Mathematical Processes

Vocabulary

natural number
prime number
perfect square
vertex
pentomino
rational number
conjecture
mean
counter-example

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.

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.

Overall Expectations

By the end of this course, students will:

NAV.01 demonstrate an understanding of the exponent rules of multiplication and division, and apply them to simplify expressions;

NAV.02 manipulate numerical and polynomial expressions, and solve first-degree equations

Specific Expectations

Manipulating Expressions and Solving Equations

By the end of this chapter, students will:

NA2.01 simplify numerical expressions involving integers and rational numbers, with and without the use of technology;

NA2.02 solve problems requiring the manipulation of expressions arising from applications of percent, ratio, rate, and proportion.

Mathematical Processes

The mathematical processes have been included at the beginning of the textbook to reflect the spirit of the 2005 Curriculum Revisions. These processes are interwoven throughout the other chapters, but they are introduced here to set the tone.

The focus of all the problems in Chapter 1 is on numeracy skills. Students can review these skills through a process approach, instead of through pages of drill. This way, students will become engaged in mathematical Problem Solving, Reasoning and Proving, Reflecting, Selecting Tools and Computational Strategies, Connecting, Representing, and Communicating.

Chapter 1 Planning Chart

Section Suggested Timing	Student Text Page (s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 1 Opener • 15 min	2–3			
Get Ready • 80 min	4–5	• BLM G1 Integer Number Lines • BLM 1.GR.1 Practice: Get Ready	• BLM 1.GR.2 Get Ready Self-Assessment Checklist	
1.1 Focus on Problem Solving • 80 min	6–9	• BLM 1.1.1 Investigate A Table • BLM 1.1.2 Investigate B Table • BLM 1.1.3 Practice: Focus on Problem Solving • BLM 1.1.4 Sudoku	• BLM A18 My Progress as a Problem Solver	
1.2 Focus on Communicating • 80 min	10–13	• BLM 1.2.1 Practice: Focus on Communicating • BLM 1.2.2 Sudoku	• BLM A9 Communication General Scoring Rubric • BLM A4 Presentation Checklist	
1.3 Focus on Connecting • 80 min	14–18	• BLM 1.3.1 Practice: Focus on Connecting • BLM 1.3.2 Sudoku	• BLM A5 Problem Solving Checklist • BLM A10 Observation General Scoring Rubric	
1.4 Focus on Representing • 80 min	19–22	• BLM 1.4.1 Practice: Focus on Representing • BLM G9 Centimetre Grid Paper	• BLM A4 Presentation Checklist BLM A11 Group Work Assessment Recording Sheet • BLM A12 Group Work Assessment General Scoring Rubric	**Tools** • centimetre grid paper
1.5 Focus on Selecting Tools and Computational Strategies • 160 min	23–28	• BLM 1.5.1 Practice: Focus on Selecting Tools and Computational Strategies • BLM G10 Grid Paper • BLM G7 Square Dot Paper • BLM 1.5.2 Tangram	• BLM A5 Problem Solving Checklist	**Tools** • square tiles • linking squares • grid paper • geoboards • square dot paper • tangrams
1.6 Focus on Reasoning and Proving • 80 min	29–33	• BLM 1.6.1 Practice: Focus on Reasoning and Proving • BLM 1.6.2 Chess Board • BLM 1.6.3 Sudoku	• BLM A11 Group Work Assessment Recording Sheet • BLM A12 Group Work Assessment General Scoring Rubric • BLM A10 Observation General Scoring Rubric	
1.7 Focus on Reflecting • 80 min	34–36	• BLM 1.7.1 Practice: Focus on Reflecting	• BLM A11 Group Work Assessment Recording Sheet • BLM A12 Group Work Assessment General Scoring Rubric • BLM A9 Communication General Scoring Rubric	**Tools** • paper strips • tape
Chapter 1 Review • 80 min	37	• BLM 1.CR.1 Chapter 1 Review	• BLM A14 Self-Assessment Recording Sheet • BLM A15 Self-Assessment Checklist • BLM A20 Learning Skills Checklist • BLM A16 My Progress as a Mathematician • BLM A18 My Progress as a Problem Solver	

Chapter 1 Blackline Masters Checklist

	BLM	Title	Purpose
Get Ready			
	BLM G1	Integer Number Lines	Teacher Support
	BLM 1.GR.1	Practice: Get Ready	Practice
	BLM 1.GR.2	Get Ready Self-Assessment Checklist	Self-Assessment
1.1: Focus on Problem Solving			
	BLM 1.1.1	Investigate A Table	Student Support
	BLM 1.1.2	Investigate B Table	Student Support
	BLM A18	My Progress as a Problem Solver	Student Self-Assessment
	BLM 1.1.3	Practice: Focus on Problem Solving	Practice
	BLM 1.1.4	Sudoku	Student Support
1.2: Focus on Communicating			
	BLM A9	Communication General Scoring Rubric	Assessment
	BLM A4	Presentation Checklist	Assessment
	BLM 1.2.1	Practice: Focus on Communicating	Practice
	BLM 1.2.2	Sudoku	Student Support
1.3: Focus on Connecting			
	BLM A5	Problem Solving Checklist	Assessment
	BLM 1.3.1	Practice: Focus on Connecting	Practice
	BLM 1.3.2	Sudoku	Student Support
	BLM A10	Observation General Scoring Rubric	Assessment
1.4: Focus on Representing			
	BLM A4	Presentation Checklist	Assessment
	BLM 1.4.1	Practice: Focus on Representing	Practice
	BLM G9	Centimetre Grid Paper	Student Support
	BLM A11	Group Work Assessment Recording Sheet	Assessment
	BLM A12	Group Work Assessment General Scoring Rubric	Assessment
1.5: Focus on Selecting Tools and Computational Strategies			
	BLM A5	Problem Solving Checklist	Assessment
	BLM 1.5.1	Practice: Focus on Selecting Tools and Computational Strategies	Practice
	BLM G10	Grid Paper	Student Support
	BLM G7	Square Dot Paper	Student Support
	BLM 1.5.2	Tangram	Student Support

	BLM	Title	Purpose
1.6: Focus on Reasoning and Proving			
	BLM A11	Group Work Assessment Recording Sheet	Assessment
	BLM A12	Group Work Assessment General Scoring Rubric	Assessment
	BLM 1.6.1	Practice: Focus on Reasoning and Proving	Practice
	BLM 1.6.2	Chess Board	Student Support
	BLM A10	Observation General Scoring Rubric	Assessment
	BLM 1.6.3	Sudoku	Student Support
1.7: Focus on Reflecting			
	BLM A11	Group Work Assessment Recording Sheet	Assessment
	BLM A12	Group Work Assessment General Scoring Rubric	Assessment
	BLM 1.7.1	Practice: Focus on Reflecting	Practice
	BLM A9	Communication General Scoring Rubric	Assessment
Chapter 1 Review			
	BLM A14	Self-Assessment Recording Sheet	Student Self-Assessment
	BLM A15	Self-Assessment Checklist	Student Self-Assessment
	BLM 1.CR.1	Chapter 1 Review	Review
	BLM A20	Learning Skills Checklist	Assessment
	BLM A16	My Progress as a Mathematician	Student Self-Assessment
	BLM A18	My Progress as a Problem Solver	Student Self-Assessment

Get Ready

Common Errors

- Some students may find the common denominator when multiplying or dividing fractions.

R_x Have students think about the reasons behind finding the common denominator when adding and subtracting—in order to combine parts of a whole, fractions must relate to each other with a common denominator. When multiplying and dividing, there is no need to do that.

- Some students may mix up the rules for adding two negatives and give a positive answer.

R_x Use integer tiles to illustrate adding 2 red tiles with 3 red tiles equals 5 red tiles, rather than 5 green tiles.

Accommodations

Perceptual—Encourage students to use a number line when adding and subtracting fractions.

Memory—Allow students to use a scientific calculator to evaluate order of operations questions.

Teaching Suggestions

- As this chapter is meant to highlight mathematical processes, the Get Ready should be used for quick warm-ups, rather than as a full period exercise.
- Refer to the Link to Get Ready in the chapter sections of the Teacher's Resource.
- Have students work with each part when it is relevant to the section in the chapter. You may wish to use **BLM G1 Integer Number Lines** for questions 4 to 6.
- You may wish to use **BLM 1.GR.1 Practice: Get Ready** for remediation or extra practice.
- All BLMs referred to throughout this chapter can be found on 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; have students place a checkmark beside topics in the Get Ready in which they feel confident with the necessary skills, or have students use **BLM 1.GR.2 Get Ready Self-Assessment Checklist**. Remedial action can be taken in small groups or with a whole class skill review.