Chapter 3 Lesson Plans

MathLinks 8   Pre-Planning for Chapter 3

STRAND/ORGANIZER: **Number**
Shape and Space (Measurement)

General Outcomes: Develop number sense.
Use direct or indirect measurement to solve problems.

1. Before getting started with lesson planning for Chapter 3 Pythagorean Relationship, you need to understand what skills students have already been exposed to.
   - If students in your jurisdiction have *not* completed the new Grade 7 WNCP (2006) curriculum, they should have some understanding of the following outcomes from the previous curriculum:
   Grade 7 (1995):
   ☑ Compare and/or order improper fractions, mixed numbers and decimals to thousandths.

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

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 the concept, some sections may take two or three classes to complete. The Teacher's Resource suggests time lines.

3. Before starting Chapter 3, read through the **chapter opener** (p. 76), **Key Words** (p. 77), **Math Links** (pp. 79, 87, 94, 100, 105, and 111), and **Wrap It Up!** (p. 115). 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. 77) and a **Foldable** feature (p. 78).
   a) The Verbal Visual Chart helps students organize their learning and activate previously learned concepts.
   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 each 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 Wrap It Up! questions,
   - the Blackline Masters (BLMs) for additional questions, scaffolding of all Math Links, a chapter test, and assessment assistance,
   - the *MathLinks 8 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 8 — Chapter 3, Lesson 1

STRAND/ORGANIZER: Number
Shape and Space (Measurement)

General Outcomes: Develop number sense.
Use direct or indirect measurement to solve problems.

Specific Outcomes:
N1   Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).
N2   Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).
SS1   Develop and apply the Pythagorean theorem to solve problems.

Resource/Materials:
- *MathLinks 8*, pp. 76–79
- BLM 3–1 Chapter 3 Math Link Introduction
- BLM 3–2 Chapter 3 Get Ready or *MathLinks 8 Practice and Homework Book,* pp. 22–23
- BLM 3–4 Chapter 3 Problems of the Week
- BLM 3–5 Playing Leader Board
- sample chapter Foldable
- eight sheets of grid paper
- stapler
- ruler
- scissors
- coloured counters

Teacher's Resource:
pp. 97–100

***MathLinks 8* Adapted Resource:**
Get Ready, pp. 104–105
Math Link, p. 106

Introduction:
Before working on Chapter 3, review the Get Ready and the Math Link (p. 79). 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 3 and, in addition, introduces the chapter problem.

Read the chapter opener together (p. 76). Read through the What You Will Learn (p. 76) and the Key Words (p. 77). How many students can already define or describe the key words?

Tell students that they will learn about the relationships between squares and triangles and how they are used in games, construction, art, and mathematics.

Procedure/Activities/Instruction:
1. Have students complete the Get Ready. Use **BLM 3–2 Chapter 3 Get Ready** or *MathLinks 8 Practice and Homework Book* (pp. 22–23).
2. Have students complete a Verbal Visual Chart (see Teacher's Resource p. 98 for instructions). Collect these from students before they leave the class to get a better idea of students' ability to use this tool.
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 Foldables together as a class or have students make their own following the instructions (p. 78). They could label it as shown or according to your directions. Explain that they will use the back of their Foldables to record ideas for the Wrap It Up!
4. Have students complete the Math Link. Read the Math Link as a class. Explain that the chapter problem involves designing a board game. If doing the Math Link, provide **BLM 3–5 Playing Leader Board** and allow time for students to play the game. Some students may benefit from using **BLM 3–1 Chapter 3 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 3–4 Chapter 3 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. Verbal Visual Chart (Assessment *as* Learning)
3. Math Link (p. 79) (Assessment *for* Learning). You might use **BLM 3–1 Chapter 3 Math Link Introduction**.
4. Foldable (Assessment *for* Learning)

Math Link:
Have students start a section in their notebook or the back of their Foldables to write down ideas for the Wrap It Up! As a class, consider reading through each Math Link (pp. 79, 87, 94, 100, 105, and 111), and the Wrap It Up! (p. 115) so

students have a good understanding of the chapter problem. 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 Foldables. Have them use diagrams, illustrations, or explanations to define each term. Remind them to use their own words and examples.

composite number	prime factorization	perimeter	area equation

MathLinks 8 — Chapter 3, Lesson 2

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:

N1   Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).

Achievement Indicators:

☑ Represent a given perfect square as a square region using materials, such as grid paper or square shapes.

☑ Determine the factors of a given perfect square and explain why one of the factors is the square root and the others are not.

☑ Determine whether or not a given number is a perfect square using materials and strategies, such as square shapes, grid paper or prime factorization, and explain the reasoning.

☑ Determine the square root of a given perfect square and record it symbolically.

☑ Determine the square of a given number.

Resource/Materials:

- *MathLinks 8*, pp. 80–85
- BLM 3–3 Chapter 3 Warm-Up
- BLM 3–15 Algebra Tiles
- square tiles
- grid paper, Master 8 Centimetre Grid Paper, or Master 9 0.5 Centimetre Grid Paper
- ruler
- Foldable

Teacher's Resource:

pp. 101–103

MathLinks 8 Adapted Resource:

3.1 Warm-Up, p. 107
3.1, pp. 108–113

Introduction:

Start the lesson by reviewing the picture and text about Pythagoras (p. 80). Note the many squares in the picture. Allow students to learn more about Pythagoras

by accessing the Web links in the Teacher's Resource (p. 104). You may wish to screen the Disney movie *Donald Duck in Mathmagic Land* (1959) to give students an interesting look into the role of math in everyday life through an examination of the ancient Greeks.

In the Explore the Math, students use square tiles and prime factorization to identify perfect squares.

Procedure/Activities/Instruction:
1. Reactivate students' learning by having them complete the warm-up questions for section 3.1 on **BLM 3–3 Chapter 3 Warm-Up**.
2. Divide students into pairs and have them use square tiles or centimetre cubes to do the Explore the Math. You may wish to provide **BLM 3–15 Algebra Tiles** to complete the Explore. Refer students to the Literacy Links about square numbers, and prime numbers and prime factors to help them recall these terms. After completing the Explore the Math, have students discuss their findings as a class.
   Have students complete an individual response to Reflect on Your Findings #5.
3. Walk through Examples 1 and 2 (pp. 82–83). Have students complete Show You Know questions before going on. Refer students to the Literacy Links (p. 83), which will help them understand representing repeated multiplication as a square and how to read square roots.
4. Assign and then collect all students' individual work for Communicate the Ideas #1 (p. 85).

Assessment:
1. Section 3.1 on **BLM 3–3 Chapter 3 Warm-Up** (Assessment *for* Learning)
2. Reflect on Your Findings #5 (p. 81) (Assessment *as* Learning)
3. Show You Know questions (pp. 82–83) (Assessment *for* Learning)
4. Communicate the Ideas #1 (p. 85) (Assessment *as* Learning)

Foldable Entry:
Have students use their Foldables to define each of the following terms. Encourage them to use diagrams or illustrations.

non-perfect square	perfect square	prime factorization
prime factor	prime number	square number square root

MathLinks 8

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:
N1   Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).

Achievement Indicators:
- ☑ Represent a given perfect square as a square region using materials, such as grid paper or square shapes.
- ☑ Determine the factors of a given perfect square and explain why one of the factors is the square root and the others are not.
- ☑ Determine whether or not a given number is a perfect square using materials and strategies, such as square shapes, grid paper or prime factorization, and explain the reasoning.
- ☑ Determine the square root of a given perfect square and record it symbolically.
- ☑ Determine the square of a given number.

Resource/Materials:
- *MathLinks 8,* pp. 83–87
- *MathLinks 8 Practice and Homework Book*, pp. 24–25
- BLM 3–6 Section 3.1 Extra Practice
- BLM 3–7 Section 3.1 Math Link
- calculator
- grid paper, Master 8 Centimetre Grid Paper, or Master 9 0.5 Centimetre Grid Paper
- ruler

Teacher's Resource:
pp. 103–108

***MathLinks 8* Adapted Resource:**
3.1, pp. 113–116

Introduction:
Start the lesson by recalling the class activity from the previous day and the terms that were used. Discuss the responses to Communicate the Ideas #1. Explain that students will work through Example 3 and then apply their knowledge to solve problems. You may wish to start with a factor-tree race.

Procedure/Activities/Instruction:
1. Work through Example 3 (pp. 83–84). Have students complete the Show You Know question before going on.
2. As a class, discuss the Key Ideas (p. 84). Challenge students to compare the terminology and examples in their Foldables to the information in the Key Ideas. Ask how they might improve their work in their Foldables.
3. Assign questions as outlined in the Assessment section below. Have all students record their response to Communicate the Ideas #2 to 4 in their Math Learning Log. Collect and review their responses to gain insight into students' understanding.
   Ensure that students are successful with the Practise questions before proceeding to the Apply questions. Support for remediation 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. 108).

Assessment:
1. Communicate the Ideas #2 to 4 (p. 85) (Assessment *as* Learning)
2. Student assignments (Assessment *for* Learning)
   Essential: #2–5, 7, 9, 11, 15, 17, Math Link
   Typical: #2–5, 7, 9, 11, 15, 17, 18, 23, 24, Math Link
   Extension/Enrichment: #2–4, 19, 21, 22, 24–27, Math Link
   Note: Some students may benefit from completing **BLM 3–6 Section 3.1 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. 87). They may need additional class time to complete the Math Link. **BLM 3–7 Section 3.1 Math Link** is available for students who may benefit from scaffolding to get started on the Math Link.
3. The *MathLinks 8 Practice and Homework Book* provides additional problems (Assessment *for* 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 Foldables.

Math Learning Log:
Have students write a brief explanation about prime numbers and square numbers. Have them note the similarities and differences.

MathLinks 8   Chapter 3, Lesson 4

Time: 40–50 min

STRAND/ORGANIZER: Shape and Space (Measurement)

General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome:
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
- ☑ Model and explain the Pythagorean theorem concretely, pictorially or using technology.
- ☑ Explain, using examples, that the Pythagorean theorem applies only to right triangles.
- ☑ Determine whether or not a given triangle is a right triangle by applying the Pythagorean theorem.

Resource/Materials:
- *MathLinks 8*, pp. 88–91
- BLM 3–3 Chapter 3 Warm-Up
- BLM 3–8 Table for Explore the Math
- BLM 3–9 Triangles for Explore the Math
- BLM 3–10 Section 3.2 Extra Practice
- grid paper or Master 8 Centimetre Grid Paper
- scissors
- transparent tape
- ruler
- protractor
- Foldable

Teacher's Resource:
pp. 109–113

MathLinks 8 Adapted Resource:
3.2 Warm-Up, p. 117
3.2, pp. 118–121

Introduction:
Students will learn about properties of right triangles. Ask them to discuss examples of right triangles in daily life. List the examples on the board. Consider giving student pairs a two-minute scavenger hunt for examples of right triangles in the school. Have students identify and list as many right triangles as they can.

You may wish to have students make an additional Foldable in the shape of a right triangle to help them visualize the new concepts they are learning.

In the Explore the Math, students create and verify right triangles.

Procedure/Activities/Instruction:
1. Have students complete the warm-up questions for section 3.2 on **BLM 3–3 Chapter 3 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 Foldables.
3. Hand out grid paper, **BLM 3–8 Table for Explore the Math**, and **BLM 3–9 Triangles for Explore the Math** and have students complete the Explore the Math (pp. 88–89) independently or in pairs.
   Have students complete Reflect on Your Findings #8 (p. 89) and compare answers with a partner. Discuss the results as a class to gauge if students have understood the big question in the Explore the Math or if further reinforcement is needed.
4. Work through Example 1 as a class (p. 90). This example describes relationships in right triangles. Have students complete the Show You Know questions and then discuss the answers as a class. Work through Example 2 as a class (pp. 90–91). This example identifies properties of a right triangle. Draw attention to the Literacy Link (p. 91) that explains "is not equal to" and write some examples on the board. You may wish to begin the examples with a word or visual analogy (e.g., apples ≠ oranges). Have students complete the Show You Know questions and discuss their responses orally.
5. Assign and then collect all students' individual work for Communicate the Ideas #1–3.

Assessment:
1. Section 3.2 on **BLM 3–3 Chapter 3 Warm-Up** (Assessment *for* Learning)
2. Show You Know questions (pp. 90–91) (Assessment *for* Learning). Students may find using **Master 8 Centimetre Grid Paper** to draw diagrams helpful.
3. Communicate the Ideas #1–3 (Assessment *as* Learning)

Foldable Entry:
Have students use their Foldables to define each of the following terms. Have them provide an example for each. Direct students to the Literacy Link (p. 89) about right triangles to help clarify the terminology.

hypotenuse	Pythagorean relationship	≠

Math Learning Log:
Have students describe how a right triangle is different from other triangles.

MathLinks 8   Chapter 3, Lesson 5

Time: 80 min

STRAND/ORGANIZER: Shape and Space (Measurement)

General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome:
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
- ☑ Model and explain the Pythagorean theorem concretely, pictorially or using technology.
- ☑ Explain, using examples, that the Pythagorean theorem applies only to right triangles.
- ☑ Determine whether or not a given triangle is a right triangle by applying the Pythagorean theorem.

Resource/Materials:
- *MathLinks 8*, pp. 91–94
- *MathLinks 8 Practice and Homework Book*, pp. 26–27
- BLM 3–10 Section 3.2 Extra Practice
- BLM 3–11 Section 3.2 Math Link
- grid paper or Master 8 Centimetre Grid Paper
- ruler
- Foldable

Teacher's Resource:
pp. 113–115

***MathLinks 8* Adapted Resource:**
3.2, pp. 121–124

Introduction:
Review Pythagorean relationships in right triangles. Students will now apply their learning and understanding to solve problems.

Procedure/Activities/Instruction:
1. Collect, orally mark, or take up the Communicate the Ideas answers.
2. Distribute **Master 8 Centimetre Grid Paper** and 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 remediation 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. 115).

Assessment:
1. Student assignments (Assessment *for* Learning)
   Essential: #5, 6, 8, 10, 12a), c), Math Link
   Typical: #5, 6, 8, 10, 12–17, Math Link
   Extension/Enrichment: #14, 17–21, Math Link
   Note: Some students may benefit from completing **BLM 3–10 Section 3.2
   Extra Practice**, if they have not already done so.
   Encourage students who work faster to start the Math Link (p. 94). **BLM 3–11
   Section 3.2 Math Link** is available for students who may benefit from
   scaffolding to get started on the Math Link.
2. The *MathLinks 8 Practice and Homework Book* provides additional problems
   (Assessment *for* Learning).
3. 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 Foldables.

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

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:
N2   Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).

Achievement Indicators:
- ☑ Estimate the square root of a given number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Approximate the square root of a given number that is not a perfect square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a number shown on the calculator may be an approximation.

Resource/Materials:
- *MathLinks 8*, pp. 95–98
- Master 3 Integer Number Lines or Master 4 Vertical and Horizontal Number Lines
- Master 19 Multiplication Chart
- BLM 3–3 Chapter 3 Warm-Up
- BLM 3–12 Section 3.3 Extra Practice
- ruler
- calculator
- Foldable

Teacher's Resource:
pp. 116–120

MathLinks 8 Adapted Resource:
3.3 Warm-Up, p. 125
3.3, pp. 126–128

Introduction:
Read the section title and opening paragraph (p. 95) and then ask students where they think it might be necessary to estimate the side lengths of objects. Ask them to suggest ways to solve the problem in the cartoon. Make sure they understand the big question in the Explore the Math.

In the Explore the Math, students estimate a square root.

Procedure/Activities/Instruction:
1. Reactivate student learning by completing section 3.3 questions of **BLM 3–3 Chapter 3 Warm-Up** as a class.
2. Collect, orally mark, or take up the previous lesson's homework. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldables.
3. Have students complete the Explore the Math with a partner or as a whole class. If working in pairs, have them compare their results with another student pair before discussing the results as a class. Have students complete Reflect on Your Findings #5 individually. Have them list questions or concepts they are having difficulty with in the What I Need to Work On section of their Foldables.
4. Example 1 and Example 2 (pp. 96–97) model problems related to square roots. Work through each example as a class.
   Have students work in pairs to complete the Show You Know questions (pp. 96–97) and then share their answers with the class. You may wish to provide **Master 19 Multiplication Chart** for students to use as a reference.
5. Have students who would benefit from additional practice complete **BLM 3–12 Section 3.3 Extra Practice**.
6. Assign and then collect all students' individual work for Communicate the Ideas #1–3.

Assessment:
1. Section 3.3 on **BLM 3–3 Chapter 3 Warm-Up** (Assessment *for* Learning)
2. Reflect on Your Findings #5 (p. 95) (Assessment *as* Learning)
3. Show You Know questions (pp. 96–97) (Assessment *for* Learning)
4. Communicate the Ideas #1–3 (Assessment *as* Learning)

Foldable Entry:
Have students record the following symbol in their Foldables along with an explanation of how and when it is used.

$$\approx$$

Math Learning Log:
Have students complete the following statement: To estimate the root of a number, you …

MathLinks 8   Chapter 3, Lesson 7

Time: 40–50 min

STRAND/ORGANIZER: Number

General Outcome: Develop number sense.

Specific Outcome:
N2   Determine the approximate square root of numbers that are not perfect
      squares (limited to whole numbers).

Achievement Indicators:
- ☑ Estimate the square root of a given number that is not a perfect square
  using the roots of perfect squares as benchmarks.
- ☑ Approximate the square root of a given number that is not a perfect
  square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a number shown on the calculator may
  be an approximation.

Resource/Materials:
- *MathLinks 8*, pp. 98–100
- *MathLinks 8 Practice and Homework Book*, pp. 28–29
- Master 19 Multiplication Chart
- BLM 3–12 Section 3.3 Extra Practice
- BLM 3–13 Section 3.3 Math Link
- ruler
- calculator
- Foldable

Teacher's Resource:
pp. 121–122

***MathLinks 8* Adapted Resource:**
3.3, pp. 128–131

Introduction:
Begin the class with an oral recall of terms that students have recorded in their
Foldables. This lesson provides students with an opportunity to apply their
understanding of the concepts learned in the previous lessons to solve problems.

Procedure/Activities/Instruction:
1. Collect, orally mark, or take up the previously assigned Communicate the Ideas questions. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldables.
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 remediation 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. 122).

Assessment:
1. Student assignments (Assessment *for* Learning)
    Essential: #4, 6, 10, Math Link
    Typical: #4–7, 9–11, 13–16, Math Link
    Extension/Enrichment: #11, 15, 16, 19–21, Math Link
    Note: Some students may benefit from completing **BLM 3–12 Section 3.3 Extra Practice**, if they have not already done so.
    Encourage students who work faster to start the Math Link (p. 100).
    BLM 3–13 Section 3.3 Math Link is available for students who may benefit from scaffolding to get started on the Math Link.
2. The *MathLinks 8 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
3. 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 Foldables.

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

MathLinks 8   # Chapter 3, Lesson 8

Time: 50–60 min

STRAND/ORGANIZER: Shape and Space (Measurement)

General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome:
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicator:
   ☑ Determine the measure of the third side of a right triangle, given the
      measures of the other two sides, to solve a given problem.

Resource/Materials:
- *MathLinks 8*, pp. 101–105
- *MathLinks 8 Practice and Homework Book*, pp. 30–31
- BLM 3–3 Chapter 3 Warm-Up
- BLM 3–14 Section 3.4 Extra Practice
- BLM 3–15 Section 3.4 Math Link
- grid paper, Master 8 Centimetre Grid Paper, or Master 9 0.5 Centimetre Grid
  Paper
- ruler
- Foldable

Teacher's Resource:
pp. 123–128

MathLinks 8 Adapted Resource:
3.4 Warm-Up, p. 132
3.4, pp. 133–138

Introduction:
Read the section title and opening paragraph (p. 101). Ask students how they
would solve the baseball diamond problem. Challenge them to think how they
could use the Pythagorean relationship to solve the problem. Have them reflect
on how else the Pythagorean relationship might be applied in daily life.

In the Explore the Math, students use the Pythagorean relationship to determine
the missing side length of a right triangle.

Procedure/Activities/Instruction:

1. As a class, have students complete the warm-up questions for section 3.4 on **BLM 3–3 Chapter 3 Warm-Up** to reinforce material learned previously.
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 Foldables.
3. Complete the Explore the Math as a whole class and then discuss the results. Have students complete their own response to Reflect on Your Findings #3.
4. Work through Examples 1 and 2 (p. 102), which illustrate how to determine the length of the hypotenuse and the leg of a right triangle.
   Have students work in pairs to complete the Show You Know question (p. 102) and then discuss the answers as a class.
5. Discuss the Key Ideas. Have students add an example to their Foldables.
6. 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 remediation 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. 128). Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldables.

Assessment:

1. Section 3.4 on **BLM 3–3 Chapter 3 Warm-Up** (Assessment *for* Learning)
2. Reflect on Your Findings #3 (p. 101) (Assessment *as* Learning)
3. Show You Know questions (p. 102) (Assessment *for* Learning)
4. Student assignments (Assessment *for* Learning)
   Essential: #1–3, 5, 6, 9, 10, Math Link
   Typical: #1–3, 5, 6, 9–14, Math Link
   Extension/Enrichment: #1–3, 10, 11, 13–16, Math Link
   Note: Some students may benefit from completing **BLM 3–14 Section 3.4 Extra Practice**, if they have not already done so.
   Encourage students who work faster to start the Math Link (p. 105).
   BLM 3–15 Section 3.4 Math Link is available for students who may benefit from scaffolding to get started on the Math Link.
5. The *MathLinks 8 Practice and Homework Book* provides additional problems (Assessment *for* Learning).

Foldable Entry:
Have students provide an explanation, including diagrams for the following.

How to find the length of the hypotenuse	$c^2 = a^2 + b^2$
How to find the length of the leg	$p^2 + q^2 = r^2$

Math Learning Log:
Have students complete the following statement: The length of the leg or the hypotenuse of a right triangle can be found when I know …

MathLinks 8   Chapter 3, Lesson 9/10

Time: 80–100 min

STRAND/ORGANIZER: Shape and Space (Measurement)

General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome:
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
- ☑ Model and explain the Pythagorean theorem concretely, pictorially or using technology.
- ☑ Determine whether or not a given triangle is a right triangle by applying the Pythagorean theorem.
- ☑ Determine the measure of the third side of a right triangle, given the measures of the other two sides, to solve a given problem.

Resource/Materials:
- *MathLinks 8*, pp. 106–111
- *MathLinks 8 Practice and Homework Book*, pp. 32–33
- BLM 3–3 Chapter 3 Warm-Up
- BLM 3–16 Section 3.5 Extra Practice
- BLM 3–17 Section 3.5 Math Link
- ruler
- Foldable

Teacher's Resource:
pp. 129–134

***MathLinks 8* Adapted Resource:**
3.5 Warm-Up, p. 139
3.5, pp. 140–146

Introduction:
Read the section title and opening paragraph as well as the big question in the Explore the Math (p. 106). Students apply the Pythagorean relationship to solve for an unknown distance in the Explore the Math and then solve other real world contextual problems.

Procedure/Activities/Instruction:
1. Have students complete the warm-up questions for section 3.5 on **BLM 3–3 Chapter 3 Warm-Up** to reinforce material learned previously.

2. Collect, orally mark, or take up the previous lesson's homework. Remind students to note any question they had difficulty with in the What I Need to Work On section of their Foldables.

3. Have students work in pairs to complete the Explore the Math and then compare answers with another student pair before discussing the results as a class. Have students prepare an individual response to Reflect on Your Findings #3. Encourage them to list questions or concepts they are having difficulty with in the What I Need to Work On section of their Foldables.

4. Work through Examples 1 and 2 (pp. 107–108), which illustrate how to determine distances with right triangles and how to use distance to verify a right triangle.
Have students work with a partner to complete the Show You Know questions and then share their answers with the class.

5. Discuss the Key Ideas with students. Encourage students to add notes to their Foldables.

6. 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 remediation or alternative approaches for students who are not successful with the assigned questions can be found in the Teacher's Resource under Assessment – Supporting Learning (p. 134). Have students write the page reference and question numbers they had difficulty with in the What I Need to Work On section of their Foldables.

Assessment:
1. Section 3.3 on **BLM 3–3 Chapter 3 Warm-Up** (Assessment *for* Learning)
2. Reflect on Your Findings #3 (p. 106) (Assessment *as* Learning)
3. Show You Know questions (pp. 107–108) (Assessment *for* Learning)
4. Student assignments (Assessment *for* Learning)
Essential: #1–3, 5, 7, Math Link
Typical: #1–3, 5, 7–10, 13, Math Link
Extension/Enrichment: #1–3, 8, 11–14, Math Link
Note: Some students may benefit from completing **BLM 3–16 Section 3.5 Extra Practice**, if they have not already done so.
Encourage students who work faster to start the Math Link (p. 111).
BLM 3–17 Section 3.5 Math Link is available for students who may benefit from scaffolding to get started on the Math Link.
5. The *MathLinks 8 Practice and Homework Book* provides additional problems (Assessment *for* Learning).
6. Math Learning Log (Assessment *as* Learning)

Foldable Entry:
Have students explain the following procedures in their Foldables, along with examples of when these procedures might be used.
• Explain how to find distance using right triangles.
• Explain how to use the Pythagorean relationship to verify a right triangle.

Math Learning Log:
Have students complete the following statements:
- What I find easy to understand about the Pythagorean relationship is …
- What I find difficult is …

MathLinks 8   Chapter 3, Lesson 11

Time: 40–50 min

STRAND/ORGANIZER: Number
                                    Shape and Space (Measurement)

General Outcomes: Develop number sense.
                            Use direct or indirect measurement to solve problems.

Specific Outcomes:

N1   Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).

N2   Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).

SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:

☑ Represent a given perfect square as a square region using materials, such as grid paper and square shapes.

☑ Determine the factors of a given perfect square, and explain why one of the factors is the square root and the others are not.

☑ Determine whether or not a given number is a perfect square using materials and strategies, such as square shapes, grid paper or prime factorization, and explain the reasoning.

☑ Determine the square root of a given perfect square and record it symbolically.

☑ Determine the square of a given number.

☑ Estimate the square root of a given number that is not a perfect square using the roots of perfect squares as benchmarks.

☑ Approximate the square root of a given number that is not a perfect square using technology, e.g., calculator, computer.

☑ Explain why the square root of a number shown on the calculator may be an approximation.

☑ Identify a number with a square root that is between two given numbers.

☑ Explain, using examples, that the Pythagorean theorem applies only to right triangles.

☑ Model and explain the Pythagorean theorem concretely, pictorially or using technology.

☑ Determine whether or not a given triangle is a right triangle by applying the Pythagorean theorem

☑ Determine the measure of the third side of a right triangle, given the measures of the other two sides, to solve a given problem.

☑ Solve a given problem that involves Pythagorean triples, e.g., 3, 4, 5 or 5, 12, 13.

Resource/Materials:
- *MathLinks 8*, pp. 112–113
- *MathLinks 8 Practice and Homework Book*, pp. 34–35
- BLM 3–4 Chapter 3 Problems of the Week
- BLM 3–6 Section 3.1 Extra Practice
- BLM 3–10 Section 3.2 Extra Practice
- BLM 3–12 Section 3.3 Extra Practice
- BLM 3–14 Section 3.4 Extra Practice
- BLM 3–16 Section 3.5 Extra Practice
- ruler
- Foldable

Teacher's Resource:
pp. 135–136

***MathLinks 8* Adapted Resource:**
Chapter 3 Review, pp. 147–150
Key Word Builder, p. 155

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

Procedure/Activities/Instruction:
1. Decide how you wish students to approach the Chapter 3 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 Foldables 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.
- Have students play the Math Game (p. 116), which provides reinforcement of the chapter concepts.
- If students have the *MathLinks 8 Practice and Homework Book*, have them complete questions from the relevant sections.
- You may wish to use questions from **BLM 3–6 Section 3.1 Extra Practice**, **BLM 3–10 Section 3.2 Extra Practice**, **BLM 3–12 Section 3.3 Extra Practice**, **BLM 3–14 Section 3.4 Extra Practice**, and **BLM 3–16 Section 3.5 Extra Practice**.

Assessment:
1. Chapter 3 Review (pp. 112–113) (Assessment *for* Learning). Consider assigning #6, 7, 8, 9, 11, 13, 14, 15, and 16, 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 Foldables. 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 3–4 Chapter 3 Problems of the Week**.

MathLinks 8   Chapter 3, Lesson 12

Time: 40–50 min

STRAND/ORGANIZER: **Number**
                     Shape and Space (Measurement)

General Outcomes: Develop number sense.
                     Use direct or indirect measurement to solve problems.

Specific Outcomes:
N1   Demonstrate an understanding of perfect square and square root,
      concretely, pictorially and symbolically (limited to whole numbers).
N2   Determine the approximate square root of numbers that are not perfect
      squares (limited to whole numbers).
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
   ☑ Represent a given perfect square as a square region using materials,
     such as grid paper or square shapes.
   ☑ Determine the factors of a given perfect square, and explain why one
     of the factors is the square root and the others are not.
   ☑ Determine whether or not a given number is a perfect square using
     materials and strategies, such as square shapes, grid paper or prime
     factorization, and explain the reasoning.
   ☑ Determine the square root of a given perfect square and record it
     symbolically.
   ☑ Determine the square of a given number.
   ☑ Estimate the square root of a given number that is not a perfect square
     using the roots of perfect squares as benchmarks.
   ☑ Approximate the square root of a given number that is not a perfect
     square using technology, e.g., calculator, computer.
   ☑ Explain why the square root of a number shown on the calculator may
     be an approximation.
   ☑ Identify a number with a square root that is between two given
     numbers.
   ☑ Explain, using examples, that the Pythagorean theorem applies only to
     right triangles.
   ☑ Model and explain the Pythagorean theorem concretely, pictorially or
     using technology.
   ☑ Determine whether or not a given triangle is a right triangle by applying
     the Pythagorean theorem.
   ☑ Determine the measure of the third side of a right triangle, given the
     measures of the other two sides, to solve a given problem.
   ☑ Solve a given problem that involves Pythagorean triples, e.g., 3, 4, 5 or
     5, 12, 13.

Resource/Materials:
- *MathLinks 8*, pp. 114–115
- BLM 3–18 Chapter 3 Test
- ruler
- Foldable

Teacher's Resource:
pp. 137–138

***MathLinks 8* Adapted Resource:**
Chapter 3 Practice Test, pp. 151–153

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).

Procedure/Activities/Instruction:
1. 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.
2. You may wish to use **BLM 3–18 Chapter 3 Test**, items from the computerized assessment bank (CAB), or the Challenge in Real Life as a summative assessment.

Assessment:
1. Chapter 3 Practice Test (pp. 114–115) (Assessment *for* Learning). Essential questions to meet the curriculum requirements are #3–5, 7, 8, 10a), 11, 13, and 15. Assignments should be completed within class time in order for students to get assistance.
2. **BLM 3–18 Chapter 3 Test** (Assessment *of* Learning)
3. Challenge in Real Life (p. 117) (Assessment *of* Learning)

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

STRAND/ORGANIZER: Number
                     Shape and Space (Measurement)

General Outcomes: Develop number sense.
                     Use direct or indirect measurement to solve problems.

Specific Outcomes:
N1   Demonstrate an understanding of perfect square and square root,
       concretely, pictorially and symbolically (limited to whole numbers).
N2   Determine the approximate square root of numbers that are not perfect
       squares (limited to whole numbers).
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
   ☑ Represent a given perfect square as a square region using materials,
      such as grid paper or square shapes.
   ☑ Determine the factors of a given perfect square, and explain why one
      of the factors is the square root and the others are not.
   ☑ Determine whether or not a given number is a perfect square using
      materials and strategies, such as square shapes, grid paper or prime
      factorization, and explain the reasoning.
   ☑ Determine the square root of a given perfect square and record it
      symbolically.
   ☑ Determine the square of a given number.
   ☑ Estimate the square root of a given number that is not a perfect square
      using the roots of perfect squares as benchmarks.
   ☑ Approximate the square root of a given number that is not a perfect
      square using technology, e.g., calculator, computer.
   ☑ Explain why the square root of a number shown on the calculator may
      be an approximation.
   ☑ Identify a number with a square root that is between two given
      numbers.
   ☑ Explain, using examples, that the Pythagorean theorem applies only to
      right triangles.
   ☑ Model and explain the Pythagorean theorem concretely, pictorially or
      using technology.
   ☑ Determine whether or not a given triangle is a right triangle by applying
      the Pythagorean theorem.
   ☑ Determine the measure of the third side of a right triangle, given the
      measures of the other two sides, to solve a given problem.
   ☑ Solve a given problem that involves Pythagorean triples, e.g., 3, 4, 5 or
      5, 12, 13.

Resource/Materials:
- *MathLinks 8*, p. 115
- Master 1 Project Rubric
- grid paper or Master 8 Centimetre Grid Paper
- BLM 3–19 Chapter 3 Wrap It Up!
- poster board or cardboard
- coloured pencils, coloured markers
- scissors
- glue
- game pieces
- ruler
- protractor
- other materials for creating a board game
- Foldable

Teacher's Resource:
pp. 139–141

***MathLinks 8* Adapted Resource:**
Wrap It Up!, p. 154

Introduction:
Students will complete the chapter problem Wrap It Up! (p. 115), which consolidates their work on the Math Links throughout the chapter. It allows students to use and display their knowledge of the Pythagorean relationship.

Procedure/Activities/Instruction:
1. Decide and communicate how much class time students will have to complete the Wrap It Up! and how much needs to be completed at home.
2. Read through the Wrap It Up! and clarify any misunderstandings. Encourage students to use any work they completed during the Math Links.
   Some students may benefit from using **BLM 3–19 Chapter 3 Wrap It Up!**, which provides scaffolding.
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. 141). 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 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 Foldables as they practise using appropriate mathematical terminology.

MathLinks 8   Chapter 3, Lesson 14

Time: 40–50 min

STRAND/ORGANIZER: Number
Shape and Space (Measurement)

General Outcomes: Develop number sense.
Use direct or indirect measurement to solve problems.

Specific Outcomes:
N1   Demonstrate an understanding of perfect square and square root, concretely, pictorially and symbolically (limited to whole numbers).
N2   Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers).
SS1   Develop and apply the Pythagorean theorem to solve problems.

Achievement Indicators:
- ☑ Represent a given perfect square as a square region using materials, such as grid paper or square shapes.
- ☑ Determine the factors of a given perfect square, and explain why one of the factors is the square root and the others are not.
- ☑ Determine whether or not a given number is a perfect square using materials and strategies, such as square shapes, grid paper or prime factorization, and explain the reasoning.
- ☑ Determine the square root of a given perfect square and record it symbolically.
- ☑ Determine the square of a given number.
- ☑ Estimate the square root of a given number that is not a perfect square using the roots of perfect squares as benchmarks.
- ☑ Approximate the square root of a given number that is not a perfect square using technology, e.g., calculator, computer.
- ☑ Explain why the square root of a number shown on the calculator may be an approximation.
- ☑ Identify a number with a square root that is between two given numbers.
- ☑ Explain, using examples, that the Pythagorean theorem applies only to right triangles.
- ☑ Model and explain the Pythagorean theorem concretely, pictorially or using technology.
- ☑ Determine whether or not a given triangle is a right triangle by applying the Pythagorean theorem.
- ☑ Determine the measure of the third side of a right triangle, given the measures of the other two sides, to solve a given problem.
- ☑ Solve a given problem that involves Pythagorean triples, e.g., 3, 4, 5 or 5, 12, 13.

Resource/Materials:

Math Games	Challenge
• *MathLinks 8,* p. 116 • two dice per student pair • calculator (optional) • Foldable	• *MathLinks 8,* p. 117 • Master 1 Project Rubric • grid paper, Master 8 Centimetre Grid Paper, or Master 9 0.5 Centimetre Grid Paper • ruler

Teacher's Resource:
pp. 142–145

***MathLinks 8* Adapted Resource:**
Math Games, p. 156
Challenge in Real Life, pp. 157–158

Introduction:
The game allows students to use their understanding of prime factorization, prime numbers, and perfect squares to play a dice game.

The challenge allows students to apply their understanding of the Pythagorean theorem to a real world problem.

Procedure/Activities/Instruction:
Math Games
1. Read through the game with students. You might want to play a demonstration round.
2. Partner students according to ability.
 Note: The game could be used as reinforcement in place of the Chapter 3 Review.

Challenge in Real Life
1. Introduce the challenge by exploring as a class what students know about stairs and stair construction. Have them describe the different shapes that stairs can take (e.g., straight, spiral, long, steep).
2. Read through Building a Staircase as a class.
3. Clarify that the task is to determine the total rise and run of the staircase, calculate the length of the stringer (the hypotenuse), design a step stool, and calculate the length of the stringer for the stool.
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. 145) 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 in an effort to encourage students to improve their performance.

Assessment:
1. You may decide to let students choose either the game or the challenge, depending on the type of assessment you are looking for.
   - Math Games (Assessment *for* Learning)
   - Challenge in Real Life (Assessment *of* Learning or Assessment *for* Learning)

Foldable Entry:
Encourage students to refer to their Foldables to help them use appropriate mathematical terminology. This is a good opportunity for students to review the What I Need to Work On section of their Foldables and note what they learned throughout the chapter.