations should include at least two of each of the following operations: addition, subtraction, multiplication, and division. Some students may benefit from using **BLM 2–14 Chapter 2 Math Link: Wrap It Up!**, which provides scaffolding for the chapter problem wrap-up.
3. It is important for students to understand how they will be graded. Provide each student with **Master 1 Project Rubric**. Clarify the assessment criteria using the master rubric or the version of the rubric in the Teacher's Resource (p. 115). Work with students to develop the expected outcomes for each level. If using the rubric in the Teacher's Resource, delete the content in the column with the specific question notes and work with students to complete the expected outcomes for each level. Completing specific question notes in this way allows students to identify the key criteria for each level. At the same time, you might emphasize the criteria that differentiate different levels (e.g., Level 3 and Level 4), in an effort to encourage students to improve their performance.

Assessment:
1. **Master 1 Project Rubric** (Assessment *of* Learning)

Foldable Entry:
Encourage students to refer to their Foldable as they practise using appropriate mathematical terminology.

MathLinks 9 Chapter 2, Lesson 13

Time: 80–100 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcomes:

N3 Demonstrate an understanding of rational numbers by:
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers.

N5 Determine the square root of positive rational numbers that are perfect squares.

N6 Determine an approximate square root of positive rational numbers that are non-perfect squares.

Achievement Indicators:

- ☑ Solve a given problem involving operations on rational numbers in fraction form and decimal form.
- ☑ Determine the square root of a given positive rational number that is a perfect square.
- ☑ Determine a positive rational number given the square root of that positive rational number.
- ☑ Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.

Resources/Materials:

Challenges	
Reaction Time	**Going Up?**
MathLinks 9, p. 86 40–50 min • Master 1 Project Rubric • 30-cm ruler • calculator • Foldable	*MathLinks 9,* p. 87 40–50 min • Master 1 Project Rubric • grid paper or Master 9 0.5 Centimetre Grid Paper

Teacher's Resource:
pp. 116–122

***MathLinks 9* Adapted Resource:**
See corresponding chapter for adapted materials to support individual students.

Introduction:
Both Challenges allow students to apply skills and knowledge about rational numbers. In Reaction Time, students perform an experiment and calculate average reaction distance and in Going Up?, they design an elevator and solve problems involving operations with rational numbers.

Procedures/Activities/Instruction:
Reaction Time
Note: Students need to work with a partner.

1. Introduce the Challenge by discussing the current requirements for obtaining a graduated driver's licence. Many provinces and territories provide a *Basic Licence Driver's Handbook* that contains information on the rules and laws of the road, skills that are needed to drive and handle a motor vehicle, and the proper attitude a driver should have. Ask how many students have the handbook and have started studying for the written test
2. Discuss the meaning of *reaction time* in this context. (Reaction time is the time it takes for drivers to react to danger by moving their foot from the gas pedal to the brake pedal.) Discuss the types of obstacles a driver might encounter on the road and factors that might impair reaction time.
   Explain that this Challenge involves calculating reaction time.
3. Read through the directions as a class. For #1, you might ask two volunteers to demonstrate how to hold the ruler, drop it, and record the reaction distance. Before students begin, consider partnering them according to ability.
4. Clarify that the task is to:
   - perform the experiment five times
   - compute the average reaction distance of the five trials
   - calculate the average reaction time using the provided formula
   - determine the distance travelled before the brake is engaged when travelling at 40 km/h and at 100 km /h
   - list factors other than reaction time that affect stopping distance.
5. If you use the Challenge for Assessment *of* Learning, it is important that students understand how they will be graded. Review **Master 1 Project Rubric** or use the version in the Teacher's Resource (p. 119) and work with students to develop the expected outcomes for each level. If using the version in the Teacher's Resource, delete the content in the column with the specific question notes and work with students to complete the expected outcomes for each level. Completing specific question notes in this way allows students to identify the key criteria for each level. At the same time, you might emphasize the criteria that differentiate different levels (e.g., Level 3 and Level 4), in an effort to encourage students to improve their performance.

Going Up?

1. As a class, discuss the differences between an elevator and an escalator. See the Teacher's Resource (p. 120) for ideas. You might mention that while escalator design is quite universal, elevator design varies. For instance,

elevators in some European countries are limited in size to holding one person and one bag.

2. Read through the directions as a class. Make **Master 9 0.5 Centimetre Grid Paper** available.
3. Clarify that the task is to:
   - calculate how long it would take to use the escalator to move 100 people from the main level to the upper level
   - choose dimensions for an efficient elevator and then justify the use of these dimensions
   - calculate how many people the elevator could transport from the main level to the upper level in 1 min
4. If you use the Challenge for Assessment *of* Learning, it is important that students understand how they will be graded. Review **Master 1 Project Rubric** or use the version in the Teacher's Resource (p. 122) and work with students to develop the expected outcomes for each level. If using the version in the Teacher's Resource, delete the content in the column with the specific question notes and work with students to complete the expected outcomes for each level. Completing specific question notes in this way allows students to identify the key criteria for each level. At the same time, you might emphasize the criteria that differentiate different levels (e.g., Level 3 and Level 4), in an effort to encourage students to improve their performance.

Assessment:

1. You may decide to let students choose either Challenge, depending on the type of assessment you are looking for (Assessment *of* Learning or Assessment *for* Learning).

Foldable Entry:

Encourage students to refer to their Foldable to help them use appropriate mathematical terminology.