CHAPTER

2

Relations

Vocabulary

hypothesis
statistics
primary data
secondary data
sample
population
census
random sample
simple random sampling
systematic random sampling
stratified random sampling
non-random sampling
bias
inference
dependent variable
independent variable
outlier
interpolate
extrapolate
linear relation
line of best fit
curve of best fit
distance–time graph

Additional information and teaching materials for this chapter are available on the McGraw-Hill Ryerson web site at http://www.mcgrawhill.ca/books/principles9. You will need your password to access this material.

Curriculum Expectations

Mathematical Process Expectations

Throughout this course, students will:

PROBLEM SOLVING

MPS.01 develop, select, apply, and compare a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;

REASONING AND PROVING

MPS.02 develop and apply reasoning skills (e.g., recognition of relationships, generalization through inductive reasoning, use of counter-examples) to make mathematical conjectures, assess conjectures, and justify conclusions, and plan and construct organized mathematical arguments;

REFLECTING

MPS.03 demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by assessing the effectiveness of strategies and processes used, by proposing alternative approaches, by judging the reasonableness of results, by verifying solutions);

SELECTING TOOLS AND COMPUTATIONAL STRATEGIES

MPS.04 select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;

CONNECTING

MPS.05 make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);

REPRESENTING

MPS.06 create a variety of representations of mathematical ideas (e.g., numeric, geometric, algebraic, graphical, pictorial representations; onscreen dynamic representations), connect and compare them, and select and apply the appropriate representations to solve problems;

COMMUNICATING

MPS.07 communicate mathematical thinking orally, visually, and in writing, using mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.

Strand:
Linear Relations

Overall Expectations

By the end of this course, students will:
LRV.01 apply data-management techniques to investigate relationships between two variables;
LRV.02 demonstrate an understanding of the characteristics of a linear relation;
LRV.03 connect various representations of a linear relation.

Specific Expectations

Using Data Management to Investigate Relationships

By the end of this chapter, students will:
RE1.01 interpret the meanings of points on scatter plots or graphs that represent linear relations, including scatter plots or graphs in more than one quadrant (e.g., on a scatter plot of height versus age, interpret the point (13, 150) as representing a student who is 13 years old and 150 cm tall; identify points on the graph that represent students who are taller and younger than this student);
RE1.02 pose problems, identify variables, and formulate hypotheses associated with relationships between two variables;
RE1.03 design and carry out an investigation or experiment involving relationships between two variables, including the collection and organization of data, using appropriate methods, equipment, and/or technology (e.g., surveying; using measuring tools, scientific probes, the Internet) and techniques (e.g., making tables, drawing graphs);
RE1.04 describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain any differences between the inferences and the hypotheses (e.g., describe the trend observed in the data. Does a relationship seem to exist? Of what sort? Is the outcome consistent with your hypothesis? Identify and explain any outlying pieces of data. Suggest a formula that relates the variables. How might you vary this experiment to examine other relationships?);

Understanding Characteristics of Linear Relations

By the end of this chapter, students will:
RE2.01 construct tables of values, graphs, and equations, using a variety of tools (e.g., graphing calculators, spreadsheets, graphing software, paper and pencil), to represent linear relations derived from descriptions of realistic situations;
RE2.02 construct tables of values, scatter plots, and lines or curves of best fit as appropriate, using a variety of tools (e.g., spreadsheets, graphing software, graphing calculators, paper and pencil), for linearly related and non-linearly related data collected from a variety of sources (e.g., experiments, electronic secondary sources, patterning with concrete materials);
RE2.03 identify, through investigation, some properties of linear relations (i.e., numerically, the first difference is a constant, which represents a constant rate of change; graphically, a straight line represents the relation), and apply these properties to determine whether a relation is linear or non-linear;
RE2.05 determine the equation of a line of best fit for a scatter plot, using an informal process (e.g., using a movable line in dynamic statistical software; using a process of trial and error on a graphing calculator; determining the equation of the line joining two carefully chosen points on the scatter plot).

Connecting Various Representations of Linear Relations

By the end of this chapter, students will:
RE3.01 determine values of a linear relation by using a table of values, by

using the equation of the relation, and by interpolating or extrapolating from the graph of the relation;
RE3.02 describe a situation that would explain the events illustrated by a given graph of a relationship between two variables;
RE3.03 determine other representations of a linear relation, given one representation (e.g., given a numeric model, determine a graphical model and an algebraic model; given a graph, determine some points on the graph and determine an algebraic model).

Chapter Problem

The Chapter Problem is introduced in the Chapter Opener. Have students discuss their understanding of the topic. You may wish to have students complete the Chapter Problem revisits that occur throughout the chapter. These questions are designed to help students move toward the Chapter Problem Wrap-Up on page 99.

Alternatively, you may wish to assign only the Chapter Problem when students have completed the chapter. The Chapter Problem Wrap-Up is a summative assessment.

When discussing factors for a high jumper, look for factors such as height, speed, jumping ability, strength, and conditioning. A key component is for students to explain their thinking. This is a good opportunity to practise reasoning and communication skills.

Chapter 2 Planning Chart

Section Suggested Timing	Student Text Page (s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 2 Opener • 15 min	38–39			
Get Ready • 80 min	40–41	• BLM G10 Grid Paper • BLM 2.GR.1 Practice: Get Ready • BLM 2.GR.2 How to Draw a Scatter Plot	• BLM 2.GR.3 Get Ready Self-Assessment Checklist	**Tools** • grid paper
2.1 Hypotheses and Sources of Data • 80 min	42–47	• BLM 2.1.1 Practice: Hypotheses and Sources of Data	• BLM 2.1.2 Achievement Check Rubric • BLM A9 Communication General Scoring Rubric	
2.2 Sampling Principles • 80–160 min	48–55	• BLM 2.2.1 Practice: Sampling Principles • BLM T6 *Fathom*™	• BLM A21 Opinion Piece Checklist • BLM A4 Presentation Checklist	**Technology Tools** • graphing calculators • *Fathom*™ • computers
2.3 Use Scatter Plots to Analyse Data • 80 min	56–67	• BLM T6 *Fathom*™ • BLM T1 Corel® *Quattro Pro*® 8 • BLM T2 Corel® *Quattro Pro*® 10 • BLM T3 Microsoft® *Excel* • BLM 2.3.1 Practice: Use Scatter Plots to Analyse Data • BLM G10 Grid Paper	• BLM A7 Thinking General Scoring Rubric	**Tools** • grid paper **Technology Tools** • graphing calculators • *Fathom*™ • Corel® *Quattro Pro*® • Microsoft® *Excel* • computers
2.4 Trends, Interpolation, and Extrapolation • 80 min	68–76	• BLM G10 Grid Paper • BLM T6 *Fathom*™ • BLM 2.4.1 Practice: Trends, Interpolation, and Extrapolation	• BLM A10 Observation General Scoring Rubric • BLM 2.4.2 Achievement Check Rubric	**Tools** • grid paper **Technology Tools** • graphing calculators • *Fathom*™ • computers
2.5 Linear and Non-Linear Relations • 80–160 min	77–87	• BLM G10 Grid Paper • BLM T6 *Fathom*™ • BLM T1 Corel® *Quattro Pro*® 8 • BLM T2 Corel® *Quattro Pro*® 10 • BLM T3 Microsoft® *Excel* • BLM 2.5.1 Practice: Linear and Non-Linear Relations	• BLM A5 Problem Solving Checklist • BLM 2.5.2 Achievement Check Rubric	**Tools** • grid paper **Technology Tools** • graphing calculators • *Fathom*™ • Corel® *Quattro Pro*® • Microsoft® *Excel* • computers
2.6 Distance-Time Graphs • 80 min	88–94	• BLM 2.6.1 Practice: Distance-Time Graphs • BLM G10 Grid Paper	• BLM A9 Communication General Scoring Rubric	**Tools** • large ball (such as a basketball or volleyball) • grid paper **Technology Tools** • graphing calculators • CBR™ (calculator-based rangefinder) • link cables
Chapter 2 Review • 80 min	95–97	• BLM 2.CR.1 Chapter 2 Review • BLM G10 Grid Paper		**Tools** • grid paper
Chapter 2 Practice Test • 80 min	98–99	• BLM G10 Grid Paper	• BLM 2.PT.1 Chapter 2 Practice Test • BLM 2.CT.1 Chapter 2 Test	**Tools** • grid paper
Chapter 2 Problem Wrap-Up • 80 min	99	• BLM G10 Grid Paper	• BLM A17 Teamwork Self Assessment • BLM 2.CP.1 Chapter 2 Problem Wrap-Up Rubric	**Tools** • grid paper

Chapter 2 Blackline Masters Checklist

	BLM	Title	Purpose
Get Ready			
	BLM G10	Grid Paper	Teacher Support
	BLM 2.GR.1	Practice: Get Ready	Practice
	BLM 2.GR.2	How to Draw a Scatter Plot	Student Support
	BLM 2.GR.3	Get Ready Self-Assessment Checklist	Student Self-Assessment
2.1: Hypotheses and Sources of Data			
	BLM 2.1.1	Practice: Hypotheses and Sources of Data	Practice
	BLM 2.1.2	Achievement Check Rubric	Assessment
	BLM A9	Communication General Scoring Rubric	Assessment
2.2: Sampling Principles			
	BLM 2.2.1	Practice: Sampling Principles	Practice
	BLM T6	*Fathom*™	Technology
	BLM A21	Opinion Piece Checklist	Assessment
	BLM A4	Presentation Checklist	Assessment
2.3: Use Scatter Plots to Analyse Data			
	BLM T6	*Fathom*™	Technology
	BLM T1	Corel® *Quattro Pro*® 8	Technology
	BLM T2	Corel® *Quattro Pro*® 10	Technology
	BLM T3	Microsoft® *Excel*	Technology
	BLM 2.3.1	Practice: Use Scatter Plots to Analyse Data	Practice
	BLM A7	Thinking General Scoring Rubric	Assessment
	BLM G10	Grid Paper	Student Support
2.4: Trends, Interpolation, and Extrapolation			
	BLM G10	Grid Paper	Student Support
	BLM T6	*Fathom*™	Technology
	BLM 2.4.1	Practice: Trends, Interpolation, and Extrapolation	Practice
	BLM A10	Observation General Scoring Rubric	Assessment
	BLM 2.4.2	Achievement Check Rubric	Assessment

	BLM	Title	Purpose
2.5: Linear and Non-Linear Relations			
	BLM G10	Grid Paper	Student Support
	BLM T6	*Fathom*™	Technology
	BLM T1	Corel® *Quattro Pro*® 8	Technology
	BLM T2	Corel® *Quattro Pro*® 10	Technology
	BLM T3	Microsoft® *Excel*	Technology
	BLM 2.5.1	Practice: Linear and Non-Linear Relations	Practice
	BLM A5	Problem Solving Checklist	Assessment
	BLM 2.5.2	Achievement Check Rubric	Assessment
2.6: Distance-Time Graphs			
	BLM 2.6.1	Practice: Distance-Time Graphs	Practice
	BLM A9	Communication General Scoring Rubric	Assessment
	BLM G10	Grid Paper	Student Support
Chapter 2 Review			
	BLM 2.CR.1	Chapter 2 Review	Practice
	BLM G10	Grid Paper	Student Support
Chapter 2 Practice Test			
	BLM 2.PT.1	Chapter 2 Practice Test	Diagnostic Assessment
	BLM 2.CT.1	Chapter 2 Test	Summative Assessment
	BLM G10	Grid Paper	Student Support
Chapter 2 Problem Wrap-Up			
	BLM A17	Teamwork Self Assessment	Student Self-Assessment
	BLM G10	Grid Paper	Student Support
	BLM 2.CP.1	Chapter 2 Problem Wrap-Up Rubric	Summative Assessment

Get Ready

Student Text Pages
40 to 41

Suggested Timing
80 min

Tools
- grid paper

Related Resources
BLM G10 Grid Paper

BLM 2.GR.1 Practice: Get Ready

BLM 2.GR.2 How to Draw a Scatter Plot

BLM 2.GR.3 Get Ready Self-Assessment Checklist

Common Errors

- Some students may misinterpret question 1c) and not refer to the graph, but rather to their own experiences or opinions.

R_x Remind students that the graph needs to be interpreted appropriately.

- Some students may have forgotten how to draw a scatter plot.

R_x Remind students that the dots represent ordered pairs, for example, (10, 16). The first value, 10, is plotted on the horizontal or *x*-axis, and the second value, 16, is plotted on the vertical or *y*-axis. The dot is placed at the intersection of the two values.

- Some students will not divide appropriately when finding unit rate.

R_x Have students consider which quantity should be the "unit" and to divide by that quantity.

Accommodations

Gifted and Enrichment—Encourage students to create many ways to solve the same problem.

Teaching Suggestions

- Questions 1 and 2 provide a good opportunity for students to work in pairs to discuss their observations about the graphs.
- Refer to the Link to Get Ready in the chapter sections of the Teacher's Resource.
- You may wish to have students use **BLM G10 Grid Paper** for questions 3a) and 4a). You can use **BLM 2.GR.2 How to Draw a Scatter Plot** to provide students with detailed instructions on drawing scatter plots.
- You may wish to use **BLM 2.GR.1 Practice: Get Ready** for remediation or extra practice.
- All BLMs referred to throughout this chapter can be found in the *Principles of Mathematics 9* Teacher's Resource CD-ROM.

Assessment

Assess student readiness to proceed by informal observation as students are working on the exercises. A formal test would be inappropriate since this material is not part of the grade 9 curriculum for this chapter. Student self-assessment is also an effective technique; using **BLM 2.GR.3 Get Ready Self-Assessment Checklist**, students can place a check mark beside topics in the Get Ready in which they feel confident with the necessary skills. Remedial action can be taken in small groups or with a whole class skill review.