Grade 3 Assessment in Numeracy

Support Document for Teachers

Manitoba

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Ce document est disponible en français.

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INTRODUCTION

Purpose

Grade 3 Assessment in Numeracy: Support Document for Teachers was developed by Manitoba Education, Citizenship and Youth as a resource to support teachers in implementing the Grades 3 and 4 Assessment policy, as identified in *Grade 3 Assessment in Reading,* Lecture, *and Numeracy and Grade 4 Assessment in French Immersion* Lecture (Manitoba Education, Citizenship and Youth).

Assessment Policy Overview

The primary purpose of this policy is to improve student learning by identifying, early in the school year, students' strengths and needs in key competencies in numeracy and reading and using this information to guide instructional planning. This formative application of the policy is consistent with assessment *for* and *as* learning, as described in the support document *Rethinking Classroom Assessment with Purpose in Mind: Assessment* for *Learning, Assessment* as *Learning, Assessment* of *Learning* (Manitoba Education, Citizenship and Youth). Teachers must determine the performance level of students at the end of October and report the information to parents.* By collecting the assessment information early in the school year, and reporting it to parents, educators can use it to plan next steps in students' learning and to support ongoing dialogue with parents to ensure that students have the foundation knowledge and skills needed to support learning across the curricula.

The second purpose of this policy is to communicate summative information about student achievement in the key competencies. This application of the policy reflects assessment *of* learning. There are three types of audiences for the achievement information. The first is the parent community, the second is the school-based learning team consisting of teachers, administrators, and divisional leaders, and the third is the larger educational and stakeholder communities, including the Department, the public, and researchers. These groups use the information to inform inquiry, look for trends, and make decisions about the provision of resources to support student learning.

* In this document, the term *parents* refers to both parents and guardians, and is used with the recognition that in some cases only one parent may be involved in a child's education.

Document Content and Organization

Grade 3 Assessment in Numeracy: Support Document for Teachers contains the following sections:

- **Introduction:** The purpose and content of this support document are addressed here in relation to the purpose of the policy document *Grade 3 Assessment in Reading,* Lecture, *and Numeracy and Grade 4 Assessment in French Immersion* Lecture.
- **Classroom-Based Assessment:** This section addresses formative and summative assessment practices.
- **Grade 3 Assessment in Numeracy:** Following an explanation of the rationale for the selection of the key competencies in mathematics for the Grade 3 Assessment in Numeracy, this section discusses the four specific competencies being assessed:
  - **Algebraic Reasoning Skills**
    Competency 1: predicting elements in repeating patterns
    Competency 2: understanding what equality represents
  - **Number Sense**
    Competency 3: representing whole numbers to 100 in a variety of ways
    Competency 4: using mental mathematics strategies to determine answers to addition and subtraction questions to 18

  The teacher background information provided for each competency area includes suggested assessment strategies and ideas on the student behaviours to observe during the assessment process.

  The continuum for assessment provided for each competency identifies the following:

  - Grade 2 (and before) learning outcomes from which the respective competencies were developed
  - criteria for three levels of performance (Grade 3 entry) used to determine student achievement of the learning outcomes
  - Grade 3 learning outcome(s) toward which students will progress during the school year
- **Reporting Assessment Results:** This section discusses the three audiences to whom assessment data is reported at the beginning of the school year to encourage collaborative efforts by parents, the Department, and the teacher team in the school to improve student learning.
- **Using Assessment Data:** This section explains how the information gleaned from the assessment is used in the classroom, in the school and school division, and by the Department.
- **References:** The resources cited in this document are identified in the References.

Formative Assessment

Formative assessment moves learning forward. It embodies two aspects: assessment *for* learning, done primarily by the teacher, and assessment *as* learning, which is done by the student. The teacher gathers and reflects on information in order to adjust instructional pacing, content, and strategies. Students also use assessment information to make adjustments in learning strategies and processes.

Research has found that the following strategies are the most powerful when teachers use them to inform instruction:

- clarifying and sharing learning intentions and criteria for success
- engineering effective classroom discussions, questions, and learning tasks
- providing feedback that moves learning forward
- activating students as the owners of their own learning
- activating students as instructional resources for one another (Leahy et al. 18)

The active engagement of students is an essential element of formative assessment that makes a positive difference in student learning. To become independent learners, students need to get an idea from the start of what is to be learned. Therefore, the teacher needs to explain the learning outcomes targeted, and have the students participate in

- setting criteria
- identifying performance indicators
- obtaining feedback from others (peers and teacher)
- further clarifying the criteria

Teachers model assessment of a performance or product against the established criteria for quality work. Students then practise comparing their work to these established criteria by providing themselves and others with feedback as they reflect on their own work and the work of their peers.

Teachers further support students by helping them to revise their work and move it closer to the established criteria. Students accomplish this by using their own personal feedback, as well as feedback from their peers and teachers. Ultimately, through this modelling of practice, and using feedback to adjust understanding and performance, students can learn not only to self-assess but also to

- understand the criteria better
- self-regulate their learning
- determine their next steps

These are critical steps in becoming independent, lifelong learners.

Summative Assessment

The intention behind summative assessment, also referred to as assessment *of* learning, is to produce defensible and accurate descriptions of student knowledge and skill in relation to defined outcomes and to present this information in summative reports for use at the individual student or aggregated levels. It requires the collection of information from observations, conversations, work samples as well as the interpretation of this information about students' accomplishments in the key competencies in relation to established criteria that represent the nature and complexity of the intended learning.

Various methods and multiple opportunities help ensure reliable results that can be interpreted and used both within and outside the classroom context. Assessment methods need to be congruent with learning goals.

Rationale for the Selection of Key Competencies in Mathematics

Algebraic reasoning skills and *number sense* are two aspects of the provincial Grade 3 Assessment in Numeracy. These two aspects of the mathematics curriculum are fundamental to ongoing success in school and in society. All the strands in the curriculum are important; however, since the reporting of the Grade 3 Assessment occurs in early November, only two strands have been targeted.

The competencies have been chosen as predictors of future success in algebraic reasoning and number sense. They focus on what students need to know at the end of Grade 2 to be successful in Grade 3. Teachers assess these competencies in a formative way to inform instruction and to guide learning.

Algebraic Reasoning

Algebraic reasoning involves analyzing, representing, and generalizing patterns and regularities in all aspects of mathematics. Conceptual understanding of algebra contributes to the development of number sense.

Algebraic reasoning skills are critical and can contribute to students' number sense by allowing them to be more flexible in developing and applying mental mathematics strategies. Algebraic reasoning skills focus on repeating patterns and relationships, which help students make connections to other mathematical concepts. The specific algebraic reasoning competencies being assessed are

- predicting elements in repeating patterns
- understanding what equality represents

Number Sense

In our rapidly changing and increasingly technological society, making sense of numbers and solving problems have become more important skills than simply performing operations on numbers. Number sense requires a deep and fundamental understanding of, and proficiency with, counting, numbers, and operations, as well as an understanding of number systems and their structures.

As students learn new mathematical concepts, they need to make sense of numbers by becoming aware of the relationships found between numbers. A key idea in mathematics for students to understand is that numbers are represented in different ways. As students develop mental mathematics strategies and part-part-whole thinking, they will gain a strong understanding of operations and of number relationships.

Students need to develop mental images to represent numbers in order to facilitate their understanding. The specific number sense competencies being assessed are

- representing whole numbers to 100 in a variety of ways
- using mental mathematics strategies to determine answers to addition and subtraction questions to 18

Algebraic Reasoning Skills (Competency 1)

Student predicts an element in a repeating pattern.

Why Assess This Competency?

Algebraic reasoning (thinking) involves representing, generalizing, and formalizing patterns in mathematics. It demonstrates how students use algebra to understand and communicate mathematical concepts. Students who develop algebraic thinking are able to apply this knowledge to other strands in mathematics.

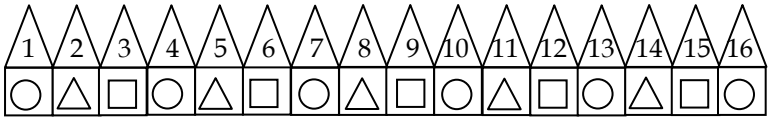
Students who develop the ability to **identify**, **reproduce**, **extend**, and **create** patterns are able to make generalizations and see relationships with numbers. This is why identifying and extending patterns is an important process in algebraic reasoning.

To work with increasing and decreasing patterns, it is important that Grade 3 students have a sound foundation with repeating patterns, as well as some abilities with increasing patterns (Grade 2).

Assessment Strategies and Observations

In Grade 3 students are expanding their knowledge of increasing patterns. They are beginning to explore decreasing patterns and making more in-depth connections with number concepts. When presenting a repeating pattern, encourage students to verbalize the rule for the patterns they are working with. To encourage students to make connections with numbers, present the pattern with numerical term position.

Examples of Student Responses



- "This is a repeating pattern."
- "The core (the part that repeats) of the pattern is circle, triangle, square."
- "Every 3rd shape is a square."
- "If I start at a circle and I add 3 elements (shapes, . . .), I notice that I land on a circle."
- "If I start at a triangle and I add 3 elements (shapes, . . .), I notice that I land on a triangle."
- "If I start at a square and I add 3 elements (shapes, . . .), I notice that I land on a square."

- "To find the 20th element (shape, . . .),"
  - "I think 16th element (shape, . . .), plus 4."
  - "I think 3 times 6 plus 2 more elements (shapes, . . .)."
  - "I know the 21st element is a square and I do 1 less or go back 1."
  - "Every 3rd shape is a square, so I know the 18th shape will be a square because I skip counted by 3s and continued the pattern for 2 more shapes."

Information for Increasing Pattern

Increasing patterns should be both numerical and non-numerical. Numerical increasing patterns lead to a better sense of number.

When presenting an increasing pattern, encourage students to make connections with hundred charts.

Example

★★	★★★★	★★★★★★	★★★★★★★★	
Term 1	Term 2	Term 3	Term 4	Term 5

Language to Model with Students

- "As each term increases by 1, the number of elements (stars) increase by 2."
- "On the hundred chart it would be all even numbers."
- "On the hundred chart starting with 1, all the columns ending with 2, 4, 6, 8, and 0 would show the increasing pattern."
- "This pattern of stars is the same as counting by 2s."
- "To know how many stars are needed for a term, I just double the term position. For example, the 4th term would have 8 stars (4 + 4)."
- "The 1st term has 2 stars, the 2nd term has 4 stars, the 3rd term has 6 stars, so to determine how many stars for any term, I just think to double the term number."

Ask students to create increasing patterns on a hundred chart or a number line, and have them explain their pattern.

Use a hundred chart to skip count, and ask students to identify the increasing pattern.

NOTE

When presenting a repeating pattern to students, always repeat the core three times. When presenting increasing patterns to students, always provide the first three terms. Some students have difficulty identifying an increasing pattern and think of the first terms as being the core of a repeating pattern. Although students may use other language to describe patterns, it is important to model mathematical language and thinking.

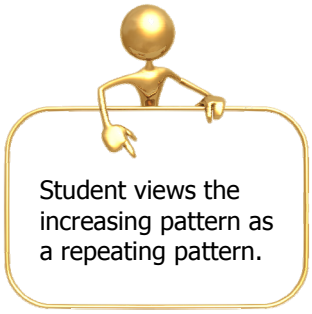
Increasing Pattern Given to Student

Term Number	1	2	3	4	5	6	7
Number of Triangles	▲▲	▲▲▲	▲▲▲▲				

Examples of Student Responses

Increasing Pattern View Misconception

Term Number	Number of Triangles
1	▲▲
2	▲▲▲
3	▲▲▲▲
4	▲▲
5	▲▲▲
6	▲▲▲▲
7	



Correct Increasing Pattern View

Term Number	Number of Triangles	
1	▲▲	
		+1
2	▲▲▲	
		+1
3	▲▲▲▲	
		+1
4	▲▲▲▲▲	
5	▲▲▲▲▲▲	
6	▲▲▲▲▲▲▲	
7	▲▲▲▲▲▲▲▲	

NOTE

Probe students to discover all patterns that are displayed in the table. Have students discover the pattern found in the term number. For example, the term numbers increase by one, or they have a pattern of odd and even.

Remember to present the chart horizontally and vertically.

Continuum for Algebraic Reasoning Skills (Competency 1)

Competency 1: Student predicts an element in a repeating pattern.

Algebraic reasoning involves analyzing, representing, and generalizing patterns and regularities in all aspects of mathematics. Conceptual understanding of algebra contributes to the development of number sense.

Grade 2 (and before) Learning Outcomes	Levels of Performance—Grade 3 Entry			Grade 3 Learning Outcome(s)
	Needs Ongoing Help	Approaching Expectations	Meeting Expectations	
▪ K.PR.1. Demonstrate an understanding of repeating patterns (two or three elements) by identifying, reproducing, extending, and creating patterns using manipulatives, sounds, and actions. [C, CN, PS, V] ▪ 1.PR.1. Demonstrate an understanding of repeating patterns (two to four elements) by describing, reproducing, extending, and creating patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V] ▪ 1.PR.2. Translate repeating patterns from one representation to another. [C, R, V] ▪ 2.PR.1. Predict an element in a repeating pattern using a variety of strategies. [C, CN, PS, R, V] ▪ 2.PR.2. Demonstrate an understanding of increasing patterns by describing, reproducing, extending, and creating patterns using manipulatives, diagrams, sounds, and actions (numbers to 100). [C, CN, PS, R, V]	▪ Identifies the core of a repeating pattern. e.g., O□Δ O□Δ O□Δ "Circle, square, triangle is the core."	▪ Predicts an element in a repeating pattern using manipulatives or drawings to support own thinking. e.g., O□Δ O□Δ O□Δ O□___ "The next element will be a triangle because I drew out the pattern."	▪ Predicts an element in a repeating pattern making connections with numbers. e.g., O□Δ O□Δ O□Δ "The 12th element is a triangle because a triangle comes 3rd, 6th, and 9th, and so the next will be 12." ▪ Relates number relationships to the pattern, such as recognizing skip counting, and odd and even numbers, to determine an element.	▪ 3.PR.1. Demonstrate an understanding of increasing patterns by describing, extending, comparing, and creating patterns using manipulatives, diagrams, and, numbers (to 1000). [C, CN, PS, R, V]

Algebraic Reasoning Skills (Competency 2)

Student understands that the equal symbol represents an equality of the terms found on either side of the symbol.

Why Assess This Competency?

Understanding that the equal symbol (=) means the quantity on the left is the same as the quantity on the right is a fundamental mathematics concept. This type of thinking is critical in algebra, and it can enrich the number sense of students by allowing them to be more flexible in applying and developing mental mathematics strategies.

Many students in the Early Years grades may have the misconception that the equal symbol (=) means "give the answer." These students see the equal symbol (=) as an "action" rather than as a relationship.

Example

Students should think of $3+4$ as another way of thinking about 7 rather than $3+4$ "makes" 7.

Exploring Relationship between Terms

Exploring the relationship between terms on either side of an equal symbol enables students to develop the understanding of the relationship that exists between the terms. It is important that they discover this relationship on their own.

You may wish to provide examples for students to explore the relationship.

Examples

16 + 18 = 18 + 16
13 + 9 = 15 + 7
16 + 26 = 8 + 34
2 + 8 = 1 + 9

Ask students what relationship they notice between the terms. If students don't notice any relationship, provide more examples. Observation of the relationship between the numbers has to come from the students. If the relationship is noticed, introduce unknowns.

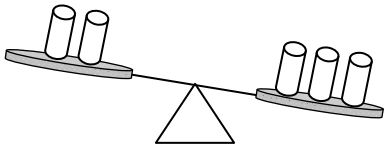
Examples

21 + 56 = ☐ + 50
16 + 12 = ☐ + 17
☐ + 48 = 36 + 42

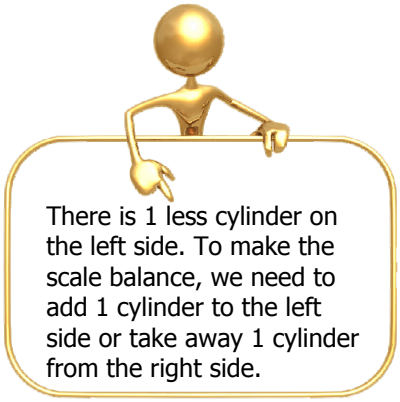
Assessment Strategies and Observations

In Grades 1 and 2 students have been exposed to using balance scales to represent equalities and inequalities. When using balance scales, it is important to help students develop and apply relational thinking.

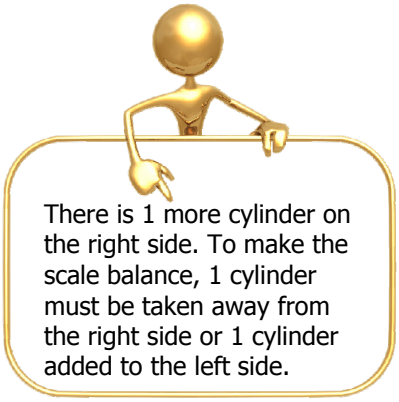
Example



2 cylinders ≠ 3 cylinders

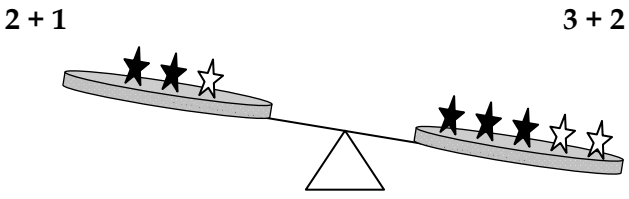


OR



In Grade 3 students are working toward being able to explain the inequality without having to count, but use language such as "1 less white star" and "1 less black star" for an example such as the following. To make the scale balance, students would know they need to add 2 stars to one side.

Example



It is important to make the connection with the symbolic representation. Have students create number sentences to match the pictorial representation. When using a balance scale to illustrate equalities and inequalities, the objects (e.g., bingo chips, stars, cubes) must always be **uniform in size, shape, and mass**. The colour of the object used can vary and will not be a factor in determining equality.

Recommended Reading

Carpenter, Thomas P., Megan Loef Franke, and Linda Levi. *Thinking Mathematically: Integrating Arithmetic and Algebra in Elementary School*. Portsmouth, NH: Heinemann, 2003. Chapter 2, pages 9 to 24.

Continuum for Algebraic Reasoning Skills (Competency 2)

Competency 2: Student understands that the equal symbol represents an equality of the terms found on either side of the symbol.

Algebraic reasoning involves analyzing, representing, and generalizing patterns and regularities in all aspects of mathematics. Conceptual understanding of algebra contributes to the development of number sense.

Grade 2 (and before) Learning Outcomes	Levels of Performance—Grade 3 Entry			Grade 3 Learning Outcome(s)
	Needs Ongoing Help	Approaching Expectations	Meeting Expectations	
▪ 1.PR.3. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V] ▪ 1.PR.4. Record equalities using the equal symbol (0 to 20). [C, CN, PS, V] ▪ 2.PR.3. Demonstrate and explain the meaning of equality and inequality by using manipulatives and diagrams (0 to 100). [C, CN, R, V] ▪ 2.PR.4. Record equalities and inequalities symbolically using the equal symbol or the not-equal symbol. [C, CN, R, V]	▪ Sees the equal symbol as meaning only "give me the answer" to a number sentence. e.g., 15 + 2 = ___ ▪ Believes the only answer that can be given on the right side of the equal sign is 17. ▪ Does not see that answers such as 17 + 0, 2 + 15, and 18 – 1 are also correct.	▪ Sees the equal symbol as meaning a balance between the two sides of the equation. e.g., 15 + 2 = ___ or ___ = 15 + 2 ▪ Is able to give multiple answers on either the right or left side of the equal sign. ▪ Knows that 15 + 2 is the same as 3 + 14 because both equal 17.	▪ Understands and can explain the relationship between two different expressions. e.g., 15 + 2 ☐ 3 + 14 ☐ is "=" since 14 is one less than 15 and 3 is one more than 2, so both sides are the same. ▪ Is able to compare both sides of the number sentence without adding the numbers.	▪ 3.PR.3. Solve one-step addition and subtraction equations involving symbols representing an unknown number. [C, CN, PS, R, V]

Number Sense (Competency 3)

Student understands that a given whole number may be represented in a variety of ways (to 100).

Why Assess This Competency?

To develop a good sense of number, students have to develop an intuition about numbers and their relationships. Flexible intuitive thinking about numbers develops gradually as a result of exploring numbers and visualizing in a variety of contexts.

When students are representing numbers in a variety of ways, they demonstrate their understanding of the use of a number (e.g., my house number is 34), how a number compares to another number (e.g., 34 is 1 less than 35), how a number can be broken into parts (e.g., 34 is 32 + 2), and place value (e.g., 34 is 30 + 4 or 20 + 14 or 10 + 24).

The ability to represent numbers in a variety of ways will benefit students when doing operations and mental mathematics problems. Present number sentences horizontally rather than vertically, to encourage students to use different representations of numbers and **part-part-whole thinking.**

Examples

Developing part-part-whole relationships allows students to think of a number as a composition of other numbers. This includes knowing the parts and being able to find the whole, knowing the whole and finding the parts, knowing a part and a whole, and finding the missing part.

Assessment Strategies and Observations

Encourage students to represent numbers in a variety of ways (e.g., using manipulatives, words and pictures, number sentences, place value, money, ten frames, horizontal and vertical number lines, connections to other strands, and real-life situations).

Representations of Numbers

- Pictorial (e.g., ten frames, base-10 materials)
- Part-part-whole relationships using multiples of 10 (e.g., 85 = 80 + 5 or 40 + 40 + 5)
- Part-part-whole relationships using non-multiples of 10 (e.g., 85 = 83 + 2)
- Regular place value (e.g., 56 is 5 tens, 6 ones/units)
- Irregular place value (e.g., 56 is 4 tens, 16 ones/units)
- Various concrete materials (e.g., 36 can be represented with money, a model for tens, blocks, straws)
- Words
- Naming a number less than
- Naming a number greater than
- Odd or even
- Connections to real-life situations
- Connections to other strands
- Story problems

Number of the Day

In your daily routine, you may use the Number of the Day strategy to develop and observe the different representations that students have of numbers.

Number of the Day can be done with the whole class, with partners or small groups, and individually to collect information:

- **With the whole class**—this allows students to propose as many ways as possible to represent a given number and explore new representations.
- **With partners or small groups**—this allows students to apply, construct, and reinforce understandings from the whole-class activity.
- **Individually**—this provides a "snapshot" of what students are able to do.

An important facet to building representations of numbers is to provide opportunities for students to discuss and reflect upon their thinking and the connections they are making through the representations. Allow time to discuss these connections during daily routines.

Place Value Development

Place value is a complex idea that involves relationships that are developed during the span of the Early Years grades. The understanding of place value is an essential concept for the development of number sense, estimating skills, and mental mathematics skills, and to an understanding of multi-digit operations.

Students can develop a sense of place value by

- counting by 10 on and off the multiple from any starting point
- using a variety of number charts (e.g., 1 – 100, 0 – 99, 100 – 1, 41 – 140, rows of 20), horizontal and vertical number lines, bead measures, and ten frames
- constructing their own base-10 materials
- using base-10 models, including money
- developing part-part-whole thinking
- working with horizontal algorithms and empty number lines

Students can often identify the place value of the digits. This does not indicate a full understanding of place value. Students will progress through different developmental levels of understanding of place value, which can be observed through classroom-based activities. When requiring further evidence, an interview about the representation of digits in a number can be done.

Take the opportunity when observing students at work to get more information about their level of understanding of place value. For example, for the number 28, you may identify one of the following levels of place value understanding.

Present number sentences horizontally rather than vertically so students use place value knowledge instead of digit-based thinking.

Examples

- Presenting 57 + 33 horizontally encourages strategic thinking.
- Presenting
  $$\begin{array}{r} 57 \\ +\ 33 \\ \hline \end{array}$$
  vertically, encourages students to concentrate on digits and, therefore, they never think of a number larger than 10.

Level 1: Single Numeral Understanding

The student identifies the individual digits 2 and 8 have no meaning by themselves. The student views 28 as a single numeral.

Level 2: Position Names Understanding

The student identifies the tens and ones/units positions but makes no connections between the numerals and corresponding blocks.

Level 3: Face Value Understanding

The student interprets the representation of the number literally (e.g., for 28, the 2 means 2 and 8 means 8, the student will show 2 blocks to represent 20 and then show 8 blocks to represent the 8).

Level 4: Partial Place Value Understanding

The student matches 8 to 8 objects and the 2 with the remaining 20 objects but not as groups of ten. The student has not connected 20 to 2 tens.

Level 5: Full Understanding

The student represents the number 28 with the 2 as 2 groups of 10 blocks and the 8 as 8 single blocks.

Continuum for Number Sense (Competency 3)

Competency 3: Student understands that a given whole number may be represented in a variety of ways (to 100).

Number sense requires a deep and fundamental understanding of, and proficiency with, counting, numbers, and operations, as well as an understanding of number systems and their structures.

Grade 2 (and before) Learning Outcomes	Levels of Performance—Grade 3 Entry			Grade 3 Learning Outcome(s)
	Needs Ongoing Help	Approaching Expectations	Meeting Expectations	
▪ K.N.3. Relate a numeral, 1 to 10, to its respective quantity. [CN, R, V] ▪ K.N.4. Represent and describe numbers 2 to 10 in two parts, concretely and pictorially. [C, CN, ME, R, V] ▪ 1.N.4. Represent and describe numbers to 20, concretely, pictorially, and symbolically. [C, CN, V] ▪ 1.N.7. Demonstrate, concretely and pictorially, how a number, up to 30, can be represented by a variety of equal groups with and without singles. [C, R, V] ▪ 2.N.4. Represent and describe numbers to 100, concretely, pictorially, and symbolically. [C, CN, V] ▪ 2.N.7. Illustrate, concretely and pictorially, the meaning of place value for numbers to 100. [C, CN, R, V]	▪ Represents numbers from 1 to 20 in a variety of ways. ▪ Represents numbers using manipulatives, words, pictures, and symbols.	▪ Represents numbers from 1 to 100 in a variety of ways, including: part-part-whole using multiples of 10. e.g., 45 is 40 + 5, or 10 + 10 + 10 + 10 + 5	▪ Represents numbers from 1 to 100 in a variety of ways, including: part-part-whole using non-multiples of 10. e.g., 45 is 43 + 2 ▪ Makes connection to real-life situations. e.g., 45 can be 1 quarter and 2 dimes or 4 dimes and 1 nickel. e.g., 45 can be my age of 8 plus 37	▪ 3.N.2. Represent and describe numbers to 1000, concretely, pictorially, and symbolically. [C, CN, V] ▪ 3.N.5. Illustrate, concretely and pictorially, the meaning of place value for numerals to 1000. [C, CN, R, V]

Number Sense (Competency 4)

Student uses mental mathematics strategies to determine answers to addition and subtraction questions to 18.

Why Assess This Competency?

Research indicates the importance of helping students develop a strong understanding of operations and of number relationships. Students need to be able to choose a mental mathematics strategy and explain their choice and thinking. It is important to provide students with practice in the use and selection of strategies in order for them to develop efficiency. The use of mental mathematics strategies and part-part-whole thinking will lead to long-term recall and understanding of basic facts.

Assessment Strategies and Observations

Developing number sense by strategically working with part-part-whole thinking leads to recall of basic facts. Students can retain basic facts only if they understand the strategies that allow them to find the answer.

Developing strategies allows students to acquire more sophisticated knowledge; likewise, knowledge leads to the development of more sophisticated strategies. This cycle continues, enabling students to be proficient with numbers in a meaningful way that will last a lifetime. Using drill, rather than developing strategies, may promote speed, but not necessarily accuracy. This results in temporary acquisition of facts. Practising math facts is appropriate only after students have acquired known facts through strategic thinking.

Students need to have prior knowledge about number relationships such as subitizing, one more, one less, two more, two less, anchoring to 5 and 10, and part-part-whole thinking.

Students need to have opportunities to develop and practise strategies that will lead to automaticity. When students are counting two sets of objects, observe the strategies they use. For example, for a set of 7 objects and 5 objects, observe to determine the strategies students are using (e.g., counting all, counting on, using doubles plus two, making 10, recalling the fact).

Strategic thinking allows students to develop known facts (recall). However, students who know their facts only by memorization will need to develop strategic approaches to understanding number. Having a known fact is a point of strength. Encourage students to use the known fact with a strategy to acquire unknown facts.

Have students match facts to the strategy they use, or have them sort a set of facts that correspond to one strategy, or sort them on a Venn Diagram. Observe how students arrange the set and whether they apply the strategy correctly. This observation can be done over time, and observations can be noted on a checklist.

Mental Mathematics

The following list compiles mental mathematics strategies as found in *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes* (Manitoba Education, Citizenship and Youth).

Grade(s)	Concept	Strategy	Meaning	Example(s)
1	Addition	Counting on	Students begin with a number and count on to get the sum. They should begin to recognize that beginning with the larger of the two addends is generally most efficient.	for 3 + 5, think: 5 + 1 + 1 + 1 is 8; think: 5, 6, 7, 8
1	Subtraction	Counting back	Students begin with the bigger number and count back to find the difference.	for 6 – 2, think: 6 – 1 – 1 is 4; think: 6, 5, 4
1, 2	Addition	Using one more	Starting from a known fact and adding one more.	for 8 + 5, if you know 8 + 4 is 12 and one more is 13
1, 2	Addition	Using one less	Starting from a known fact and taking one away.	for 8 + 6, if you know 8 + 7 is 15 and one less is 14
1, 2	Addition Subtraction	Making 10	Students use combinations that add up to 10.	4 + ____ is 10 7 + ____ is 10
1	Addition Subtraction	Starting from known doubles	Students need to work to know their doubles.	2 + 2 is 4 and 4 – 2 is 2
1, 2, 3	Subtraction	Using addition to subtract	This is a form of part-part-whole representation. Thinking of addition as: part + part "gives the" whole Thinking of subtraction as: whole – part "gives the" part	for 12 – 5, think: 5 + ____ = 12 so, 12 – 5 = 7
2	Addition Subtraction	The zero property of addition	Knowing that adding 0 to an addend does not change its value and taking 0 from a minuend does not change the value.	0 + 5 = 5; 11 – 0 = 11
2, 3	Addition Subtraction	Using doubles	Students learn doubles, and use this to extend facts: ▪ using doubles ▪ doubles plus one (or two) ▪ doubles minus one (or two)	for 5 + 7, think: 6 + 6 is 12; for 5 + 7, think: 5 + 5 + 2 is 12 for 5 + 7, think: 7 + 7 – 2 is 12
2, 3	Addition Subtraction	Building on known doubles	Students learn doubles, and use this to extend facts.	for 7 + 8, think: 7 + 7 is 14 so, 7 + 8 is 14 + 1 is 15
3	Addition Subtraction	Making 10	Students use combinations that add up to 10 to calculate other math facts and can extend this to multiples of 10 in later grades.	for 8 + 5, think: 8 + 2 + 3 is 10 + 3 or 13

continued

Grade(s)	Concept	Strategy	Meaning	Example(s)
3	Addition Subtraction	Compensation	Using other known math facts and compensating. For example, adding 2 to an addend and taking 2 away from the sum.	for 8 + 7, think: 8 + 2 + 7 – 2 is 10 + 7 – 2 is 17 – 2 is 15
3	Addition	Commutative property	Switching the order of the two numbers being added will not affect the sum.	4 + 3 is the same as 3 + 4
3, 4	Addition Subtraction	Compatible (complementary) numbers	Compatible numbers are friendly numbers (often associated with compatible numbers to 5 or 10).	for 4 + 3, think: 4 + 1 is 5 and 2 more makes 7

Continuum for Number Sense (Competency 4)

Competency 4: Student uses mental mathematics strategies to determine answers to addition and subtraction questions to 18.

Number sense requires a deep and fundamental understanding of, and proficiency with, counting, numbers, and operations, as well as an understanding of number systems and their structures.

Grade 2 (and before) Learning Outcomes	Levels of Performance—Grade 3 Entry			Grade 3 Learning Outcome(s)
	Needs Ongoing Help	**Approaching Expectations**	**Meeting Expectations**	
▪ K.N.4. Represent and describe numbers 2 to 10 in two parts, concretely and pictorially. [C, CN, ME, R, V] ▪ 1.N.4. Represent and describe numbers to 20, concretely, pictorially, and symbolically. [C, CN, V] ▪ 1.N.7. Demonstrate, concretely and pictorially, how a number, up to 30, can be represented by a variety of equal groups with and without singles. [C, R, V] ▪ 1.N.8. Identify the number, up to 20, that is one more, two more, one less, and two less than a given number. [C, CN, ME, R, V] ▪ 1.N.10. Describe and use mental mathematics strategies (memorization not intended), including: counting on or counting back, using one more or one less, making 10, starting from known doubles, using addition to subtract, to determine the basic addition and related subtraction facts to 18. [C, CN, ME, PS, R, V] ▪ 2.N.8. Demonstrate and explain the effect of adding zero to or subtracting zero from any number. [C, R] ▪ 2.N.10. Apply mental mathematics strategies, including: using doubles, making 10, using one more, one less, using two more, two less, building on a known double, using addition for subtraction, to develop recall of basic addition facts to 18 and related subtraction facts. [C, CN, ME, R, V]	▪ Relies on counting (count all, count on, and count back). e.g., 3 + 5 is 3, 4, 5, 6, 7, 8 . . . ▪ Uses manipulatives such as fingers and counters.	▪ Uses count on and count back by 1, 2, and 3. e.g., 8 + 2 is 8, 9, 10 ▪ Knows doubles e.g., 4 + 4, 5 + 5, 7 + 7 ▪ Knows addition facts with zero. ▪ Uses one more, one less, two more, and two less.	▪ Uses known facts such as doubles. e.g., for 4 + 6, think 5 + 5 makes 10 e.g., for 7 + 5, think 7 + 3 + 2 → 10 + 2 is equal to 12 ▪ Knows addition and subtraction facts with zero. ▪ Uses addition for subtraction. e.g., for 7 – 3, think 3 + ? = 7 ▪ Knows that the order in which numbers are added does not affect the sum. e.g., 5 + 3 is the same as 3 + 5 ▪ Uses known facts. e.g., for 8 + 5, if you know 8 + 4 = 12, then add the 1 to 12 to make 13 ▪ Uses the inverse relationship between addition and subtraction. e.g., since 5 + 3 = 8, then 8 – 5 = 3 and 8 – 3 = 5 (fact families)	▪ 3.N.10. Determine addition facts and related subtraction facts (to 18). [C, CN, ME, R, V]

Reporting Assessment Results

Overview of the Reporting Process

Schools report each student's performance in two ways: to parents, distributed in a timely manner, and to Manitoba Education, Citizenship and Youth no later than the end of November. The reporting of student achievement is to reflect student performance as of the last week of October.

Student performance reflects cumulative growth and achievement as a result of instruction over previous years. Therefore, it is appropriate to share the information with the teacher team in the school to foster collaborative efforts to improve student learning.

Sending Results to Parents

Schools use the reporting forms provided by the Department to communicate results to parents. These reports are to be signed by the teacher and the principal, and copies are to be kept in students' cumulative files.

Schools or school divisions that wish to incorporate reporting for this policy into other reporting procedures rather than using the provincial reporting templates must first obtain authorization from Manitoba Education, Citizenship and Youth.

Sending Results to the Department

Schools will report individual student results to the Department by the end of November. Schools will receive a letter each fall describing the procedures for reporting data to the Department using a web-based application. Information in the web-based application will be provided on a student-by-student basis and will be based on September 30 enrolment data of the previous year. Procedures for adding new students and removing students no longer enrolled will be provided.

Student Performance below Competency Criteria

If a student's performance level is below the lowest level described in the reporting template for a given competency, and the student has, or will soon have, an individual education plan (IEP), it is not necessary to send a report home to parents, provided that appropriate communication between home and school is ongoing. Reporting to the Department is still a requirement. As well, a copy of the completed report must be kept in the student's cumulative file. No performance levels will be indicated for the competencies and the comment section should be used to explain the circumstances.

For students whose level of performance is below the lowest level on the report, an option will be provided for each competency to indicate that the student is performing below the lowest performance level described on the reporting form for the competency.

Students with Exceptional Circumstances

In rare instances, it will not be possible to report the assessment results to parents or to the Department as required by the policy due to "exceptional circumstances." For example, the student might have arrived in the province in late October with no performance information available. Such a student may be exempted from the reporting process, provided the parents are informed, they give consent, and the school makes a request that includes the details of the circumstances to the Department by the end of October.

The formal request letter must include

- school name
- student name and MET number
- description of the exceptional circumstances
- statement that the parent approves of the exemption
- school contact person with title, telephone number, and signature

The request may be mailed or sent by fax to

English Program
Coordinator, Assessment Unit
Instruction, Curriculum and Assessment Branch
1567 Dublin Avenue
Winnipeg MB R3E 3J5
Fax: 204-948-2442

Français or French Immersion Program
Directrice, Direction des services de soutien en éducation (Section évaluation)
Bureau de l'éducation française
309–1181 Portage Avenue
Winnipeg MB R3G 0T3
Fax: 204-948-3234

Once the exemption from reporting is granted by the Department, no reporting to parents is required. For reporting to the Department, no further action is required. The exemption is indicated in the data and no performance levels for any of the competencies are reported.

USING ASSESSMENT DATA

The information gleaned from the Grade 3 and Grade 4 Assessment is used in the classroom, in the school and school division, and by the Department.

Classroom

At the classroom level, teachers, students, and parents can use the assessment data as additional information to set goals and monitor progress over time. Particularly if students are having difficulty in one or more of the competencies, special attention by the teacher, support teachers, parents, and the student is necessary to address newly identified areas of concern or to continue support for the student.

School and School Division

The data sent by schools will be summarized by the Department and returned to schools and school divisions. This data can be used to inform decisions on how best to support Early Years learners and to identify areas of strength or concern. Educators could also use the data to identify possible professional learning priorities or resources at the school and school division levels.

Province

The provincial summary of the data will provide a snapshot of how students are performing province-wide. Analyzing and reflecting on this summary of data each year will influence future policies and decisions about how best to support Early Years learners.

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