Grade 6 Table of Contents

Curriculum Requirement:

- ● Required
- ◉ Recommended
- ○ Optional
- * Review
- ___ Give a quiz/test

Grade 6, Part 1

Introductory Material

Unit 1 Patterns and Algebra: Patterns

Unit 2 Number Sense: Addition and Subtraction

Unit 3 Probability and Data Management: Graphs

Curriculum Requirement				Lesson	Title	Section-Page
AB	BC	MB	ON			
					Introduction	D-1
◐*	◐*	◐*	●	PDM6-1	Bar Graphs and Double Bar Graphs	D-3
○	○	○	●	PDM6-2	Stem and Leaf Plots	D-10
●	●	●	●	PDM6-3	Continuous and Discrete Data, Broken Line Graphs	D-15
●	●	●	●	PDM6-4	Reading and Predicting Graphs	D-21
●	●	●	●	PDM6-5	Continuous Line Graphs	D-26
●	●	●	●	PDM6-6	Choosing and Interpreting Graphs	D-31
				BLM	Properties of Double Bar Graphs	D-34
				BLM	Interpreting Line Graphs	D-35

Unit 4 Number Sense: Multiplication and Division

Curriculum Requirement				Lesson	Title	Section-Page
AB	BC	MB	ON			
					Introduction	E-1
◐	◐	◐	●	NS6-9	Multiplying by Powers of Ten	E-3
◐	●	◐	●	NS6-10	Dividing Using Tens	E-9
◐	●	◐	●	NS6-11	Mental Math	E-14
◐*	◐*	◐*	◐*	NS6-12	The Standard Method for Multiplication	E-19
◐*	●	◐*	◐*	NS6-13	Multiplication (2-Digit by 2-Digit)	E-21
◐	●	◐	●	NS6-14	Multiplying Multi-Digit Numbers by 2-Digit Numbers	E-26
●	◐	●	●	NS6-15	Multiplication Word Problems	E-32
◐*	◐*	◐*	●	NS6-16	Long Division	E-34
●	●	●	●	NS6-17	Estimating	E-41
				BLM	Using Triples to Multiply	E-46
					Problem-Solving Lessons Introduction	E-47
○	○	○	○	PS6-1	Searching Systematically	E-49
○	○	○	○	PS6-2	Using Structure I: Multiplication Puzzles	E-59
○	○	○	○	PS6-3	Using Structure II: Division Puzzles	E-71

Unit 5 Measurement: Length, Perimeter, and Mass

Unit 6 Geometry: Angles, Polygons, and Symmetry

Unit 7 Number Sense: Divisibility and Prime Numbers

Unit 8 Number Sense: Fractions

Generic Blackline Masters

Answer Keys for Assessment & Practice Book 6.1

Grade 6, Part 2

Unit 9 Number Sense: Adding and Subtracting Decimals

Unit 10 Number Sense: Multiplying and Dividing Decimals

Unit 11 Geometry: Transformations

Unit 12 Patterns and Algebra: Equations and Graphs

Unit 13 Measurement: Area

Unit 14 Number Sense: Percentages and Ratios

Unit 15 Probability and Data Management: Probability, Collecting and Analyzing Data

Unit 16 Measurement: 3-D Shapes, Volume, and Surface Area

Generic Blackline Masters

Answer Keys for Assessment & Practice Book 6.2

JUMP Math Correlation to the Alberta Curriculum

JUMP Math Correlation to the New BC Curriculum

JUMP Math Correlation to the Manitoba Curriculum

JUMP Math Correlation to the Ontario Curriculum

Welcome to JUMP Math and Your Grade 6 Teacher Resource

JUMP Math is …

JUMP Math is an award-winning charitable organization dedicated to helping people lead more fulfilled lives. JUMP Math's research-informed materials and professional development replace math anxiety with an understanding and a love of math in students and educators.

JUMP Math Features

The following are the features of JUMP Math:

- Confidence building
- Structured inquiry
- Guided practice
- Scaffolded instruction
- Continuous assessment
- Differentiation
- Mental math

Confidence building

JUMP Math recognizes that math anxiety is a significant barrier to learning for many students. The research in cognition that shows the brain can be altered by education also shows that the brain can't register the effects of education if it is not attentive. However, a student's brain can't be truly attentive unless the student is confident and excited and believes that there is a point in being engaged in the work. The JUMP Math approach reduces math anxiety by building on success in small steps. When students who are struggling become convinced that they cannot keep up with the rest of the class, their brains begin to work less efficiently, as they are never attentive enough to fully consolidate new skills or develop new neural pathways. That is why it is so important to give students the skills they need to take part in lessons and to give them opportunities to show off by answering questions in front of their classmates.

Structured inquiry

Structured inquiry is a balanced instructional approach that incorporates explicit instruction combined with guided and independent practice. In JUMP Math lessons, students are expected to derive concepts and solve problems themselves, but the teacher provides enough rigorous guidance to make sure this happens with all students and not just the advanced few. Students are led to deep conceptual understanding and computational fluency.

Guided practice

In guided practice, teachers offer students purposeful practice that immediately follows the teaching of a skill or scaffolded step of a concept. This guided practice allows the teacher to continuously assess and confirm students' understanding and mastery.

Scaffolded instruction

Scaffolded instruction is an effective instructional practice where new ideas and skills are reviewed and introduced in smaller incremental steps directly linked to and built upon earlier learning. Each lesson offers a series of carefully considered exercises and explorations in which each new concept follows from the last. Students are more likely to make discoveries if the progression of ideas makes sense to them and does not overwhelm them.

Continuous assessment

The progression of learning contained in each JUMP Math lesson enables active and ongoing assessment, often referred to as "continuous assessment." Through observation, questioning, and interaction with students as they work, teachers are readily able to check for understanding, identify and correct misunderstandings, and differentiate instruction with timely interventions. Continuous assessment often provides a more accurate and complete picture of a student's ability and has a positive impact on learning.

Differentiation

JUMP Math recognizes that classrooms are diverse in their makeup and needs, and that students range in their levels of focus, concentration, engagement, processing speed, and readiness to explore and demonstrate learning. In order to support this diversity, JUMP Math lessons and supporting resources provide multiple approaches to exploring, practising, and assessing skills. Teachers can differentiate the development of skills without differentiating the outcomes of their students by teaching lessons in short instructional pieces and assigning scaffolded exercises, hands-on activities, and extension questions. In JUMP Math, mastery is the goal of each lesson and all students are supported to reach that goal.

Mental math

Mental math is a mathematical framework that includes number sense, computational fluency, and the application of number concepts through purposeful and varied practice, not just rote memorization. In JUMP Math, mental math is explored through regular practice.

JUMP Math Classroom Materials

JUMP Math has developed a variety of materials to help you teach math. In this section, we will describe the following components and features of the JUMP Math classroom materials:

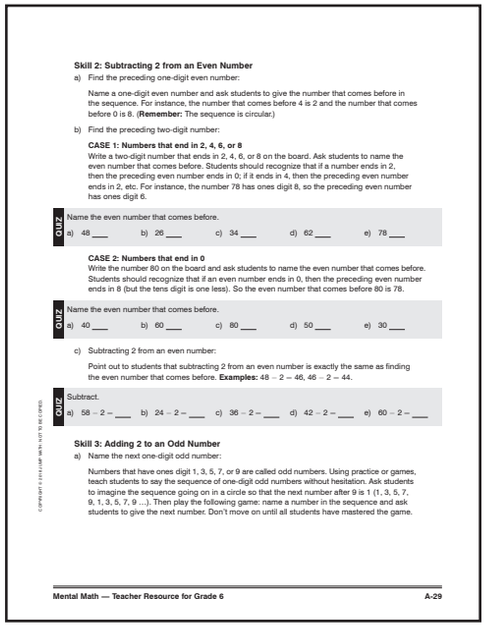
- Teacher Resource Table of contents
- Mental math
- Unit introductions
- Lesson plans
- Digital lesson slides
- Blackline Masters (BLMs)
- Problem-solving lessons
- Assessment tools
- Assessment & Practice Books
- Answer keys
- Curriculum correlations
- Confidence Building Units

Teacher Resource Table of Contents

The table of contents for the Teacher Resource contains information on where to find each component, as well as details on the provincial curriculum requirement for each lesson. The lessons are flagged as required, recommended, or optional for each province. Lessons labelled as required are necessary to cover the curriculum. Lessons labelled as recommended are either essential review or contain extra material that is used in future lessons. Lessons labelled as optional cover material that is not required by the curriculum or in future lessons. Review lessons are marked with an asterisk (*) in the table of contents. If the significant majority of your students have a strong foundation in the material covered in a review lesson, we recommend you use the material with individuals or small groups of students who need the review. Otherwise, you should teach them to the whole class.

Mental Math

Mental math is a mathematical framework that includes number sense, computational fluency, and the application of number concepts through purposeful and varied practice, not just rote memorization. Essential mental math concepts, skills, exercises, and assessments that can be used throughout the year are presented in this section (see p. A-23).



Skill 2: Subtracting 2 from an Even Number

a) Find the preceding one-digit even number:

Name a one-digit even number and ask students to give the number that comes before in the sequence. For instance, the number that comes before 4 is 2 and the number that comes before 0 is 8. (**Remember:** The sequence is circular.)

b) Find the preceding two-digit number:

CASE 1: Numbers that end in 2, 4, 6, or 8

Write a two-digit number that ends in 2, 4, 6, or 8 on the board. Ask students to name the even number that comes before. Students should recognize that if a number ends in 2, then the preceding even number ends in 0; if it ends in 4, then the preceding even number ends in 2, etc. For instance, the number 78 has ones digit 8, so the preceding even number has ones digit 6.

QUIZ

Name the even number that comes before.

a) 48 ___ b) 26 ___ c) 34 ___ d) 62 ___ e) 78 ___

CASE 2: Numbers that end in 0

Write the number 80 on the board and ask students to name the even number that comes before. Students should recognize that if an even number ends in 0, then the preceding even number ends in 8 (but the tens digit is one less). So the even number that comes before 80 is 78.

QUIZ

Name the even number that comes before.

a) 40 ___ b) 60 ___ c) 80 ___ d) 50 ___ e) 30 ___

c) Subtracting 2 from an even number:

Point out to students that subtracting 2 from an even number is exactly the same as finding the even number that comes before. **Examples:** 48 − 2 = 46, 46 − 2 = 44.

QUIZ

Subtract.

a) 58 − 2 = ___ b) 24 − 2 = ___ c) 36 − 2 = ___ d) 42 − 2 = ___ e) 60 − 2 = ___

Skill 3: Adding 2 to an Odd Number

a) Name the next one-digit odd number:

Numbers that have ones digit 1, 3, 5, 7, or 9 are called odd numbers. Using practice or games, teach students to say the sequence of one-digit odd numbers without hesitation. Ask students to imagine the sequence going on in a circle so that the next number after 9 is 1 (1, 3, 5, 7, 9, 1, 3, 5, 7, 9 ...). Then play the following game: name a number in the sequence and ask students to give the next number. Don't move on until all students have mastered the game.

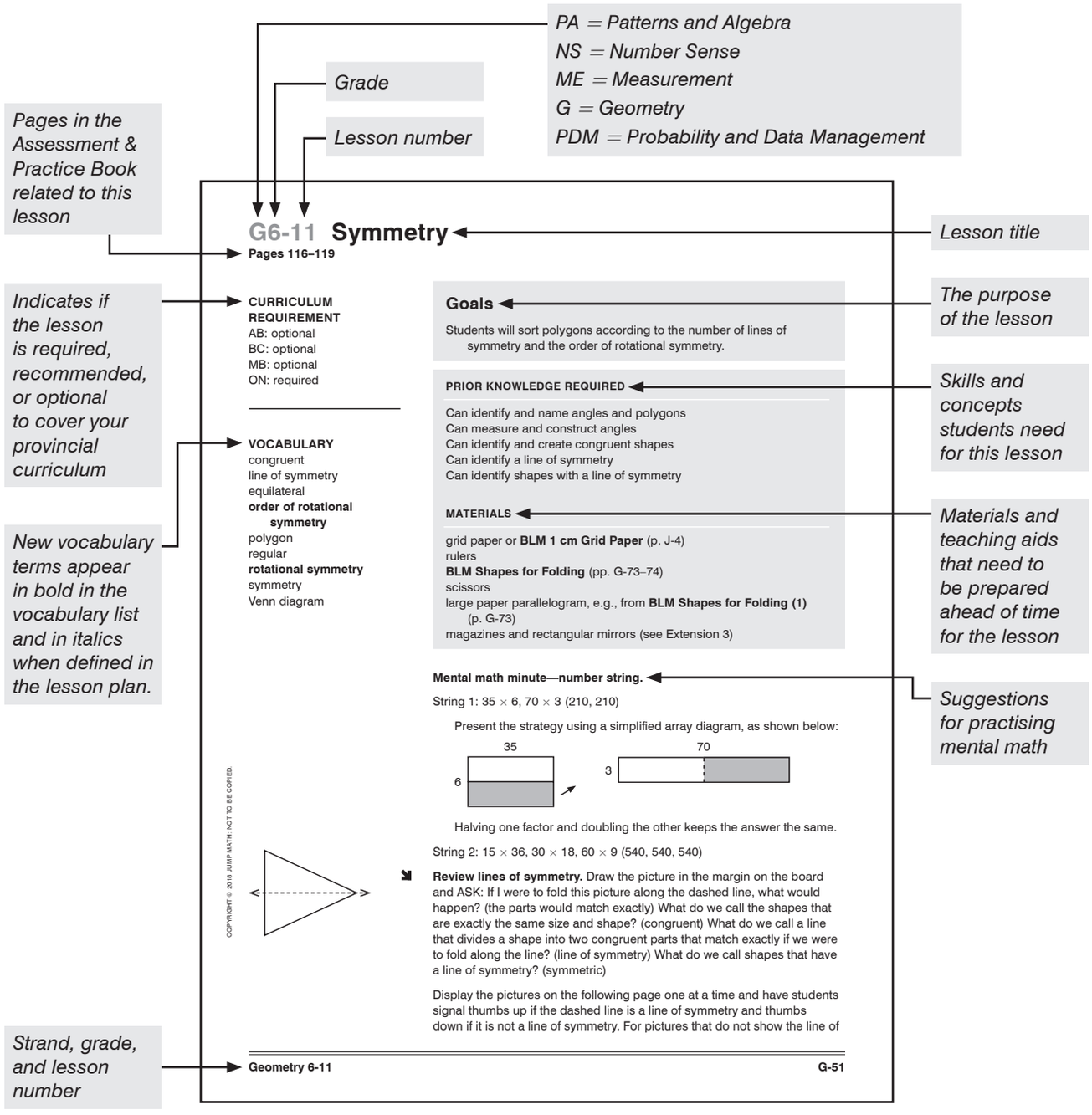
Unit Introductions

Each unit begins with an introduction that is designed to serve as a planning support. The unit introductions include some or all of the following:

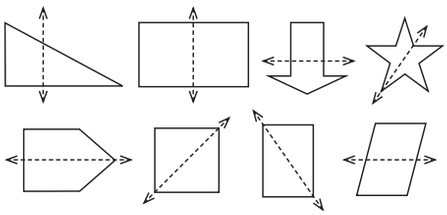
- Overview of the topics covered in the unit
- Specifications on meeting your curriculum
- Rationale for the mental math minutes used in the unit
- Correlation between the lessons and the quizzes and tests
- Notes on materials and vocabulary used in the lessons

Lesson Plans

The JUMP Math lesson plans guide teachers through a progression of skill and concept development, tasks to demonstrate and model, and varied opportunities to guide student exploration, practice, and learning. The lesson plans provide clear explanations and explicit guidance on how to introduce one concept at a time, explore concepts and make connections in a variety of ways, assess students quickly, enhance learning with interactive activities, and challenge students with bonus questions. Problem-solving skills are developed progressively throughout the lesson with a series of probing questions and enriched discussions. The lesson plans are designed to be used in conjunction with Blackline Masters, digital lesson slides, and corresponding pages in the Assessment & Practice Books.



symmetry, ASK: Does this shape have a line of symmetry at all? Again, have students signal the answer. For shapes that have a line of symmetry, invite a volunteer to draw the line. Have students show thumbs up if they agree that the line the volunteer drew is a line of symmetry.



In the last two cases, if students disagree about the answer (the rectangle has two lines of symmetry, horizontal and vertical, but the parallelogram does not have a line of symmetry), demonstrate the folding with a paper shape.

Exercises: Use grid paper and a ruler.

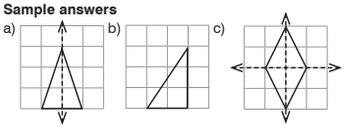
a) Draw a polygon that has a line of symmetry. Draw the line of symmetry.

b) Draw a polygon that does not have a line of symmetry.

Bonus: Draw a polygon that has more than one line of symmetry. Draw all the lines of symmetry.

Sample answers

a) b) c)



ACTIVITY 1 (Essential)

1. **Using folding to find lines of symmetry in polygons.** Divide students into groups of four and give each student half a page from **BLM Shapes for Folding**. Have students cut out the shapes. Have students fold the shapes in different ways trying to identify all lines of symmetry in each of their three shapes. The shapes on the BLM have from 0 to 8 lines of symmetry. When students find a fold that is a line of symmetry, have them trace the fold so that they can later show their partners all the lines of symmetry they found. Have students share their findings in the group, and sort all the shapes by the number of lines of symmetry.

Exercises for individual practice (with answers) are highlighted.

Bonus questions are often provided.

Activities in the lesson plan are labelled as either essential or optional.

The main idea behind each part of the lesson is in bold at the beginning of the paragraph.

Specific prompts provide suggested wording.

Sample answers are provided in brackets.

Extension questions appear at the end of the lesson plan.

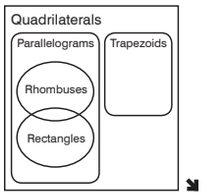
Review squares. Remind students that squares are shapes with four equal sides and four right angles. SAY: This means that squares are equilateral rectangles. ASK: Is a square also a rhombus? How do you know? PROMPT: A rhombus is an equilateral parallelogram. Is a rectangle a parallelogram? (yes) Is a square equilateral? (yes) Is a square a rhombus? (yes)

Have students compare the angles of the quadrilaterals on BLM Rhombus or Not? to a right angle using a protractor. ASK: Which quadrilateral is a square? (B) Draw a Venn diagram with the groups "rhombuses" and "rectangles" on the board. ASK: In which region of the Venn diagram do all squares appear? (in the central region) Can there be anything else in the central region? (no) Why not? (a rectangle that is a rhombus is an equilateral rectangle, so it is a square) Have students copy the Venn diagram into their notebooks and sketch an example polygon in each region.

ACTIVITY 2 (Essential)

2. Give students four yarn circles and have them make index cards with a title "Quadrilaterals" and the labels "Parallelograms," "Trapezoids," "Rhombuses," and "Rectangles." Explain that you want students to arrange these circles to make a Venn diagram for all quadrilaterals. Have them think how to arrange the circles. Write these questions on the board for students to consider:
   - Should some groups overlap?
   - Are there groups that do not overlap? Which ones?
   - Are there groups that are completely inside another group? Which ones?

   Have students compare answers in pairs and come up with a common Venn diagram. See the sample diagram in the margin. Then have students sketch an example shape in each region of the Venn diagram they created.



Extensions

1. Kites are quadrilaterals with two pairs of equal sides, with equal sides sharing a vertex, and with no indentation. Decide if the statement is true or false. If it is false, draw a shape to illustrate how the statement is false—in other words, a counter-example.

   a) All kites are rhombuses.

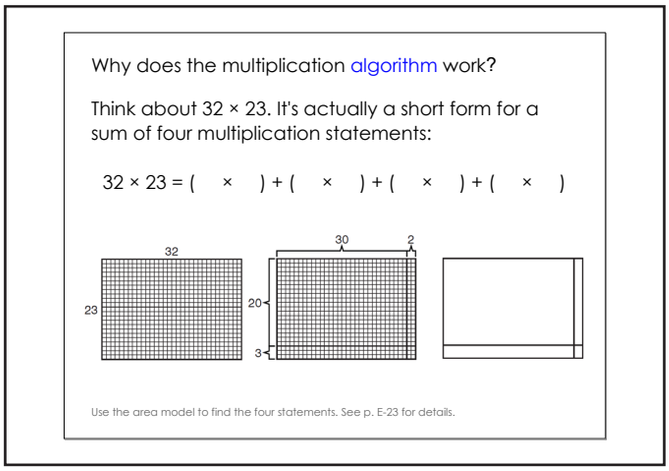
   b) Some kites are rhombuses.

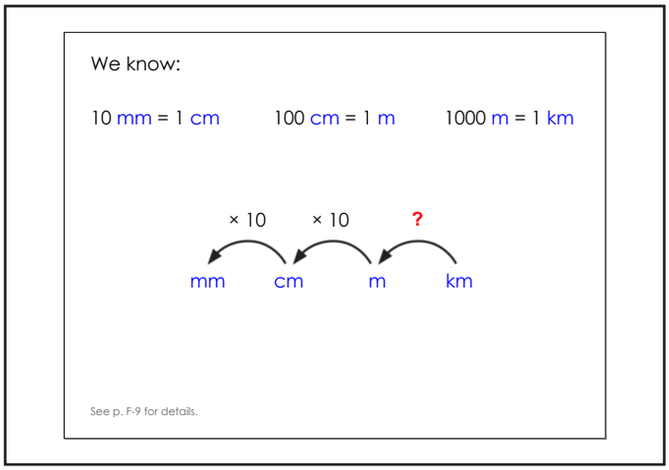
   c) All rhombuses are kites.

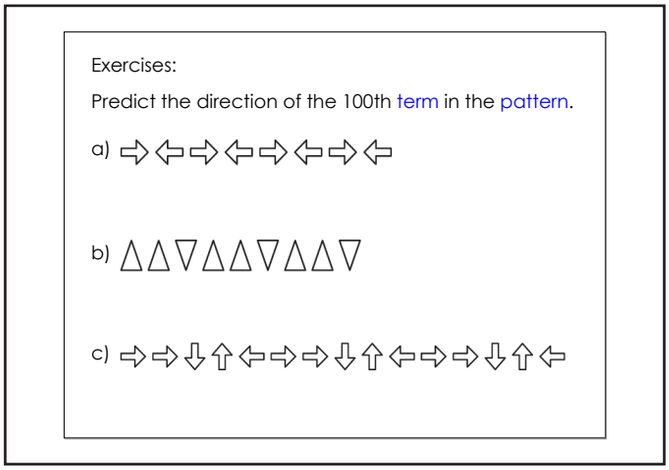
   Answers: a) false, see example in the margin; b) true; c) true

Digital Lesson Slides

Digital lesson slides guide teachers to follow the progression of skill development within a lesson. They are not intended as stand-alone tools or lessons, but are to be used in tandem with the lesson plans. The slides include diagrams, sample problems, practice exercises, bonus questions, and extensions.

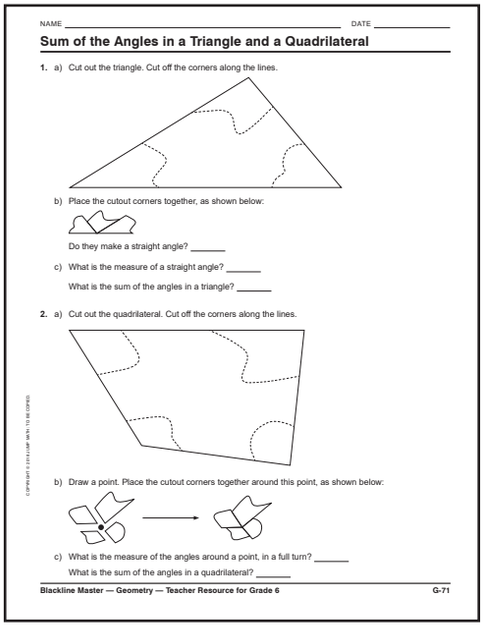






Blackline Masters (BLMs)

Blackline Masters (BLMs) are reproducible pages that are lesson-specific or used repeatedly throughout the unit and are designed to supplement instruction in the lesson. BLMs can be used to, for example, provide practice that is integral to the lesson, provide additional practice for students who require it, or serve as templates or manipulatives that can be used during the lesson.



NAME _____ DATE _____

Sum of the Angles in a Triangle and a Quadrilateral

1. a) Cut out the triangle. Cut off the corners along the lines.

b) Place the cutout corners together, as shown below:

Do they make a straight angle? _____

c) What is the measure of a straight angle? _____

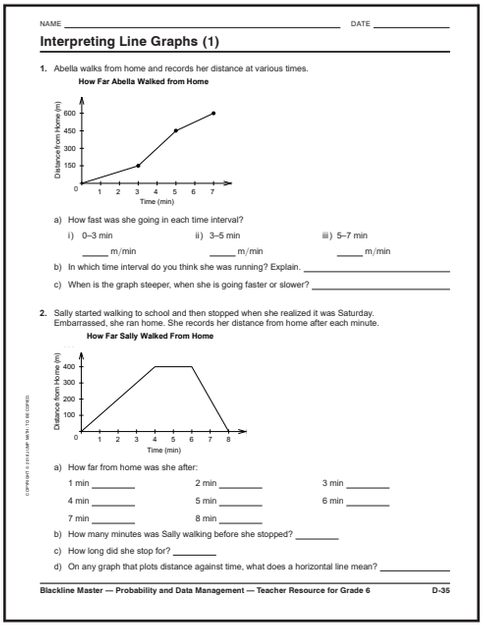
What is the sum of the angles in a triangle? _____

2. a) Cut out the quadrilateral. Cut off the corners along the lines.

b) Draw a point. Place the cutout corners together around this point, as shown below:

c) What is the measure of the angles around a point, in a full turn? _____

What is the sum of the angles in a quadrilateral? _____



NAME _____ DATE _____

Interpreting Line Graphs (1)

1. Abella walks from home and records her distance at various times.

How Far Abella Walked from Home

Distance from Home (m): 0, 150, 300, 450, 600

Time (min): 0 1 2 3 4 5 6 7

a) How fast was she going in each time interval?

i) 0–3 min _____ m/min

ii) 3–5 min _____ m/min

iii) 5–7 min _____ m/min

b) In which time interval do you think she was running? Explain. _____

c) When is the graph steeper, when she is going faster or slower? _____

2. Sally started walking to school and then stopped when she realized it was Saturday. Embarrassed, she ran home. She records her distance from home after each minute.

How Far Sally Walked From Home

Distance from Home (m): 0, 100, 200, 300, 400

Time (min): 0 1 2 3 4 5 6 7 8

a) How far from home was she after:

1 min _____ 2 min _____ 3 min _____

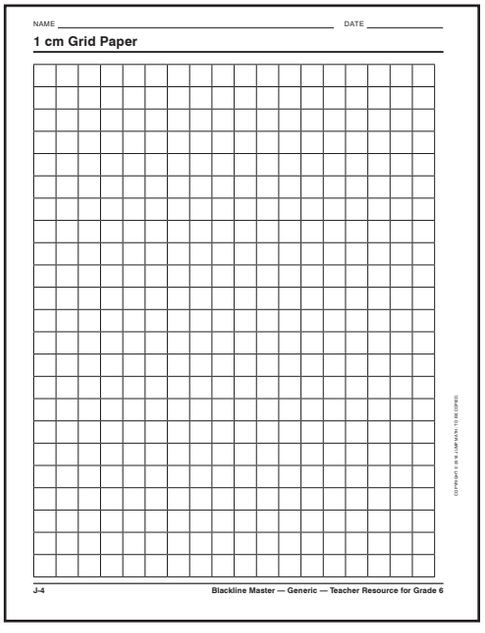
4 min _____ 5 min _____ 6 min _____

7 min _____ 8 min _____

b) How many minutes was Sally walking before she stopped? _____

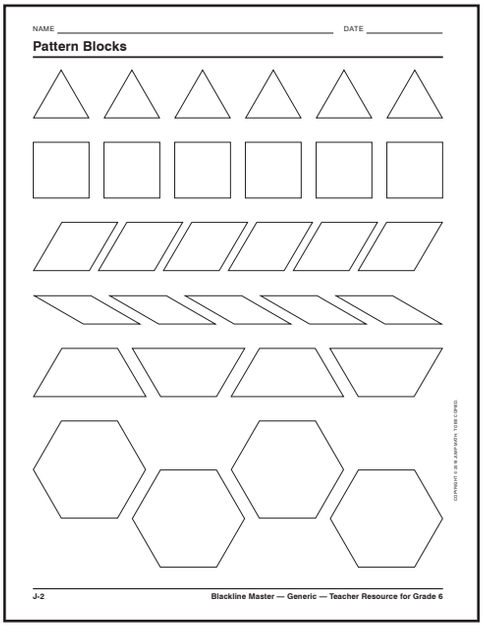
c) How long did she stop for? _____

d) On any graph that plots distance against time, what does a horizontal line mean? _____



NAME _____ DATE _____

1 cm Grid Paper



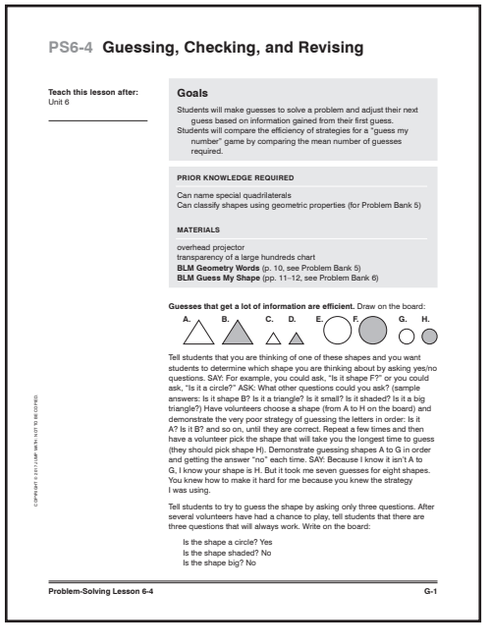
NAME _____ DATE _____

Pattern Blocks

Problem-Solving Lessons

Problem-solving lessons are provided at the end of several, but not all, units (see table of contents on p. iii). These lessons can be taught at any point in the grade after the unit in which the lessons are found. While regular lessons expose students to various problem-solving strategies, the problem-solving lessons isolate and focus on specific strategies rather than on meeting curriculum outcomes.

A detailed description of how to use the problem-solving lessons is included in the introduction to the lessons.



PS6-4 Guessing, Checking, and Revising

Teach this lesson after:
Unit 6

Goals

Students will make guesses to solve a problem and adjust their next guess based on information gained from their first guess.
Students will compare the efficiency of strategies for a "guess my number" game by comparing the mean number of guesses required.

PRIOR KNOWLEDGE REQUIRED

Can name special quadrilaterals
Can classify shapes using geometric properties (for Problem Bank 5)

MATERIALS

overhead projector
transparency of a large hundreds chart
BLM Geometry Words (p. 10, see Problem Bank 5)
BLM Guess My Shape (pp. 11–12, see Problem Bank 6)

Guesses that get a lot of information are efficient. Draw on the board:

A. B. C. D. E. F. G. H.

Tell students that you are thinking of one of these shapes and you want students to determine which shape you are thinking about by asking yes/no questions. SAY: For example, you could ask, "Is it shape F?" or you could ask, "Is it a circle?" ASK: What other questions could you ask? (sample answers: Is it shape B? Is it a triangle? Is it small? Is it shaded? Is it a big triangle?) Have volunteers choose a shape (from A to H on the board) and demonstrate the very poor strategy of guessing the letters in order: Is it A? Is it B? and so on, until they are correct. Repeat a few times and then have a volunteer pick the shape that will take you the longest time to guess (they should pick shape H). Demonstrate guessing shapes A to G in order and getting the answer "no" each time. SAY: Because I know it isn't A to G, I know your shape is H. But it took me seven guesses for eight shapes. You knew how to make it hard for me because you knew the strategy I was using.

Tell students to try to guess the shape by asking only three questions. After several volunteers have had a chance to play, tell students that there are three questions that will always work. Write on the board:

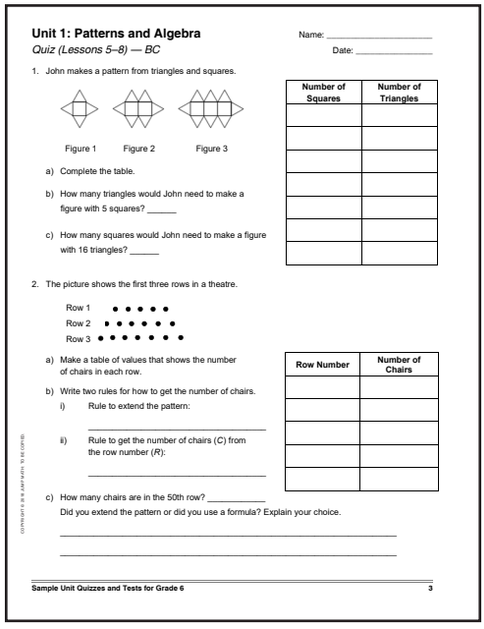
Is the shape a circle? Yes
Is the shape shaded? No
Is the shape big? No

Problem-Solving Lesson 6-4 G-1

Assessment Tools

JUMP Math provides modifiable quizzes and tests for summative assessment. We provide a quiz for, on average, every four lessons and a test covering the material of two to three quizzes, with one or two tests per unit. Students should need no more than 10 minutes to complete a quiz and no more than 45 minutes to complete a test. Quizzes cover material both from lessons that are required to cover the curriculum and lessons labelled as recommended, while tests only cover material from lessons that are required to cover the curriculum.

The quizzes and tests are available in print and in a modifiable format online at www.jumpmath.org.



Unit 1: Patterns and Algebra
Quiz (Lessons 5–8) — BC

Name: _____
Date: _____

1. John makes a pattern from triangles and squares.

Figure 1 Figure 2 Figure 3

Number of Squares	Number of Triangles

a) Complete the table.

b) How many triangles would John need to make a figure with 5 squares? _____

c) How many squares would John need to make a figure with 16 triangles? _____

2. The picture shows the first three rows in a theatre.

Row 1
Row 2
Row 3

Row Number	Number of Chairs

a) Make a table of values that shows the number of chairs in each row.

b) Write two rules for how to get the number of chairs.

i) Rule to extend the pattern:

_____

ii) Rule to get the number of chairs (*C*) from the row number (*R*):

_____

c) How many chairs are in the 50th row? _____

Did you extend the pattern or did you use a formula? Explain your choice.

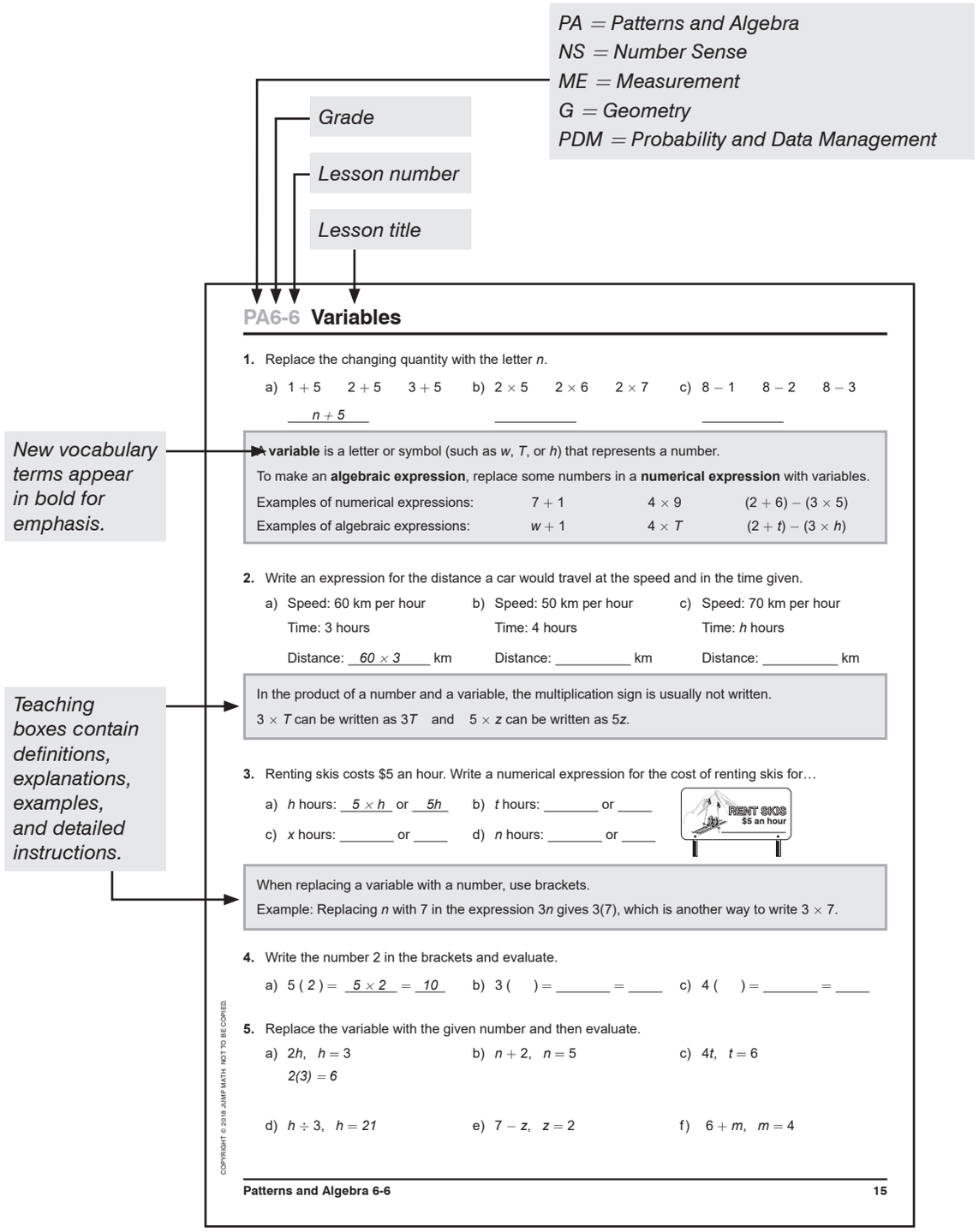
_____

_____

Sample Unit Quizzes and Tests for Grade 6 3

Assessment & Practice Books

These consumable books dovetail seamlessly with the lesson plans. Students work directly in the books to consolidate the skills and concepts taught in the lesson, while teachers assess student understanding. Each student requires one set of Assessment & Practice Books, which includes a Part 1 and Part 2, for the school year.



Reminder boxes contain summaries of information taught previously.

The notebook icon indicates that students must answer in a notebook.

Bonus questions are often provided.

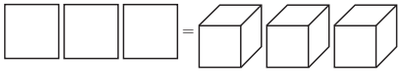
REMINDER ▶

$10 \times \square =$ | $10 \times$ | $=$ | $10 \times$ | $=$

10×1 one $= 1$ ten | 10×1 ten $= 1$ hundred | 10×1 hundred $= 1$ thousand

7. Draw a model for the multiplication. Then calculate the answer.

a) $10 \times 20 = 10 \times$  $=$ *200*

b) $10 \times 300 = 10 \times$  $=$ _____

c) $10 \times 30 = 10 \times$  $=$ _____

d) $10 \times 4 =$ _____ e) $10 \times 40 =$ _____ f) $10 \times 400 =$ _____

8. Multiply.

a) $10 \times 5 =$ _____ b) $10 \times 60 =$ _____ c) $10 \times 30 =$ _____

d) $10 \times 200 =$ _____ e) $10 \times 8 =$ _____ f) $10 \times 400 =$ _____

BONUS ▶

g) $10 \times 30\,000\,000 =$ _____ h) $50\,000 \times 10 =$ _____

$10 \times 12 = 120$ | $100 \times 12 = 1200$ | $1000 \times 12 = 12\,000$

9. Use the pattern in the grey box to multiply.

a) $10 \times 17 =$ _____ b) $100 \times 17 =$ _____ c) $10 \times 24 =$ _____

d) $1000 \times 43 =$ _____ e) $100 \times 78 =$ _____ f) $1000 \times 32 =$ _____

BONUS ▶

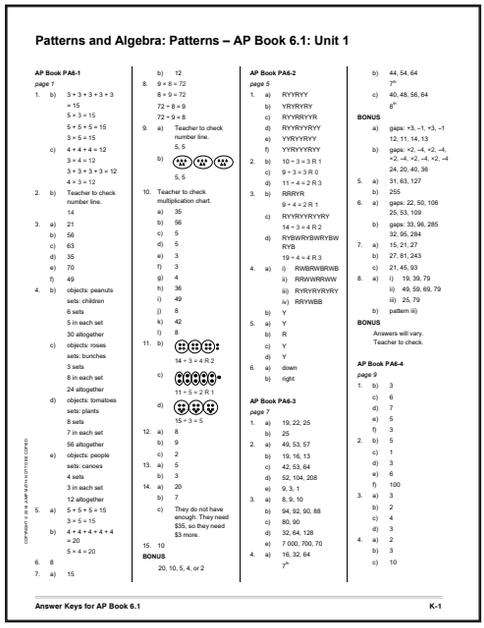
g) $1000 \times 253 =$ _____ h) $34 \times 1000 =$ _____

Partial or complete answers appear in italics.

Strand, grade, and lesson number

Answer Keys

Answer keys are available for the Assessment & Practice Books.



Patterns and Algebra: Patterns – AP Book 6.1: Unit 1

AP Book PA6-1
page 1

1. b) 3 + 3 + 3 + 3 + 3 = 15; 5 + 3 = 15; 5 + 5 + 5 = 15; 3 × 5 = 15
   c) 4 + 4 + 4 = 12; 3 × 4 = 12; 3 + 3 + 3 + 3 = 12; 4 × 3 = 12
2. b) Teacher to check number line. 14
3. a) 21
   b) 56
   c) 63
   d) 35
   e) 70
   f) 49
4. b) objects: peanuts; sets: children; 6 sets; 5 in each set; 30 altogether
   c) objects: roses; sets: bunches; 3 sets; 8 in each set; 24 altogether
   d) objects: tomatoes; sets: plants; 8 sets; 7 in each set; 56 altogether
   e) objects: people; sets: canoes; 4 sets; 3 in each set; 12 altogether
5. a) 5 + 5 + 5 = 15; 3 × 5 = 15
   b) 4 + 4 + 4 + 4 = 4 × 5 = 20
6. 8
7. a) 15
   b) 12
8. 9 × 8 = 72; 8 × 9 = 72; 72 ÷ 8 = 9; 72 ÷ 9 = 8
9. a) Teacher to check number line. 5, 5
   b) 5, 5
10. Teacher to check multiplication chart.
    a) 35
    b) 56
    c) 5
    d) 5
    e) 3
    f) 3
    g) 4
    h) 36
    i) 49
    j) 8
    k) 42
    l) 8
11. b) 14 ÷ 3 = 4 R 2
    c) 11 ÷ 5 = 2 R 1
    d) 15 ÷ 3 = 5
12. a) 8
    b) 9
    c) 2
13. a) 5
    b) 3
14. a) 20
    b) 7
    c) They do not have enough. They need $35, so they need $3 more.
15. 10

BONUS
20, 10, 5, 4, or 2

AP Book PA6-2
page 5

1. a) RYYRYY; YRYRYRY; RYYRRYYR; RYYRRYYRYY; YYRYYRYY; YYRYYYRYY
2. b) 10 ÷ 3 = 3 R 1
   c) 9 ÷ 3 = 3 R 0
   d) 11 ÷ 4 = 2 R 3
3. b) RRRYR; 9 ÷ 4 = 2 R 1
   c) RYYRYYRYYRY; 14 ÷ 3 = 4 R 2
   d) RYBWRYBWRYBW RYB; 19 ÷ 4 = 4 R 3
4. a) i) RWBRWBRWB
   ii) RRWWRRWW
   iii) RYRYRYRYRY
   iv) RRYWBB
   b) Y
5. a) Y
   b) R
   c) Y
   d) Y
6. a) down
   b) right

AP Book PA6-3
page 7

1. a) 19, 22, 25
   b) 25
2. a) 49, 53, 57
   b) 19, 16, 13
   c) 42, 53, 64
   d) 52, 104, 208
   e) 9, 3, 1
3. a) 8, 9, 10
   b) 94, 92, 90, 88
   c) 80, 90
   d) 32, 64, 128
   e) 7 000, 700, 70
4. a) 16, 32, 64; 7th
   b) 44, 54, 64; 7th
   c) 40, 48, 56, 64; 8th

BONUS

a) gaps: +3, −1, +3, −1; 12, 11, 14, 13
b) gaps: +2, −4, +2, −4, +2, −4, +2, −4; 24, 20, 40, 36

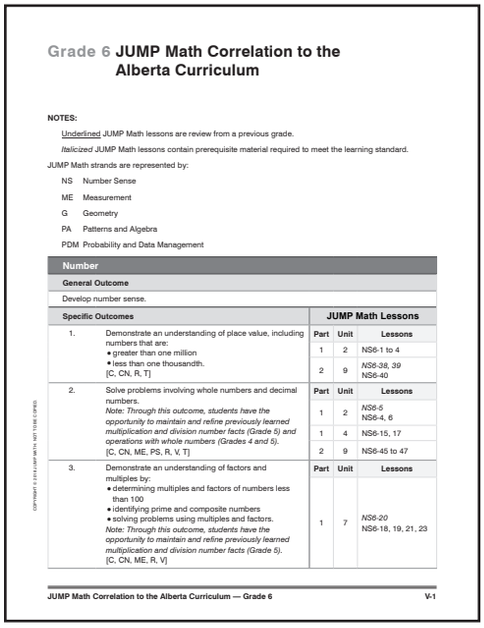
5. a) 31, 63, 127
   b) 255
6. a) gaps: 22, 50, 106; 25, 53, 109
   b) gaps: 33, 96, 285; 32, 95, 284
7. a) 15, 21, 27
   b) 27, 81, 243
   c) 21, 45, 93
8. a) i) 19, 39, 79
   ii) 49, 59, 69, 79
   iii) 25, 79
   b) pattern iii)

BONUS
Answers will vary. Teacher to check.

AP Book PA6-4
page 9

1. b) 3
   c) 6
   d) 7
   e) 5
   f) 3
2. b) 5
   c) 1
   d) 3
   e) 6
   f) 100
3. a) 3
   b) 2
   c) 4
   d) 3
4. a) 2
   b) 3
   c) 10

Answer Keys for AP Book 6.1 K-1



Grade 6 JUMP Math Correlation to the Alberta Curriculum

NOTES:

Underlined JUMP Math lessons are review from a previous grade.

Italicized JUMP Math lessons contain prerequisite material required to meet the learning standard.

JUMP Math strands are represented by:

NS Number Sense
ME Measurement
G Geometry
PA Patterns and Algebra
PDM Probability and Data Management

Number

General Outcome

Develop number sense.

Specific Outcomes		JUMP Math Lessons		
1.	Demonstrate an understanding of place value, including numbers that are: • greater than one million • less than one thousandth. [C, CN, R, T]	Part	Unit	Lessons
		1	2	NS6-1 to 4
		2	9	*NS6-38, 39* NS6-40
2.	Solve problems involving whole numbers and decimal numbers. *Note: Through this outcome, students have the opportunity to maintain and refine previously learned multiplication and division number facts (Grade 5) and operations with whole numbers (Grades 4 and 5).* [C, CN, ME, PS, R, V, T]	Part	Unit	Lessons
		1	2	*NS6-5* NS6-4, 6
		1	4	NS6-15, 17
		2	9	NS6-45 to 47
3.	Demonstrate an understanding of factors and multiples by: • determining multiples and factors of numbers less than 100 • identifying prime and composite numbers • solving problems using multiples and factors. *Note: Through this outcome, students have the opportunity to maintain and refine previously learned multiplication and division number facts (Grade 5).* [C, CN, ME, R, V]	Part	Unit	Lessons
		1	7	*NS6-20* NS6-18, 19, 21, 23

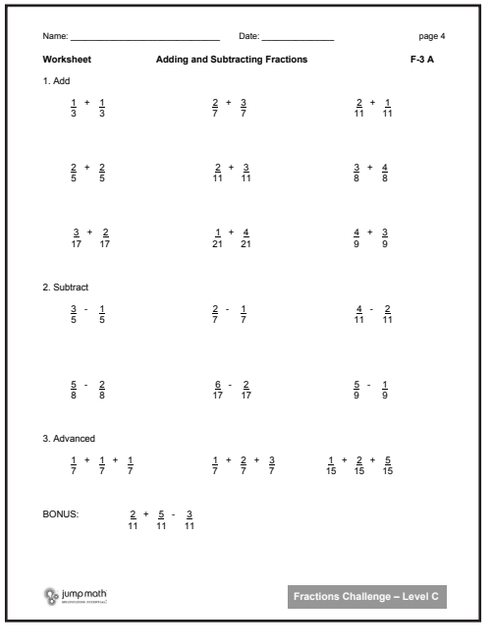
JUMP Math Correlation to the Alberta Curriculum — Grade 6 V-1

Curriculum Correlations

Curriculum correlations are documents that show, for each region and grade level, how JUMP Math lessons are aligned to curriculum learning outcomes in Alberta, British Columbia, Manitoba, and Ontario.

Confidence Building Units

There are five Confidence Building Units provided separately from the other classroom materials. Their purpose is to generate excitement in the classroom and convince all students that they are good at mathematics. Each Confidence Building Unit includes short, carefully designed "challenge lessons" in a Teacher's Manual and associated student practice pages. We recommend that teachers only use these units for no more than five days, preferably at the beginning of the school year.



Name: _____ Date: _____ page 4

Worksheet **Adding and Subtracting Fractions** **F-3 A**

1. Add

$\frac{1}{3} + \frac{1}{3}$ $\frac{2}{7} + \frac{3}{7}$ $\frac{2}{11} + \frac{1}{11}$

$\frac{2}{5} + \frac{2}{5}$ $\frac{2}{11} + \frac{3}{11}$ $\frac{3}{8} + \frac{4}{8}$

$\frac{3}{17} + \frac{2}{17}$ $\frac{1}{21} + \frac{4}{21}$ $\frac{4}{9} + \frac{3}{9}$

2. Subtract

$\frac{3}{5} - \frac{1}{5}$ $\frac{2}{7} - \frac{1}{7}$ $\frac{4}{11} - \frac{2}{11}$

$\frac{5}{8} - \frac{2}{8}$ $\frac{6}{17} - \frac{2}{17}$ $\frac{5}{9} - \frac{1}{9}$

3. Advanced

$\frac{1}{7} + \frac{1}{7} + \frac{1}{7}$ $\frac{1}{7} + \frac{2}{7} + \frac{3}{7}$ $\frac{1}{15} + \frac{2}{15} + \frac{5}{15}$

BONUS: $\frac{2}{11} + \frac{5}{11} - \frac{3}{11}$

jump math

Fractions Challenge – Level C

Teaching with JUMP Math

Professional Development

JUMP Math provides a variety of engaging on-site and online professional learning (PD) opportunities throughout the year. Each PD session is designed to enhance and support instructional practices, leading to improved success for students. Learn from our team of experienced educators who work closely with K–8 classroom teachers, principals, administrators, and parents to use research-informed instruction, practice, and assessment methods.

You can learn more about our professional learning opportunities on the Professional Development section at www.jumpmath.org, or by getting in touch (see the Contact Us section).

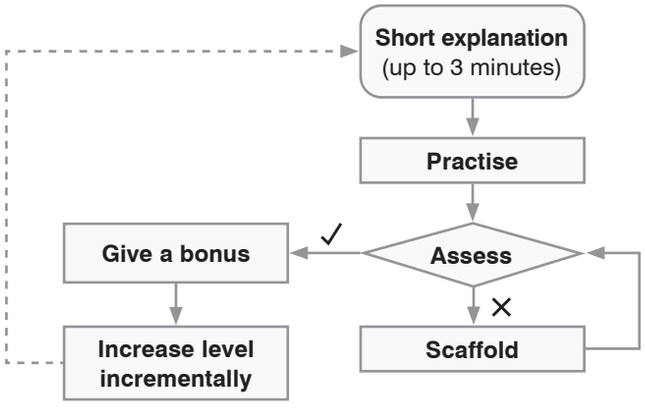
Teaching Order

To use JUMP Math to its full effect, you should teach the units in the suggested order and follow the lesson plans very closely. You should teach approximately one lesson per day; this will allow enough time to teach all of the lessons labelled as required and recommended for your curriculum.

Lesson Structure

JUMP Math lessons are designed to keep the class engaged and moving through the material together. A typical lesson begins with a brief review of relevant previous material. This recalls knowledge that will be needed in the current lesson and starts students on a comfortable footing. Many lessons also include a suggested mental math minute. These can be used at the beginning of the math lesson or at any time during the day.

The body of the lesson is taught in manageable pieces, with frequent opportunities for student participation and assessment. The bold in-line descriptive subheadings in the lesson plans outline the content and flow of the lesson. Within these sections, you will teach explicitly only for brief periods before you ask a question or assign a challenge that students can explore independently in pairs or in groups. These challenges are taken up and discussed immediately, with the expectation that all (or virtually all) students will understand and master the material before moving on. The lesson continues with an incremental increase in difficulty and another short explanation.



After you teach a lesson, or a significant portion of a lesson, students work independently on a more significant task, usually an activity or on corresponding pages in the Assessment & Practice Book. As they work, you can circulate around the class and help students who need assistance. When students complete this summative task, they can work on some of the extensions that are included at the end of most lesson plans.

Instructional Strategies

Classroom Environment

Here are some effective techniques to keep students of all ability levels engaged in the classroom.

Build confidence and excitement about math.
Engaging the entire class in lessons is not simply a matter of fairness; it is also a matter of efficiency. While the idea may seem counterintuitive, you will enable stronger students to go further by helping students who struggle. You can create a real sense of excitement about math in the classroom simply by convincing struggling students that they can do well in the subject. The class will cover far more material in the year, and students who excel will no longer have to hide their love of math for fear of appearing strange or different. In addition to the everyday techniques described below, you may wish to use a Confidence Building Unit at the beginning of the year, especially for students who are new to JUMP Math. Quizzes can also work as confidence builders when administered to students who are prepared to succeed.

Use daily routines.
Establish predictable routines that support deliberate practice of counting, math fact fluency, mathematical terminology, number talks, and number strings by incorporating exercises from the Mental Math section, mental math minutes, calendar activities, number talks, or number strings into your daily schedule.

Working in pairs or groups.
Promote communication by encouraging students to work in pairs or in small groups. Support students to organize and justify their thinking by demonstrating how to use mathematical terminology, symbols, models, and manipulatives as they discuss and share their ideas. Student groupings should be random and vary throughout the week.

Allow students enough time to think.
Discuss one or two skills or concepts at a time with the whole class, allowing students to develop ideas by themselves, but giving hints and guidance when necessary (the lesson plans show you how to do this). Ask questions in several different ways and allow students time to think and share their solutions with a partner before you solicit an answer. After presenting a particular concept, do not go on until all students are assessed and show a readiness to move ahead.

Use bonus questions.
When students have mastered a skill or concept, raise the bar slightly by challenging them to answer a question that is only incrementally more difficult or complex than the questions previously assigned. Be ready to write bonus questions on the board from time to time during the lesson for students who finish their tasks or quizzes early. Bonus questions are included in most of the lesson plans. While students who finish quickly are occupied with these questions, circulate around the class doing spot checks of the work of students who are struggling. The bonus questions you create should generally be simple extensions of the material. (See “How to Create Bonus Questions” on p. A-19).

Use extension questions.
Extension questions should be used to keep students who work quickly engaged in the content of the lesson; they can also be assigned as a group exploration activity. Extension questions don’t often introduce any skills or concepts that aren’t taught in the lesson, so students who complete their work quickly should be able to work on these questions independently. Placing students into random groupings allows them to work together to find solutions to more challenging problems. Students can submit work for assessment either as a group or individually.

Support independent work.
Take the time to show students how to develop independent work habits during a lesson and while working on their own. The length of time required for this will vary depending upon age, attention, and maturity levels, so be prepared to model and demonstrate these skills over the course of several days or weeks, as needed.

During a lesson. Explain and demonstrate effective use of whiteboards and notebooks as a practice tool throughout the learning process. Emphasize that these tools are useful in keeping track of important information; recording examples of mathematical procedures, models, and conventions; and exploring methods for solving problems.

Have students use grid paper notebooks instead of regular lined notebooks, which help with, for example, lining up digits, making tables, drawing shapes such as rectangles, and drawing coordinate planes, and are an invaluable tool for students with diagnosed and undiagnosed problems in visual organization. Demonstrate effective use of grids on the board; if your board does not have a grid section, photocopy BLM 1 cm Grid Paper onto a transparency and project it onto the board (so you can erase pictures from the board without erasing the grid).

Following a lesson. Guide students to navigate the corresponding pages in the Assessment & Practice Books by showing them where to find and how to use:

- page numbers
- instructions
- worked-out examples
- hints and memory aids
- prompts to use a notebook
- bonus and investigation questions

Teacher Explanations

Explain and demonstrate the work that you expect your students to do. If a student doesn't understand an explanation, select one to three students to rephrase or reword explanations. Sometimes lessons go too fast for a student or component concepts are inadvertently skipped. It is always possible to make an increment smaller. Taking time to reflect on what worked and didn't work in a lesson can help you reach even students who are having the most difficulty. When students are struggling, always ask, "How could I have improved the lesson?"

Continuous Assessment

The progression of learning contained in each JUMP Math lesson enables active and ongoing assessment, often referred to as "continuous assessment." Through observation, questioning, and interaction with students as they work, you are readily able to check for understanding, identify and correct misunderstandings, and differentiate instruction with timely interventions. Continuous assessment often provides a more accurate and complete picture of a student's ability and has a positive impact on learning. Here are some strategies for immediate assessment.

Signalling. When a problem has a simple answer, such as one word, a short phrase, or even a sign (such as $+$ or $-$), ask students to signal their answer with, for example, a thumbs up for yes or a thumbs down for no. Signalling is also useful when you have multiple-choice questions: number the answers and have students hold up the number of fingers corresponding to the answer they think is correct.

Signalling is most effective when students signal their answers at the same time. Give students adequate thinking time, and then have them show their answer on the count of three. Make sure students are familiar with the structure before using it in content-learning situations. Have students practise signalling the answers at the same time beforehand.

Individual whiteboards. Provide students with individual whiteboards to use throughout the lesson as they work through challenge tasks. Similar to the strategy of signalling, have students hold up their boards together on the count of three.

Using JUMP Math Components Together

Planning to Teach

Read each lesson from beginning to end, paying attention to the progression of learning that starts with the review of prior knowledge and ends with the extension questions. Following the initial reading, go back through the lesson and:

1. Review the Mental Math section and the lesson's mental math minute (if applicable), and decide which skills you will introduce, practise, and assess prior to teaching a lesson. It is most effective to concentrate on one or two skills per day. Begin each math class with a quick review of the mental math skills that were explored the previous day and then introduce one or two new skills. Do not introduce new skills until you have verified mastery of the skills introduced in earlier lessons.

2. Link the layers of skill development in the print lesson to the corresponding digital lesson slides. Decide which slides you will use, which slides you will modify or add, and how you will use the slides to support your teaching and student practice.

3. Re-read the lesson and consider how you may need to modify or adapt the lesson to meet the needs of your students.

   Consider the following:

   - Do my students have the prerequisite skills?
   - How much review will I need?
   - What materials, including Blackline Masters, will I need to gather and/or copy?

   Decide in advance:

   - Which prompts, activities, and extensions will I use?
   - Will I need to create more bonus questions?
   - What is the most effective means of organizing my students for learning, discussion, and practice?
   - How will I assess?
   - What questions will I have ready for struggling students?
   - Which questions will I have ready for students who grasp the concepts quickly?

4. Preview the corresponding pages in the Assessment & Practice Books. You may wish to use some of the exercises as models for practice during the lesson, or you may want to determine how many of the exercises you will assign to students.

Use of the Assessment & Practice Books

The Assessment & Practice Books are designed to be used in tandem with the lesson plans. Before assigning questions from the Assessment & Practice Books, it is important to verify that all students are prepared to answer the questions without your help (or with minimal help). Never allow students to work ahead in the Assessment & Practice Books on material you haven't covered with the class. Students who finish the assigned pages from the Assessment & Practice Books early should be assigned bonus questions similar to the questions on the page or extension questions from the lesson plans. Write the bonus questions on the board or have extra pages prepared and ask students to answer the questions in their notebooks. While students are working independently on the bonus questions, you can spend extra time with anyone who needs help.

Use of the Assessment Tools

The most effective assessment strategy is one where student learning is verified throughout their learning process, and not simply at the end of a unit. We recommend assigning a short quiz every four to five lessons to ensure students are working toward mastery of the skills explored in those lessons. Information gleaned from quizzes will help you catch and correct misunderstandings through review or re-teaching. At the end of each unit, assign a test to assess the depth and consolidation of all of the skills covered in the unit.

Use of the Problem-Solving Lessons

We recommend teaching as many problem-solving lessons throughout the year as your class time allows. More problem-solving lessons should be taught towards the end of the year than towards the beginning to allow time for students to consolidate their mathematical knowledge and gain confidence before attempting more challenging problems. Classes requiring fewer review lessons will have time to finish more of the problem-solving lessons, but even classes needing most of the review lessons should try at least a few problem-solving lessons.

How to Create Bonus Questions

You can make math lessons more exciting (and also make time to check the work of students who need extra time) if you know how to create engaging bonus questions. Bonus questions generally shouldn't be based on new concepts and they don't have to be extremely difficult to capture the attention of students. Students are more likely to consolidate their understanding and commit material to memory when they are attentive and engaged in appropriately challenging work.

Before You Create Bonus Questions

- Bonus questions shouldn't look tedious; avoid giving students an endless series of calculations that appear to have no purpose.
- Assign only a few questions at a time.
- It helps if you are excited when you assign bonus questions; students should feel like they are involved in a quest, faced with increasingly difficult challenges that they believe they can meet.
- Students can make conceptual gains even when the bonus questions vary the task only slightly, such as involving larger numbers or more terms or elements.
- Generalizing from smaller to larger numbers will help all students develop the ability to hold more material in their working memory, follow a series of steps in a procedure, stay on task, and see patterns and apply rules in increasingly complex situations.
- Be careful not to introduce any new skills or concepts in bonus questions.

Creating Bonus Questions

Here are some strategies you can use to create questions that will look hard enough to interest students who work quickly, but that all students can aspire to answer.

Make the numbers in a problem larger.

The simplest way to create bonus questions without introducing any new concepts is to make the numbers in a problem larger or to introduce extra terms. Students of all ages love showing off with larger numbers or with more challenging-looking rules and procedures. You can use this strategy in almost any lesson. For example, the following problems all use place value addition without regrouping and can be done by students who have mastered adding in columns.

Example

Add.

$$\begin{array}{r} 2 \\ +\ 4 \\ \hline \end{array} \longrightarrow \begin{array}{r} 23 \\ +\ 45 \\ \hline \end{array} \longrightarrow \begin{array}{r} 235 \\ +\ 452 \\ \hline \end{array} \longrightarrow \begin{array}{r} 2354 \\ +\ 4521 \\ \hline \end{array}$$

Make a mistake and ask students to correct it.

Students love correcting a teacher's mistakes, and you can find a way to make mistakes in any lesson. For instance, if you are teaching additive sequences, you might write the following on the board:

Where is the mistake?

3, 7, 12, 16, 20, …

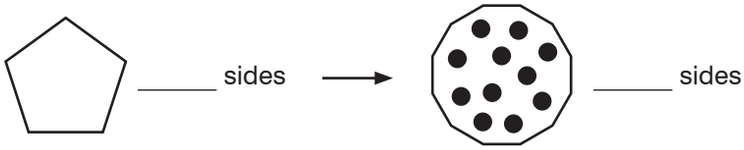
Tell students you created the sequence by adding the same number repeatedly to the initial number, but you think you made a mistake. Ask them to find the mistake and explain where you went wrong.

Increase the complexity of presentation.

When counting or matching, move objects farther apart or arrange them less neatly. In geometry lessons, combine several distractors, such as position, pattern, background, or number of sides, to hide shapes. In the higher grades, add distractors to word problems.

Example

Count the number of sides.



Partially complete a problem and ask students to say what is missing.

When matching to compare quantity, omit a matching line. When finding triangles, skip a few. When finding pairs that add to 5 or 10, create a list that is missing one addition. When teaching the counting sequence by 1s, 2s, 5s, or 10s, write the first ten numbers in a ten-frame but omit some numbers. In the higher grades, omit a step when solving an equation and have students fill it in.

Example

Fill in the missing numbers.

2	4		8	10
12		16	18	

Use more elements.

When sorting, sort more objects into more categories. Add three or more numbers instead of only two numbers. Create longer expressions, with more parentheses, to be evaluated.

Example

Evaluate.

$15 + (7 \times 3 - 1) \longrightarrow (3 \times 5 - 7) \times 5 \div (16 - 6)$

Make differences more subtle.

When the task is noticing differences, such as comparing numbers or distinguishing circles from non-circles, make the differences more subtle. For example, when comparing fractions with the same denominator, use numerators that vary by a single digit. Draw graphs on smaller grids or place points not on grid lines so that students have to pay attention to detail.

Example

Which is greater?

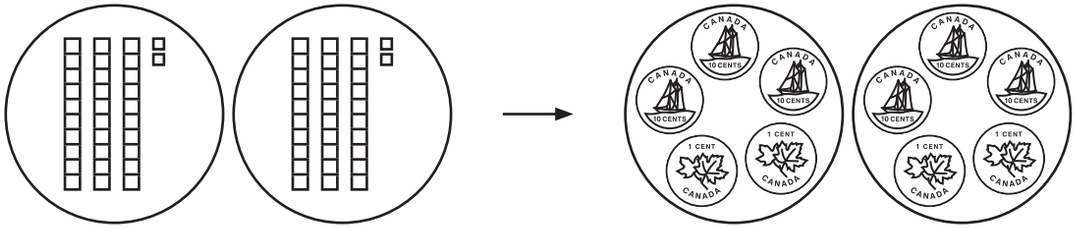
$\frac{8}{11}$ or $\frac{9}{11}$ $\longrightarrow$ $\frac{54\,645}{4\,567\,341}$ or $\frac{54\,154}{4\,567\,341}$

Vary the presentation of the problem.

Since students often under-generalize concepts, using different materials to present the same problem can seem like an entirely new problem. For example, you can use different shapes in models. Ask students to use triangles or squares instead of dots when drawing a model for a word problem, or have students identify fractions of a star instead of a circle. Division can be modelled with money instead of tens blocks. Represent the same repeated pattern with numbers, letters, colours, and shapes. When working with fractions or decimals, present a problem using money. Write rates in unconventional ways, such as hours/mile, or reverse the axes on graphs.

Example

Model $2\overline{)64}$.



Look for applications of the concept.

Lessons generally begin from a concrete representation of a concept and move towards abstract ideas. Once students have been taught an abstract idea, reapplying it can be an added challenge. For example, once students have mastered comparing numbers, present problems such as, "Thirty-seven students are going on a school trip. The bus has forty-five seats. Are there enough seats for everyone?" For another example, students could identify applications of the Pythagorean Theorem in word problems.

Example

When teaching fractions of whole numbers, ASK: How many months are in …

a) $\frac{1}{2}$ a year? b) $\frac{2}{3}$ of a year? c) $1\frac{1}{2}$ years?

Use extension questions from the lesson plans.

As students become more confident, create questions that challenge them more and that extend the ideas in the lesson. The JUMP Math lesson plans contain many extension questions that students can explore. These extension questions allow students to develop a deeper knowledge of the curriculum by working on incremental variations on the same topic. Extensions often require minimal or no teaching. Extensions that require some guidance can be taught to the whole class or to small groups.

JUMP Math Website: www.jumpmath.org

For more information about, or support in using your new resource, please contact your regional Manager of Outreach & Teacher Support. You can find contact information by region on our website in the About Us section, along with information on:

- Research
- Professional learning (PD)
- K–8 classroom materials
- Videos
- Online store materials (e.g., digital lesson slides)

Mental Math

Contents of Mental Math Section

What is Mental Math?

Mental math is a mathematical framework that includes number sense, computational fluency, and the application of number concepts through purposeful and varied practice, not just rote memorization. In JUMP Math, mental math is explored through regular practice with mental math minutes at the beginning of most lessons. You can also use the exercises starting on p. A-27.

Mental Math Minutes

Mental math minutes at the beginning of many lessons provide opportunities to practise and compare mental computation strategies that students learned in previous grades or lessons, or that they developed themselves. For example, several mental math minutes allow students to see their progress with automatizing the times tables. They fill in as much as they can of a blank times table using mental strategies in three minutes. As the year progresses, have students compare the tables they completed at different times to see the improvement in their computational skills.

Mental math minutes can sometimes be presented as number talks or number strings. A *number talk* is a structured discussion that can help students develop computational flexibility and improve their math communication skills. Number talks focus on solving a problem by analyzing and comparing different computational strategies in a non-judgmental space. Students solve a problem mentally in as many ways as they can, then share their answers and some of the strategies they used with the class (a minimum of two and a maximum of five strategies should be elicited). The class then compares strategies and identifies any mistakes in computation or reasoning. See **BLM Number Talks** (p. A-25) for detailed steps, tips, and prompts.

In a *number string*, students discover a computational strategy by solving a series of problems that are related to each other. Students are presented with a number string that consists of a series of simple, related mental computations; the answer to a problem in the string can be used to find the answer to the following problem(s) in the string. After solving all the problems in the string individually, students share their answers (but not their reasoning) with the class.

Students then pair off to explain their reasoning and justify their answers to each other for a set amount of time (for example, 1 minute) before switching roles. In this way, students practise making reasonable arguments and critiquing each other's thinking. The class then comes back together to discuss the strategy. Students follow-up by practising the same strategy in one or two more strings, depending on how quickly they work.

The complexity of the number strings increases as the year progresses, including the introduction of new, unfamiliar strategies. For the number strings in Unit 1, encourage students to always use the answer to the previous problem in the string to find the answer to the next problem in the string (this will elicit the strategy without telling it). For the number strings in later units, students can use any, none, or more than one of the answers to a previous problem in the string to get the answer to the next problem in the string. See **BLM Number Strings** (p. A-26) for detailed steps, tips, and prompts.

NAME _____ DATE _____

Number Talks

Steps	Tips and Prompts
1. Introduce or review signals	Hold thumb up against chest to show: • I have an answer/strategy (put more fingers up for more strategies). • I agree with an answer or someone's thinking.
2. Present a problem	Present the problem horizontally to avoid suggesting a single or preferred strategy. Wait up to one minute for all students to signal that they have an answer.
3. Whole-class answer sharing	Before the class shares, remind students that they are not to reveal their reasoning or strategies yet. Ask the class: • What answer did you get? • Did anyone get a different answer? Record all answers.
4. Whole-class strategy sharing	Prompt the class: • How did you arrive at your solution? • Create a picture or model to show your work. Select two to five volunteers to share their reasoning. While the volunteers are sharing, ask the class: • Did anyone use the same approach? • Can someone else explain this strategy? • Would you revise your answer based on what you've heard and seen? • Did anyone use a different strategy?
5. Whole-class analysis	Referring to the strategies recorded in Step 4, ask the class: • Does anyone want to revise their answer? • What mistake was made here? • How are these two strategies the same? • How are these two strategies different? • Which methods work? • Which strategy seems easiest to you? • Which strategy would be the fastest?

NAME _____ DATE _____

Number Strings

Steps	Tips and Prompts
1. Introduce or review signals	Hold thumb up against chest to show: • I have an answer/strategy. • I agree with an answer or someone's thinking. Confirm signal for switching roles when partners share thinking.
2. Present first string	Students solve the problems using the answer to the first problem to find the answer to the following problem(s). Wait up to one minute for all students to signal that they have an answer.
3. Whole-class answer sharing	Before the class shares, remind students that they are not to reveal their reasoning or strategies yet. Ask the class: • What answer did you get? • Did anyone get a different answer? Record all answers.
4. Partners share thinking	In pairs, students explain their solutions to their partners; encourage them to create a picture or a model to explain their strategies. Encourage the use of correct terminology, equations following the mathematical conventions, and clear diagrams. Students switch roles (e.g., after 1 minute). Use a signal for switching roles.
5. Present the strategy	Allow students to revise their answer if they wish, then have a volunteer present the strategy. Ask the class: • Who would like to share their thinking? • How did you figure that out? • Which previous problem did you use? • Would you like to revise your answer?
6. Independent work	Students work on the rest of the strings independently. Partners can check each other's answers and strategies. **NOTE:** When there are more than two strings, students who work faster can complete additional strings.

Addition and Subtraction

Students practise the simple computations in the exercises below using only their minds and (sometimes) their fingers. The exercises also teach students to recognize when a calculation can be done in an easier way than by direct computation. Many of the exercises are first taught during the regular lesson so that students understand what they are doing and why it works.

Addition and Subtraction Fluency

Students who don't know how to add, subtract, or estimate readily are at a great disadvantage in mathematics. Students can learn to mentally add and subtract numbers in a short time if they are given daily practice in a few basic skills.

In Grade 6, students are expected to gain fluency in the skills described in this section. These techniques can be used once the necessary concepts have been taught.

At the beginning of Grade 6, if students don't know their addition and subtraction facts within 18, teach them to add and subtract using their fingers by the methods shown below. You can also reinforce basic facts using practice, games, and flash cards. (Until students know all their facts, allow them to add and subtract on their fingers when necessary.)

Eventually, students should know their addition and subtraction facts and should not have to rely on mental math tricks. One of the greatest gifts you can give students is to teach them their number facts.

To **ADD** $4 + 8$, Grace says 8 with her fist closed. She counts up from 8, raising one finger at a time. She stops when 4 fingers are raised:

She said "12" when she raised her fourth finger, so $\mathbf{4 + 8 = 12}$.

1. Add.

a) $5 + 2 =$ ____ b) $2 + 3 =$ ____ c) $6 + 2 =$ ____ d) $9 + 2 =$ ____

e) $2 + 4 =$ ____ f) $2 + 7 =$ ____ g) $5 + 3 =$ ____ h) $6 + 3 =$ ____

i) $11 + 4 =$ ____ j) $3 + 9 =$ ____ k) $7 + 3 =$ ____ l) $14 + 4 =$ ____

m) $21 + 5 =$ ____ n) $32 + 3 =$ ____ o) $4 + 56 =$ ____ p) $39 + 4 =$ ____

To **SUBTRACT** $9 - 5$, Grace says the second number (5) with her fist closed. She counts up from 5 raising one finger at a time. She stops when she says the first number (9):

She has 4 fingers raised when she stops, so $\mathbf{9 - 5 = 4}$.

2. Subtract.

a) $7 - 5 =$ ____ b) $8 - 6 =$ ____ c) $5 - 3 =$ ____ d) $5 - 2 =$ ____

e) $9 - 6 =$ ____ f) $10 - 5 =$ ____ g) $11 - 7 =$ ____ h) $17 - 14 =$ ____

i) $33 - 31 =$ ____ j) $27 - 24 =$ ____ k) $43 - 39 =$ ____ l) $62 - 58 =$ ____

Skill 1: Adding 2 to an Even Number

This skill has been broken down into a number of sub-skills. After teaching each sub-skill, give students a short diagnostic quiz to verify that they have learned the skill. Sample quizzes for Skills 1 to 4 are included below.

a) Name the next one-digit even number:

Numbers that have ones digit 0, 2, 4, 6, or 8 are called the even numbers. Using practice or games, teach students to say the sequence of one-digit even numbers without hesitation. Ask students to imagine the sequence going on in a circle so that the next number after 8 is 0 (0, 2, 4, 6, 8, 0, 2, 4, 6, 8 …). Then play the following game: name a number in the sequence and ask students to give the next number. Don't move on until all students have mastered the game.

b) Name the next two-digit even number:

CASE 1: Numbers that end in 0, 2, 4, or 6

Write an even two-digit number that ends in 0, 2, 4, or 6 on the board. Ask students to name the next even number. Students should recognize that if a number ends in 0, then the next even number ends in 2; if it ends in 4, then the next even number ends in 6, etc. For instance, the number 54 has ones digit 4, so the next even number will have ones digit 6.

QUIZ

Name the next even number.

a) 52 ____ b) 64 ____ c) 36 ____ d) 22 ____ e) 80 ____

CASE 2: Numbers that end in 8

Write the number 58 on the board. Ask students to name the next even number. Remind students that even numbers must end in 0, 2, 4, 6, or 8. But 50, 52, 54, and 56 are all less than 58 so the next even number is 60. Students should see that an even number ending in 8 is always followed by an even number ending in 0 (with a tens digit that is one higher).

QUIZ

Name the next even number.

a) 58 ____ b) 68 ____ c) 38 ____ d) 48 ____ e) 78 ____

c) Add 2 to an even number:

Point out to students that adding 2 to any even number is equivalent to finding the next even number. **Examples:** $46 + 2 = 48$, $48 + 2 = 50$. Knowing this, students can easily add 2 to any even number.

QUIZ

Add.

a) $26 + 2 =$ ____ b) $82 + 2 =$ ____ c) $40 + 2 =$ ____ d) $58 + 2 =$ ____ e) $34 + 2 =$ ____

Skill 2: Subtracting 2 from an Even Number

a) Find the preceding one-digit even number:

Name a one-digit even number and ask students to give the number that comes before in the sequence. For instance, the number that comes before 4 is 2 and the number that comes before 0 is 8. (**Remember:** The sequence is circular.)

b) Find the preceding two-digit number:

CASE 1: Numbers that end in 2, 4, 6, or 8
Write a two-digit number that ends in 2, 4, 6, or 8 on the board. Ask students to name the even number that comes before. Students should recognize that if a number ends in 2, then the preceding even number ends in 0; if it ends in 4, then the preceding even number ends in 2, etc. For instance, the number 78 has ones digit 8, so the preceding even number has ones digit 6.

QUIZ

Name the even number that comes before.

a) 48 ____ b) 26 ____ c) 34 ____ d) 62 ____ e) 78 ____

CASE 2: Numbers that end in 0
Write the number 80 on the board and ask students to name the even number that comes before. Students should recognize that if an even number ends in 0, then the preceding even number ends in 8 (but the tens digit is one less). So the even number that comes before 80 is 78.

QUIZ

Name the even number that comes before.

a) 40 ____ b) 60 ____ c) 80 ____ d) 50 ____ e) 30 ____

c) Subtracting 2 from an even number:

Point out to students that subtracting 2 from an even number is exactly the same as finding the even number that comes before. **Examples:** $48 - 2 = 46$, $46 - 2 = 44$.

QUIZ

Subtract.

a) $58 - 2 =$ ____ b) $24 - 2 =$ ____ c) $36 - 2 =$ ____ d) $42 - 2 =$ ____ e) $60 - 2 =$ ____

Skill 3: Adding 2 to an Odd Number

a) Name the next one-digit odd number:

Numbers that have ones digit 1, 3, 5, 7, or 9 are called odd numbers. Using practice or games, teach students to say the sequence of one-digit odd numbers without hesitation. Ask students to imagine the sequence going on in a circle so that the next number after 9 is 1 (1, 3, 5, 7, 9, 1, 3, 5, 7, 9 …). Then play the following game: name a number in the sequence and ask students to give the next number. Don't move on until all students have mastered the game.

b) Name the next two-digit odd number:

CASE 1: Numbers that end in 1, 3, 5, or 7
Write an odd two-digit number that ends in 1, 3, 5, or 7 on the board. Ask students to name the next odd number. Students should recognize that if a number ends in 1, then the next odd number ends in 3; if it ends in 3, then the next odd number ends in 5, etc. For instance, the number 35 has ones digit 5, so the next odd number will have ones digit 7.

QUIZ

Name the next odd number.

a) 51 ____ b) 65 ____ c) 37 ____ d) 23 ____ e) 87 ____

CASE 2: Numbers that end in 9
Write the number 59 on the board. Ask students to name the next odd number. Remind students that odd numbers must end in 1, 3, 5, 7, or 9. But 51, 53, 55, and 57 are all less than 59. So the next odd number is 61. Students should see that an odd number ending in 9 is always followed by an odd number ending in 1 (with a tens digit that is one higher).

QUIZ

Name the next odd number.

a) 59 ____ b) 69 ____ c) 39 ____ d) 49 ____ e) 79 ____

c) Add 2 to an odd number:

Point out to students that adding 2 to any odd number is exactly the same as finding the next odd number. **Examples:** $47 + 2 = 49$, $49 + 2 = 51$. Knowing this, students can easily add 2 to any odd number.

QUIZ

Add.

a) $27 + 2 =$ ____ b) $83 + 2 =$ ____ c) $41 + 2 =$ ____ d) $59 + 2 =$ ____ e) $35 + 2 =$ ____

Skill 4: Subtracting 2 from an Odd Number

a) Find the preceding one-digit odd number:

Name a one-digit odd number and ask students to give the odd number that comes before in the sequence. For instance, the number that comes before 3 is 1 and the number that comes before 1 is 9. (**Remember:** The sequence is circular.)

b) Find the preceding odd two-digit number:

CASE 1: Numbers that end in 3, 5, 7, or 9
Write a two-digit number that ends in 3, 5, 7, or 9 on the board. Ask students to name the odd number that comes before. Students should recognize that if a number ends in 3, then the preceding odd number ends in 1; if it ends in 5, then the preceding odd number ends in 3, etc. For instance, the number 79 has ones digit 9, so the preceding odd number has ones digit 7.

QUIZ

Name the odd number that comes before.

a) 49 ____ b) 27 ____ c) 35 ____ d) 63 ____ e) 79 ____

CASE 2: Numbers that end in 1

Write the number 81 on the board and ask students to name the odd number that comes before. Students should recognize that if an odd number ends in 1 then the preceding odd number ends in 9 (but the tens digit is one less). So the odd number that comes before 81 is 79.

QUIZ

Name the odd number that comes before.

a) 41 _____ b) 61 _____ c) 81 _____ d) 51 _____ e) 31 _____

c) Subtract 2 from an odd number:

Point out to students that subtracting 2 from an odd number is exactly the same as finding the odd number that comes before. **Examples:** $49 - 2 = 47$, $47 - 2 = 45$.

QUIZ

Subtract.

a) $59 - 2 =$ _____ b) $25 - 2 =$ _____ c) $37 - 2 =$ _____ d) $43 - 2 =$ _____ e) $61 - 2 =$ _____

The skills that follow combine skills students have acquired to this point. You may wish to combine them in other ways that you have found useful.

Skills 5 and 6

Once students can add and subtract the numbers 1 and 2 they can easily add and subtract the number 3. Add 3 to a number by first adding 2, then 1. **Example:** $35 + 3 = 35 + 2 + 1$. Subtract 3 from a number by subtracting 2, then subtracting 1. **Example:** $35 - 3 = 35 - 2 - 1$.

Skills 7 and 8

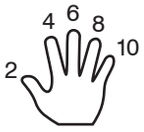
Add 4 to a number by adding 2 twice. **Example:** $51 + 4 = 51 + 2 + 2$. Subtract 4 from a number by subtracting 2 twice. **Example:** $51 - 4 = 51 - 2 - 2$.

Skills 9 and 10

Add 5 to a number by adding 4 then 1. Subtract 5 by subtracting 4 then 1.

Skill 11

Add pairs of identical numbers by learning the sums ($1 + 1 = 2$, $2 + 2 = 4$, $3 + 3 = 6$, etc.). You may also wish to teach students to count on their fingers by 2s, as shown below.



Skill 12

Add a pair of numbers that differ by 1 by rewriting the larger number as 1 plus the smaller number (then use doubling to find the sum). **Examples:** $6 + 7 = 6 + 6 + 1 = 12 + 1 = 13$; $7 + 8 = 7 + 7 + 1 = 14 + 1 = 15$.

Skill 13

Add a one-digit number to 10 by replacing the zero in 10 by the one-digit number.
Example: $10 + 7 = 17$.

Skills 14 and 15

To add 9 to a number, subtract 1 from the number and then add 10.
Examples: $9 + 6 = 10 + 5 = 15$; $59 + 7 = 60 + 6 = 66$.

To add 8 to a number, subtract 2 from the number and add 10.
Examples: $8 + 6 = 10 + 4 = 14$; $38 + 7 = 40 + 5 = 45$.

Skill 16

To add a pair of one-digit numbers whose sum is greater than 10, break apart one of the numbers to make 10. **Examples:** $7 + 8 = 7 + 3 + 5 = 10 + 5 = 15$; $6 + 5 = 6 + 4 + 1 = 10 + 1 = 11$.

To help your students learn the pairs of numbers that add to 10, we recommend the game Modified Go Fish on p. A-48.

Skill 17

Add 10 to any two-digit number by increasing the tens digit of the two-digit number by 1.
Example: $53 + 10 = 63$.

Skill 18

Add a pair of two-digit numbers (with no regrouping) by adding the ones digits of the numbers and then the tens digits. **Example:** $23 + 64 = 87$.

Skills 19 and 20

To subtract a multiple of 10 from another multiple of 10, subtract the tens digits and add a zero for the ones digit. **Example:** $70 - 50 = 20$.

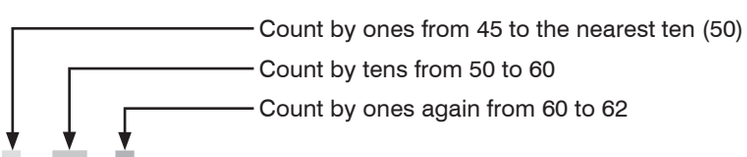
To subtract a two-digit number from another two-digit number (without regrouping), subtract the ones digit from the ones digit and the tens digit from the tens digit. **Example:** $57 - 34 = 23$.

Further Strategies

Subtracting is always more challenging than adding. With practice and maturity, the following strategies can develop into computational skills that students can use. The strategies rely on converting subtractions to easier calculations, additions, or smaller subtractions.

1. Students should be able to subtract by adding. This strategy is often used for making change.

Examples



a) $62 - 45 = 5 + 10 + 2 = 17$

b) $73 - 17 = 3 + 50 + 3 = 56$

Practice Questions

a) $88 - 36 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$ b) $58 - 21 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

c) $43 - 17 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$ d) $74 - 28 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

e) $93 - 64 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$ f) $82 - 71 = \_\_\_\_ + \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

2. Students should be able to reduce to a simpler subtraction when the hundreds and tens digits are the same.

Examples

a) $27 - 25 = 7 - 5 = 2$ b) $148 - 143 = 8 - 3 = 5$ c) $137 - 123 = 37 - 23 = 14$

Practice Questions

a) $35 - 33 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$ b) $67 - 61 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$

c) $159 - 157 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$ d) $327 - 322 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$

e) $148 - 131 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$ f) $449 - 425 = \_\_\_\_ - \_\_\_\_ = \_\_\_\_$

3. Students should be able to subtract from multiples of 10 without regrouping by subtracting from a number one smaller and then adding 1 to the answer.

Example

$30 - 17 = 29 - 17 + 1 = 12 + 1 = 13$

Practice Questions

a) $50 - 19 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

b) $70 - 23 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

c) $90 - 34 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

d) $80 - 67 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

e) $40 - 12 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

f) $100 - 52 = \_\_\_\_ - \_\_\_\_ + \_\_\_\_ = \_\_\_\_ + \_\_\_\_ = \_\_\_\_$

Exercises

NOTE: These exercises are related to the previous skills. Students may need more practice than is provided here. Create more exercises as needed. Assign the existing exercises as a test to ensure students have learned the material fully. Do not distribute these pages to students as they may be intimidated by the number of questions and the size of the font. Write each exercise on the board as students work through them.

Skills 1, 2, 3, and 4

1. Name the even number that comes after the number shown.

a) 32 ____ b) 46 ____ c) 14 ____ d) 92 ____ e) 56 ____

f) 30 ____ g) 84 ____ h) 60 ____ i) 72 ____ j) 24 ____

2. Name the even number that comes after the number shown.

a) 28 ____ b) 18 ____ c) 78 ____ d) 38 ____ e) 68 ____

3. Add. **Remember:** Adding 2 to an even number is the same as finding the next even number.

a) $42 + 2 =$ ____ b) $76 + 2 =$ ____ c) $28 + 2 =$ ____ d) $16 + 2 =$ ____

e) $68 + 2 =$ ____ f) $12 + 2 =$ ____ g) $36 + 2 =$ ____ h) $90 + 2 =$ ____

i) $70 + 2 =$ ____ j) $24 + 2 =$ ____ k) $66 + 2 =$ ____ l) $52 + 2 =$ ____

4. Name the even number that comes before the number shown.

a) 38 ____ b) 42 ____ c) 56 ____ d) 72 ____ e) 98 ____

f) 48 ____ g) 16 ____ h) 22 ____ i) 66 ____ j) 14 ____

5. Name the even number that comes before the number shown.

a) 30 ____ b) 70 ____ c) 60 ____ d) 10 ____ e) 80 ____

6. Subtract. **Remember:** Subtracting 2 from an even number is the same as finding the preceding even number.

a) $46 - 2 =$ ____ b) $86 - 2 =$ ____ c) $90 - 2 =$ ____ d) $14 - 2 =$ ____

e) $54 - 2 =$ ____ f) $72 - 2 =$ ____ g) $12 - 2 =$ ____ h) $56 - 2 =$ ____

i) $32 - 2 =$ ____ j) $40 - 2 =$ ____ k) $60 - 2 =$ ____ l) $26 - 2 =$ ____

7. Name the odd number that comes after the number shown.

a) 37 ____ b) 51 ____ c) 63 ____ d) 75 ____ e) 17 ____

f) 61 ____ g) 43 ____ h) 81 ____ i) 23 ____ j) 95 ____

8. Name the odd number that comes after the number shown.

a) 69 ____ b) 29 ____ c) 9 ____ d) 79 ____ e) 59 ____

9. Add. **Remember:** Adding 2 to an odd number is the same as finding the next odd number.

a) $25 + 2 =$ ____ b) $31 + 2 =$ ____ c) $47 + 2 =$ ____ d) $33 + 2 =$ ____

e) $39 + 2 =$ ____ f) $91 + 2 =$ ____ g) $5 + 2 =$ ____ h) $89 + 2 =$ ____

i) $11 + 2 =$ ____ j) $65 + 2 =$ ____ k) $29 + 2 =$ ____ l) $17 + 2 =$ ____

10. Name the odd number that comes before the number shown.

a) 39 ____ b) 43 ____ c) 57 ____ d) 17 ____ e) 99 ____

f) 13 ____ g) 85 ____ h) 79 ____ i) 65 ____ j) 77 ____

11. Name the odd number that comes before the number shown.

a) 21 ____ b) 41 ____ c) 11 ____ d) 91 ____ e) 51 ____

12. Subtract. **Remember:** Subtracting 2 from an odd number is the same as finding the odd number that comes before.

a) $47 - 2 =$ ____ b) $85 - 2 =$ ____ c) $91 - 2 =$ ____ d) $15 - 2 =$ ____

e) $51 - 2 =$ ____ f) $73 - 2 =$ ____ g) $11 - 2 =$ ____ h) $59 - 2 =$ ____

i) $31 - 2 =$ ____ j) $43 - 2 =$ ____ k) $7 - 2 =$ ____ l) $25 - 2 =$ ____

Skills 5 and 6

13. Add 3 to the number by adding 2, then adding 1. **Example:** $35 + 3 = 35 + 2 + 1$.

a) $23 + 3 =$ ____ b) $36 + 3 =$ ____ c) $29 + 3 =$ ____ d) $16 + 3 =$ ____

e) $67 + 3 =$ ____ f) $12 + 3 =$ ____ g) $35 + 3 =$ ____ h) $90 + 3 =$ ____

i) $78 + 3 =$ ____ j) $24 + 3 =$ ____ k) $6 + 3 =$ ____ l) $59 + 3 =$ ____

14. Subtract 3 from the number by subtracting 2, then subtracting 1. **Example:** $35 - 3 = 35 - 2 - 1$.

a) $46 - 3 =$ ____ b) $87 - 3 =$ ____ c) $99 - 3 =$ ____ d) $14 - 3 =$ ____

e) $8 - 3 =$ ____ f) $72 - 3 =$ ____ g) $12 - 3 =$ ____ h) $57 - 3 =$ ____

i) $32 - 3 =$ ____ j) $40 - 3 =$ ____ k) $60 - 3 =$ ____ l) $28 - 3 =$ ____

15. Fred has 49 stamps. He gives 3 stamps away. How many stamps does he have left?

16. There are 25 minnows in a tank. Alice adds 3 more to the tank. How many minnows are now in the tank?

Skills 7 and 8

17. Add 4 to the number by adding 2 twice. **Example:** $51 + 4 = 51 + 2 + 2$.

a) $42 + 4 =$ ____ b) $76 + 4 =$ ____ c) $27 + 4 =$ ____ d) $17 + 4 =$ ____

e) $68 + 4 =$ ____ f) $11 + 4 =$ ____ g) $35 + 4 =$ ____ h) $8 + 4 =$ ____

i) $72 + 4 =$ ____ j) $23 + 4 =$ ____ k) $60 + 4 =$ ____ l) $59 + 4 =$ ____

18. Subtract 4 from the number by subtracting 2 twice. **Example:** $26 - 4 = 26 - 2 - 2$.

a) $46 - 4 =$ ____ b) $86 - 4 =$ ____ c) $91 - 4 =$ ____ d) $15 - 4 =$ ____

e) $53 - 4 =$ ____ f) $9 - 4 =$ ____ g) $13 - 4 =$ ____ h) $57 - 4 =$ ____

i) $40 - 4 =$ ____ j) $88 - 4 =$ ____ k) $69 - 4 =$ ____ l) $31 - 4 =$ ____

Skills 9 and 10

19. Add 5 to the number by adding 4, then adding 1 (or add 2 twice, then add 1).

a) $84 + 5 =$ ____ b) $27 + 5 =$ ____ c) $31 + 5 =$ ____ d) $44 + 5 =$ ____

e) $63 + 5 =$ ____ f) $92 + 5 =$ ____ g) $14 + 5 =$ ____ h) $16 + 5 =$ ____

i) $9 + 5 =$ ____ j) $81 + 5 =$ ____ k) $51 + 5 =$ ____ l) $28 + 5 =$ ____

20. Subtract 5 from the number by subtracting 4, then subtracting 1 (or subtract 2 twice, then subtract 1).

a) $48 - 5 =$ ____ b) $86 - 5 =$ ____ c) $55 - 5 =$ ____ d) $69 - 5 =$ ____

e) $30 - 5 =$ ____ f) $13 - 5 =$ ____ g) $92 - 5 =$ ____ h) $77 - 5 =$ ____

i) $45 - 5 =$ ____ j) $24 - 5 =$ ____ k) $91 - 5 =$ ____ l) $8 - 5 =$ ____

Skill 11

21. Add.

a) $6 + 6 =$ ____ b) $7 + 7 =$ ____ c) $8 + 8 =$ ____ d) $3 + 3 =$ ____

e) $5 + 5 =$ ____ f) $4 + 4 =$ ____ g) $9 + 9 =$ ____ h) $2 + 2 =$ ____

Skill 12

22. Add by thinking of the larger number as a sum of two smaller numbers.

a) $6 + 7 =$ *6 + 6 + 1* b) $7 + 8 =$ _____ c) $2 + 3 =$ _____ d) $4 + 3 =$ _____

e) $4 + 5 =$ _____ f) $5 + 6 =$ _____ g) $9 + 8 =$ _____ **Bonus:** $6 + 8 =$ _____

Skill 13

23. Add.

a) $10 + 3 =$ ____ b) $10 + 7 =$ ____ c) $5 + 10 =$ ____ d) $10 + 1 =$ ____

e) $9 + 10 =$ ____ f) $10 + 4 =$ ____ g) $10 + 8 =$ ____ h) $10 + 2 =$ ____

Skills 14 and 15

24. Add.

a) $9 + 3 =$ ____ b) $9 + 7 =$ ____ c) $6 + 9 =$ ____ d) $4 + 9 =$ ____

e) $9 + 9 =$ ____ f) $5 + 9 =$ ____ g) $9 + 2 =$ ____ h) $9 + 8 =$ ____

25. Add.

a) $8 + 2 =$ ____ b) $8 + 6 =$ ____ c) $8 + 7 =$ ____ d) $4 + 8 =$ ____

e) $5 + 8 =$ ____ f) $8 + 3 =$ ____ g) $9 + 8 =$ ____ h) $8 + 8 =$ ____

Skill 16

26. Add by making 10.

a) $8 + 3$
$= 8 + \underline{2} + \underline{1}$
$= 10 + \underline{1}$
$= \_\_\_\_$

b) $7 + 5$
$= 7 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

c) $6 + 5$
$= 6 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

d) $9 + 7$
$= 9 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

e) $5 + 9$
$= 5 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

f) $7 + 5$
$= 7 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

g) $4 + 8$
$= 4 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

h) $2 + 9$
$= 2 + \_\_\_\_ + \_\_\_\_$
$= 10 + \_\_\_\_$
$= \_\_\_\_$

Skill 17

27. Add.

a) $10 + 20 = \_\_\_\_$ b) $40 + 10 = \_\_\_\_$ c) $10 + 80 = \_\_\_\_$ d) $10 + 50 = \_\_\_\_$

e) $30 + 10 = \_\_\_\_$ f) $10 + 60 = \_\_\_\_$ g) $10 + 10 = \_\_\_\_$ h) $70 + 10 = \_\_\_\_$

28. Add.

a) $10 + 25 = \_\_\_\_$ b) $67 + 10 = \_\_\_\_$ c) $10 + 31 = \_\_\_\_$ d) $82 + 10 = \_\_\_\_$

e) $43 + 10 = \_\_\_\_$ f) $10 + 51 = \_\_\_\_$ g) $10 + 68 = \_\_\_\_$ h) $21 + 10 = \_\_\_\_$

i) $10 + 11 = \_\_\_\_$ j) $19 + 10 = \_\_\_\_$ k) $44 + 10 = \_\_\_\_$ l) $10 + 88 = \_\_\_\_$

29. Add.

a) $20 + 30 = \_\_\_\_$ b) $40 + 20 = \_\_\_\_$ c) $30 + 30 = \_\_\_\_$ d) $50 + 30 = \_\_\_\_$

e) $20 + 50 = \_\_\_\_$ f) $40 + 40 = \_\_\_\_$ g) $50 + 40 = \_\_\_\_$ h) $40 + 30 = \_\_\_\_$

i) $60 + 30 = \_\_\_\_$ j) $20 + 60 = \_\_\_\_$ k) $20 + 70 = \_\_\_\_$ l) $60 + 40 = \_\_\_\_$

Skill 18

30. Add.

a) $20 + 23 = \_\_\_\_$ b) $32 + 24 = \_\_\_\_$ c) $51 + 12 = \_\_\_\_$ d) $12 + 67 = \_\_\_\_$

e) $83 + 14 = \_\_\_\_$ f) $65 + 24 = \_\_\_\_$ g) $41 + 43 = \_\_\_\_$ h) $70 + 27 = \_\_\_\_$

i) $31 + 61 = \_\_\_\_$ j) $54 + 33 = \_\_\_\_$ k) $28 + 31 = \_\_\_\_$ l) $42 + 55 = \_\_\_\_$

Skills 19 and 20

31. Subtract.

a) $40 - 10 =$ ____ b) $50 - 10 =$ ____ c) $70 - 10 =$ ____ d) $20 - 10 =$ ____

e) $40 - 20 =$ ____ f) $60 - 30 =$ ____ g) $40 - 30 =$ ____ h) $60 - 50 =$ ____

32. Subtract.

a) $25 - 10 =$ ____ b) $67 - 10 =$ ____ c) $89 - 10 =$ ____ d) $93 - 10 =$ ____

e) $54 - 20 =$ ____ f) $42 - 30 =$ ____ g) $71 - 40 =$ ____ h) $66 - 50 =$ ____

33. Subtract.

a) $57 - 34 =$ ____ b) $43 - 12 =$ ____ c) $62 - 21 =$ ____ d) $59 - 36 =$ ____

e) $87 - 63 =$ ____ f) $95 - 62 =$ ____ g) $35 - 10 =$ ____ h) $17 - 8 =$ ____

Place Value Addition

Multiples of Ten

In the exercises below, you will learn several ways to use multiples of ten in mental addition or subtraction.

EXAMPLE 1

$542 + 214 = 542 + 200 + 10 + 4 = 742 + 10 + 4 = 752 + 4 = 756$

$827 - 314 = 827 - 300 - 10 - 4 = 527 - 10 - 4 = 517 - 4 = 513$

Sometimes you will need to regroup:
$545 + 172 = 545 + 100 + 70 + 2 = 645 + 70 + 2 = 715 + 2 = 717$

1. Add or subtract.

a) $536 + 100 =$ ____ b) $816 + 10 =$ ____ c) $124 + 5 =$ ____ d) $540 + 200 =$ ____

e) $234 + 30 =$ ____ f) $345 + 300 =$ ____ g) $236 - 30 =$ ____ h) $442 - 20 =$ ____

i) $970 - 70 =$ ____ j) $542 - 400 =$ ____ k) $160 + 50 =$ ____ l) $756 + 40 =$ ____

2. Write the second number in expanded form and add or subtract one digit at a time.

a) $564 + 215 =$ *564 + 200 + 10 + 5* $= 779$

b) $445 + 343 =$ _____ = ____

c) $234 + 214 =$ _____ = ____

3. Add or subtract mentally (one digit at a time).

a) $547 + 312 =$ ____ b) $578 - 314 =$ ____ c) $855 - 454 =$ ____ d) $641 + 327 =$ ____

EXAMPLE 2

If one of the numbers you are adding or subtracting is close to a number with a multiple of ten, add the multiple of ten and then add or subtract an adjustment factor.

$645 + 99 = 645 + 100 - 1 = 745 - 1 = 744$

$856 + 42 = 856 + 40 + 2 = 896 + 2 = 898$

EXAMPLE 3

Sometimes in subtraction, it helps to think of a multiple of ten as a sum of 1 and a number consisting entirely of 9s. **Examples:** $100 = 1 + 99$; $1000 = 1 + 999$. You never have to borrow or exchange when you are subtracting from a number consisting entirely of 9s.

$100 - 43 = 1 + 99 - 43 = 1 + 56 = 57$ ← Do the subtraction using 99 instead of 100, then add 1 to your answer.

$1000 - 543 = 1 + 999 - 543 = 1 + 456 = 457$

4. Use the tricks you've just learned to add or subtract.

a) $845 + 91 =$ ____ b) $456 + 298 =$ ____ c) $100 - 84 =$ ____ d) $1000 - 846 =$ ____

Addition and Subtraction Checklist #1

Student Name	Can Add Numbers up to 5	Can Subtract from Numbers up to 5	Can Add 2 to Even Numbers	Can Subtract 2 from Even Numbers	Can Add 2 to Odd Numbers	Can Subtract 2 from Odd Numbers	Can Add and Subtract the Numbers 3, 4, and 5

Addition and Subtraction Checklist #2

Student Name	Knows All Pairs that Add to 5	Can Double 1-Digit Numbers	Can Add Near Doubles **Example:** $6 + 7 = 6 + 6 + 1$	Can Add a 1-Digit Number to Any Multiple of 10 **Example:** $30 + 6 = 36$	Can Add Any 1-Digit Number to a Number Ending in 9 **Example:** $29 + 7 = 30 + 6 = 36$	Can Add Any 1-Digit Number to a Number Ending in 8 **Example:** $18 + 4 = 20 + 2 = 22$

Addition and Subtraction Checklist #3

Student Name	Can Add 1-Digit Numbers by "Breaking" them Apart into Pairs that Add to 10 Example: $7 + 5$ $= 7 + 3 + 2$ $= 10 + 2$	Can Add 10 to Any 2-Digit Number	Can Add Any Pair of 2-Digit Numbers	Can Add Any Pair of 2-Digit Numbers (with no regrouping)	Can Subtract Any Multiple of 10 from another Multiple of 10	Can Subtract Any 2-Digit Number from another 2-Digit Number (with no regrouping)

Multiplication

Skip Counting

Skip counting is a useful first step in learning how to multiply. Before proceeding to multiplication, make sure that all of your students can skip count by 2s, 3s, 4s, and 5s on one hand. For example, to teach skip counting by 2, draw on the board:

Have students practise first with the hand, then without. Practise in unison as a class and then have students recite the numbers individually.

Skills 1 to 6

Skip count by 2s to 10.

Skip count by 3s to 15.

Skip count by 4s to 20.

Skip count by 5s to 25.

Skip count by 2s to 20.

Skip count by 5s to 50.

How to Learn Your Times Tables in a Week

Trying to do math without knowing your times tables is like trying to play the piano without knowing the location of the notes on the keyboard. Students will have difficulty seeing patterns in sequences and charts; solving proportions; finding equivalent fractions, decimals, and percentages; and solving problems if they don't know their times tables.

Using the method below, you can teach students their times tables in a week or so. (If you set aside five or ten minutes a day to work with students who need extra help, the pay-off will be enormous.) There is really no reason for students not to know their times tables!

Day 1: Multiplying by 2s, 3s, 4s, and 5s

If you know how to count by 2s, 3s, 4s, and 5s, then you can multiply by any combination of these numbers. For instance, to find the product 3×2, count by 2s until you have raised 3 fingers.

Day 2: The Nine Times Table

The numbers you say when you count by 9s are called the multiples of 9 (zero is also a multiple of 9). The first ten multiples of 9 (after zero) are: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90. What happens when you add the digits of any of these multiples of 9 (Examples: $1 + 8$ or $6 + 3$)? The sum is always 9!

Here is another useful fact about the nine times table: multiply 9 by any number between 1 and 10 and look at the tens digit of the product. The tens digit is always one less than the number you multiplied by:

$9 \times 4 = 36$
3 is one less than 4

$9 \times 8 = 72$
7 is one less than 8

$9 \times 2 = 18$
1 is one less than 2

You can find the product of 9 and any number by using the two facts given above. For instance, to find 9×7, follow these steps:

Step 1: $9 \times 7 =$ ____ ____
Subtract 1 from the number you are multiplying by 9: $7 - 1 = 6$

$9 \times 7 =$ 6 ____
Now you know the tens digit of the product.

NOTES: 1. Make sure students know how to subtract (by counting on their fingers if necessary) before you teach them the trick for the nine times table.

2. Give a test on Step 1 before you move on.

Step 2: $9 \times 7 =$ 6 ____
These two digits add to 9.

$9 \times 7 =$ 6 3
So the missing digit is $9 - 6 = 3$ (You can do the subtraction on your fingers if necessary).

Practise these two steps for all of the products of 9: 9×2, 9×3, 9×4, etc.

Day 3: The Eight Times Table

There are two patterns in the digits of the eight times table. Knowing these patterns will help you remember how to count by 8s.

Step 1: You can find the ones digit of the first five multiples of 8 by starting at 8 and counting backwards by 2s.

8
6
4
2
0

Step 2: You can find the tens digit of the first five multiples of 8 by starting at 0 and counting up by 1s.

08 (Of course, you don't need to write the 0 in front of the 8 for the product 1×8.)
16
24
32
40

Step 3: You can find the ones digit of the next five multiples of 8 by repeating Step 1.

8
6
4
2
0

Step 4: You can find the remaining tens digits by starting at 4 and counting up by 1s.

48
56
64
72
80

Practise writing the multiples of 8 (up to 80) until you have memorized the complete list. Knowing the patterns in the digits of the multiples of 8 will help you memorize the list very quickly. Then you will know how to multiply by 8!

Example

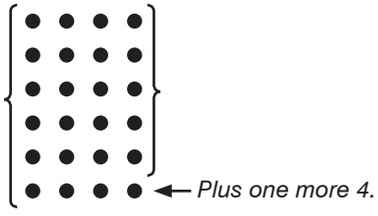
$8 \times 6 = 48$

Count by eight until you have 6 fingers up: 8, 16, 24, 32, 40, 48.

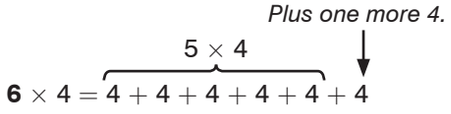
Day 4: The Six Times Table

If you have learned the eight and nine times tables, then you already know 6×9 and 6×8.

And if you know how to multiply by 5 up to 5×5, then you also know how to multiply by 6 up to 6×5! That's because you can always calculate 6 times a number by calculating 5 times the number and then adding the number itself to the result. The pictures below show why this works for 6×4:



$\mathbf{6} \times 4 = 5 \times 4 + 4 = 20 + 4 = 24$



Similarly:

$\mathbf{6} \times 2 = \mathbf{5} \times 2 + 2$; $\mathbf{6} \times 3 = \mathbf{5} \times 3 + 3$; $\mathbf{6} \times 5 = \mathbf{5} \times 5 + 5$.

Knowing this, you only need to memorize two facts:

$6 \times 6 = 36$ $\quad$ $6 \times 7 = 42$

Or, if you know 6×5, you can find 6×6 by calculating $6 \times 5 + 6$.

Day 5: The Seven Times Table

If you have learned the six, eight, and nine times tables, then you already know 6×7, 8×7, and 9×7.

And since you also already know $1 \times 7 = 7$, you only need to memorize 5 facts:

$2 \times 7 = 14$ $\quad$ $3 \times 7 = 21$ $\quad$ $4 \times 7 = 28$ $\quad$ $5 \times 7 = 35$ $\quad$ $7 \times 7 = 49$

If you are able to memorize your own phone number, then you can easily memorize these 5 facts!

NOTE: You can use doubling to help you learn the facts above. 4 is double 2, so 4×7 ($= 28$) is double 2×7 ($= 14$). 6 is double 3, so 6×7 ($= 42$) is double 3×7 ($= 21$).

Exercises

Skill 7

Multiply within 5×5.

Practice Questions

a) $2 \times 2 =$ ____ b) $3 \times 4 =$ ____ c) $4 \times 4 =$ ____ d) $5 \times 3 =$ ____

e) $3 \times 2 =$ ____ f) $5 \times 4 =$ ____ g) $2 \times 4 =$ ____ h) $3 \times 1 =$ ____

i) $5 \times 5 =$ ____ j) $4 \times 3 =$ ____ k) $1 \times 4 =$ ____ l) $2 \times 5 =$ ____

Skill 8

Multiply within 7×7.

Practice Questions

a) $6 \times 2 =$ ____ b) $3 \times 7 =$ ____ c) $4 \times 6 =$ ____ d) $5 \times 7 =$ ____

e) $6 \times 7 =$ ____ f) $5 \times 6 =$ ____ g) $3 \times 6 =$ ____ h) $7 \times 2 =$ ____

i) $4 \times 7 =$ ____ j) $7 \times 6 =$ ____ k) $6 \times 6 =$ ____ l) $7 \times 7 =$ ____

Skill 9

Multiply by 9 up to 9×9.

Practice Questions

a) $9 \times 2 =$ ____ b) $3 \times 9 =$ ____ c) $9 \times 4 =$ ____ d) $5 \times 9 =$ ____

e) $9 \times 6 =$ ____ f) $7 \times 9 =$ ____ g) $9 \times 8 =$ ____ h) $9 \times 9 =$ ____

i) $9 \times 5 =$ ____ j) $9 \times 7 =$ ____ k) $4 \times 9 =$ ____ l) $6 \times 9 =$ ____

Try this test every day until you have learned your times tables.

1. $3 \times 5 =$ ____ 2. $8 \times 4 =$ ____ 3. $9 \times 3 =$ ____ 4. $4 \times 5 =$ ____

5. $2 \times 3 =$ ____ 6. $4 \times 2 =$ ____ 7. $8 \times 1 =$ ____ 8. $6 \times 6 =$ ____

9. $9 \times 7 =$ ____ 10. $7 \times 7 =$ ____ 11. $5 \times 8 =$ ____ 12. $2 \times 6 =$ ____

13. $6 \times 4 =$ ____ 14. $7 \times 3 =$ ____ 15. $4 \times 9 =$ ____ 16. $2 \times 9 =$ ____

17. $9 \times 9 =$ ____ 18. $3 \times 4 =$ ____ 19. $6 \times 8 =$ ____ 20. $7 \times 5 =$ ____

21. $9 \times 5 =$ ____ 22. $5 \times 6 =$ ____ 23. $6 \times 3 =$ ____ 24. $7 \times 1 =$ ____

25. $8 \times 3 =$ ____ 26. $9 \times 6 =$ ____ 27. $4 \times 7 =$ ____ 28. $3 \times 3 =$ ____

29. $8 \times 7 =$ ____ 30. $1 \times 5 =$ ____ 31. $7 \times 6 =$ ____ 32. $2 \times 8 =$ ____

Multiplication Checklist

Student Name	Can Skip Count by 2s	Can Skip Count by 3s	Can Skip Count by 4s	Can Skip Count by 5s	Can Multiply within 5 × 5	Can Multiply within 7 × 7	Can Multiply by 9 up to 9 × 9

Game: Modified Go Fish

Purpose

If students know the pairs of one-digit numbers that add up to particular target numbers, they will be able to mentally break sums into easier sums.

Example: Since it is easy to add any one-digit number to 10, you can add a sum more readily if you can decompose the sum so that it includes pairs of numbers that add to 10.

$$7 + 5 = \underbrace{7 + \overbrace{3}}_{10} + 2 = 10 + 2 = 12$$

These numbers add to 10.

To help students remember pairs of numbers that add to a given target number, we have developed a co-operative variation of Go Fish as well as a competitive variation. We recommend that students play the co-operative version with each other in groups of 2–4. If you choose to use the competitive version, we recommend having a caring adult play with each individual student. The adult can build the student's confidence by allowing the student to win as many times as the adult feels is necessary. We do not recommend that students play the competitive version with each other.

The Co-operative Game

Object of the Game: To make and lay down pairs of cards that add to 10. The number of pairs to be made by the team depends on the number of players:

- 2 players must make 9 pairs
- 3 players must make 12 pairs
- 4 players must make 15 pairs

Materials: a deck of cards for each pair or group

Instructions: The player to the left of the dealer starts the game. To decide the first dealer, pick a student at random.

Take all the tens and face cards (J, Q, K) out of the deck. The dealer gives each player 6 cards, puts 12 cards face down into a draw pile, and sets any remaining cards aside (these will not be used). If players have any pairs of cards that add to 10 (e.g., ace and nine, two and eight, three and seven), they place these pairs on the table before play begins. If any player is left with no cards at this point, that player takes a card from the pile.

Player 1 selects one of the cards in her hand and asks Player 2 for a card that adds to 10 with the chosen card. For example, if Player 1's chosen card is a three, she asks Player 2 for a seven.

If Player 2 has the requested card, he must give it to Player 1. Player 1 puts the resulting pair down immediately. If Player 2 doesn't have the requested card, he says "Go fish," and Player 1 picks a card from the draw pile. If this card adds to 10 with a card in Player 1's hand, she lays the pair down right away.

If Player 1 has no cards left, she takes a card from the draw pile.

Now it is Player 2's turn to ask for a card from Player 3, and so on. On each turn, players ask for a card from the next player or pick one from the draw pile. On each turn, players may also set down any extra pairs in their hands.

Play ends when the draw pile runs out. At the end of the game, players are allowed to put down any pairs that remain in their hands. The team wins if, together, they have made the required number of pairs between them.

Scaffolding: Some students have trouble sorting their cards and finding pairs that add to 10. If this is the case, give the student only three cards, two of which add to 10. Ask the student to find the pair that adds to 10. After the student has mastered this step, repeat the exercise with four cards, then five cards, and so on.

You can also give a student a list of pairs that add to 10. As the student gets used to the game, gradually remove pairs from the list so that the student learns the pairs by heart.

The Competitive Game

Play as above with the following changes:

- The draw pile is not restricted to 12 cards. After dealing 6 cards to each player, the dealer puts all remaining cards into the draw pile.
- Play ends when one player lays down all of his or her cards. This player receives four points. Players then receive one point for each pair they have laid down. The goal of the game is to score as many points as possible.
- Players get another turn if the player from whom they request a card has it.

Different Target Numbers

The competitive version of the game is easily adaptable to different target numbers: simply tell students what number pairs must add to. With struggling students, start with pairs of numbers that add to five. Take all cards with value greater than four out of the deck. Each player should be dealt only four cards to start with.

NOTE: The co-operative version of the game is more difficult to adapt to different target numbers because it is trickier to ensure an exciting game with a close to even chance of winning or losing. Doing so requires determining an optimal number of cards to deal to each player, the number of cards to put in the draw pile, and the goal number of pairs. We have not provided the details for doing so.

Letter to Parents/Guardians

What is JUMP Math?

JUMP Math is an innovative, research-informed math resource and teaching approach used by schools to foster a deep understanding and love of math in their students. Our approach is based on the belief that all children can excel at math and, through early and continued success, can develop the confidence and cognitive abilities required to do well in all subjects.

JUMP Math has produced significant improvements in student achievement in a number of studies (including a randomized controlled trial). It is based on a method called structured inquiry. Each lesson is thorough and rigorous, and comes with instructional supports, exercises, assessments, activities, and extension questions that allow students to develop a deeper knowledge by working on incremental variations on the same topic. This allows teachers to focus their time and energy on real-time instruction and differentiation, rather than piecing lessons together from a variety of sources.

What are the components of JUMP Math?

The lesson plans are the heart of JUMP Math. Developed by a team of mathematicians and educators, it shows teachers how to:

- break concepts into fundamental units of understanding,
- assess and address gaps in student knowledge,
- present concepts in different ways and from different perspectives,
- build excitement with incrementally harder challenges, and
- foster advanced problem-solving skills.

Used in tandem with the student Assessment & Practice Books (AP Books), our Teacher Resource is aligned to provincial curricula.

How does JUMP Math benefit my child?

With JUMP Math, students derive concepts and solve problems themselves, and teachers provide guidance along the way to ensure this happens for all students, not just the advanced few. This approach ensures a critical balance of teaching and practice, and allows for varied forms of engagement, incremental challenge, and continuous assessment. At the end of each lesson, students work in their AP Books. These exercises match the material taught in the lesson exactly, allowing students to work independently to consolidate newly learned skills and concepts. At the same time, teachers get an immediate sense of where each student is and can provide individualized support as needed.

How can I support my child at home?

It's important that children understand how you use math every day: to compare prices and calculate change, measure ingredients in a recipe, estimate how much gas to buy, and predict if it will rain. Talk with them about this, and use coins, dice, cards, or dominoes to increase basic numeracy skills, pattern recognition, and fluency with math facts. Most importantly, believe in your child's potential to learn and become a mathematical thinker. If family members say "I don't have a math brain" or "I was always bad at math," your child gets the impression that math is scary and hard. Instead, use the language of possibility: "You don't have it yet but you will!"

To learn more, speak to your child's teacher or visit www.jumpmath.org.