CODE
Council of Ontario Directors of Education

Grade 7 & 8 Mathematics
Summer Learning Program

Guide for Numeracy Component

A resource developed for the Council of Ontario Directors of Education by the Ontario Mathematics Coordinators Association as a support for the 2021 CODE Summer Learning Program

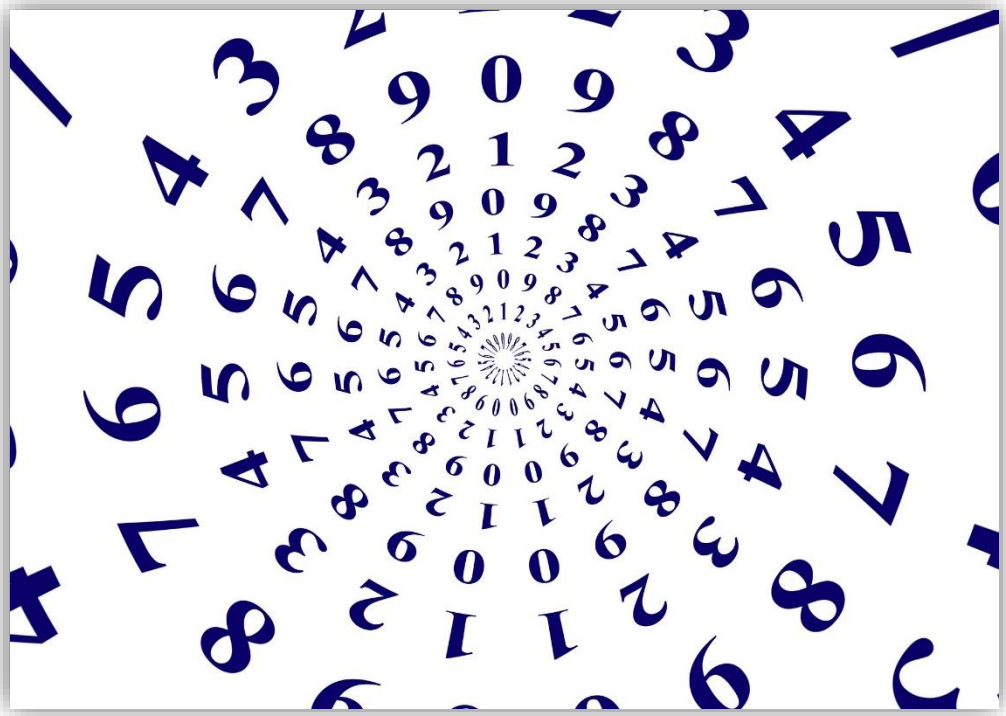

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Table of Contents

Rationale

This guide is designed to support system leaders in District School Boards across Ontario as they work with principals and teachers to develop and implement an effective summer learning program (SLP) in numeracy for vulnerable students in grades 7 and 8. Included in the guide are suggested areas of focus where these students would benefit from multiple and repeated opportunities to consolidate conceptual understanding and master procedural fluency of grades 7 and 8 mathematics. This includes developing a positive math mindset by connecting and applying concepts in a variety of ways and building on what prior knowledge, skills, and experiences the students bring to the program. Participating in this program will benefit students entering the grade 9 de-streamed mathematics program.

While we know student needs vary across district school boards, the goal is to outline high impact practices to center students in their mathematical experiences and engage them through meaningful learning during the summer learning program. The thoughtful use of these practices is an essential component of any effective math program.

Current research and shared ideas from a number of district school boards are included in this guide. Tables highlight specific examples and references that system leaders and program developers can use to support their summer learning program. Suggestions are aligned with tools and strategies for any learning environment.

Areas of Importance

Table 1 lists suggested specific expectations from which 3 or more may be selected as (an) area(s) of focus for the Summer Learning Program. This is not an exhaustive list of specific expectations. Following the administration of diagnostic assessment(s) [Learning for All document, Diagnostic Assessment p. 28], the teacher can adjust the plans to meet students' needs and highlight strengths. Educators may choose to use the expectations from a previous year to support gap-closing and to reinforce concepts and skills. Collecting diagnostic information about students' strengths and next steps can help focus the teaching-learning plan. It is highly recommended that various tools and strategies be encouraged to support student thinking. As a District School Board, educators should prioritize expectations that support student learning and conceptual understanding in number and proportional reasoning as supported by data from diagnostic assessments.

Table 1 Suggested Curricular Expectations for SLP

Strand & Concept	Grade 7 Specific Expectations	Grade 8 Specific Expectations
B. Number Properties and Relationships	**B2.1** use the properties and order of operations, and the relationships between operations, to solve problems involving whole numbers, decimal numbers, fractions, ratios, rates, and percents, including those requiring multiple steps or multiple operations	**B2.1** use the properties and order of operations, and the relationships between operations, to solve problems involving rational numbers, ratios, rates, and percents, including those requiring multiple steps or multiple operations
B. Number Addition and Subtraction	**B2.4** use objects, diagrams, and equations to represent, describe, and solve situations involving addition and subtraction of integers **B2.5** add and subtract fractions, including by creating equivalent fractions, in various contexts	**B2.4** add and subtract integers, using appropriate strategies, in various contexts **B2.5** add and subtract fractions, using appropriate strategies, in various contexts
Multiplication and Division	**B2.8** multiply and divide fractions by fractions, using tools in various contexts **B2.9** multiply and divide decimal numbers by decimal numbers, in various contexts	**B2.6** multiply and divide fractions by fractions, as well as by whole numbers and mixed numbers, in various contexts **B2.7** multiply and divide integers, using appropriate strategies, in various contexts

B. Number Proportional Reasoning	**B2.3** use mental math strategies to increase and decrease a whole number by 1%, 5%, 10%, 25%, 50%, and 100%, and explain the strategies used **B2.10** identify proportional and non-proportional situations and apply proportional reasoning to solve problems	**B2.3** use mental math strategies to to multiply and divide whole numbers and decimal numbers up to thousandths by powers of ten, and explain the strategies used **B2.8** compare proportional situations and determine unknown values in proportional situations, and apply proportional reasoning to solve problems in various contexts
E. Spatial Sense Proportional Reasoning	**E2.2** solve problems involving perimeter, area, and volume that require converting from one metric unit of measurement to another	**E2.3** solve problems involving the perimeter, circumference, area, volume, and surface area of composite two-dimensional shapes, and three-dimensional objects, using appropriate formulas
C. Algebra Patterns	**C1.1** identify and compare a variety of repeating, growing, and shrinking patterns, including patterns found in real-life contexts, and compare linear growing patterns on the basis of their constant rates and initial values **C1.2** create and translate repeating, growing, and shrinking patterns involving whole numbers and decimal numbers using various representations, including algebraic expressions and equations for linear growing patterns **C1.3** determine pattern rules and use them to extend patterns, make and justify missing elements in repeating, growing, and shrinking patterns involving whole numbers and decimal numbers, and use algebraic representations of the pattern rules to solve for unknown values in linear growing patterns.	**C1.1** identify and compare a variety of repeating, growing, and shrinking patterns, including patterns found in real-life contexts, and compare linear growing and shrinking patterns on the basis of their constant rates and initial values **C1.2** create and translate repeating, growing, and shrinking patterns involving rational numbers using various representations, including algebraic expressions and equations for linear growing and shrinking patterns **C1.3** determine pattern rules and use them to extend patterns, make and justify missing elements in growing and shrinking patterns involving rational numbers, and use algebraic representations of the pattern rules to solve for unknown values in linear growing and shrinking patterns.

C. Algebra Variables and Expressions	**C2.2** evaluate algebraic expressions that involve whole numbers and decimal numbers	**C2.2** evaluate algebraic expressions that involve rational numbers
C. Algebra Equalities and Inequalities	**C2.3** solve equations that involve multiple terms, whole numbers, and decimal numbers in various contexts, and verify solutions **C2.4** solve inequalities that involve multiple terms and whole numbers, and verify and graph the solutions	**C2.3** solve equations that involve multiple terms, integers, and decimal numbers in various contexts, and verify solutions **C2.4** solve inequalities that involve integers, and verify and graph the solutions

Focus on Skills

Following the administration of diagnostic assessment(s) [Learning for All document, Diagnostic Assessment p. 28], the teacher can adjust the plans to meet students' needs and highlight strengths. Educators may choose to use the expectations from a previous year to support gap-closing and to reinforce concepts and skills.

In addition to specific content knowledge, proficient math learners require the skills of fluency, flexibility, reasoning and problem-solving. Students gain these important math skills by way of conversations, working through problems, practice, small-group instruction, number or reasoning routines, working with concrete tools as well as application and contextual experiences. Students' personal experiences, ideas, and student-generated strategies or models should be valued and encouraged in making connections to the learning.

Fluency is the ability to flexibly and accurately work with a variety of strategies to complete operations, reason through thinking, and communicate mathematical ideas. Fluency does not mean speed. Fluency is not accessed by students through memorization and drill, but through working with tools for conceptual understanding, thinking about what they know about numbers and providing opportunities to share and listen to strategies. See the 'Resources' section for references, resources, links and ideas for how to build students' fluency. These include Number Talks, Fractions Talks and other number sense routines, as well as links to websites such as Edugains.

Flexibility is the capacity to use numbers in our base ten system, apply number properties, and work with operations in a variety of ways. It is important to provide students with a variety of opportunities to practice different strategies, and solve different types of tasks or questions in a variety of contexts. For example, task students with finding an unknown variable rather than the sum, product, difference or quotient ($110 \times n = 11\,000$) through an engaging problem-solving task. Or have students use manipulatives to decompose numbers searching for different parts that the whole can be decomposed into (100: 80 + 20, 75 + 25, 99 + 1, etc). Similarly, provide opportunities for students to find the length of a rectangle (or triangle, trapezoid, etc) given the width and area.

Students learn mathematical concepts through problem-solving. The experience provides context in which students can anchor new learning. Providing problem-solving tasks for students allows the opportunity to learn and practice strategies, along with learning mathematical concepts by thinking through the problem. This is all part of teaching *through*

problem-solving. Whereas, teaching *about* problem solving focuses on having students explore and develop problem-solving skills, strategies and mathematical processes. Students are encouraged to use both student-generated strategies and methods, as well as those being taught by the teacher. It is important to highlight student strategies and make time for students to share ideas through math conversations. Problem-solving strategies include estimating, making a model with concrete (or virtual) tools/manipulatives, using a table or chart, labelling steps in a solution, drawing a diagram, using algebraic thinking with variables, connecting to a similar problem, checking for reasonableness of a solution, and creating a diagram.

Reasoning skills are used to make sense of math. Reasoning skills include making conjectures, asking if a solution or strategy "makes sense", making generalizations and connections, as well as finding non-examples for proof. Reasoning can be developed through number sense routines, math conversations about strategies, consolidation lessons after a problem-solving task, reflecting on learning in math journals, verifying or proving answers as well as justifying conclusions.

Learning Strategies

Social-Emotional Learning (SEL) is a new strand in the elementary mathematics curriculum and it is one element of prioritizing relationships and well-being amongst mathematics educators and learners.

"These skills support students in understanding mathematical concepts and in applying the mathematical processes that are key to learning and doing mathematics. They help all students - and indeed all learners, including educators and parents - develop confidence, cope with challenges, and think critically" (The Ontario Curriculum, Grades 1-8: Mathematics, 2020).

Within the structure of the Summer Learning Program (SLP), we encourage the development of SEL skills through metacognition, reflection on mathematical ideas and processes, and self-assessment of mathematical learning. For example, multiple opportunities should be provided over the three week program for students to set their own mathematical goals and monitor their own progress with the support of a caring educator. A student may reflect that they have strengthened their understanding of integers through the use of counters and now feels confident in their ability to perform calculations and solve problems involving integer numbers. A key goal of the SLP is to promote metacognition in students who are developing their mathematical identity and agency. Daily opportunities need to be scheduled for consistent practice in reflecting on what they are learning and how they are learning it.

Making connections between a variety of representations is a key understanding for students in intermediate grades and is an important area of focus for the SLP. Providing mathematical manipulatives and tools for students to visualize the concept and make visible their own thinking are critical to social, emotional, and academic success. For example, using Cuisenaire rods, fraction strips, and virtual manipulatives allow students to visualize concepts that support proportional reasoning. Inviting them, through a brief exit ticket or a longer math journal entry, to reflect on which manipulative or tool best helped them access that thinking is an effective way to foster their metacognitive skills and SEL skills.

TABLE 2 SEL Focus for SLP

Strand A: **Social-Emotional Learning (SEL) Skills in Mathematics** **and The Mathematical Processes**
Overall Expectation A1: apply to the best of their ability, a variety of social-emotional learning skills to support their use of the mathematical processes and their learning in connection with the expectations in the other five strands of the mathematics curriculum
Focus for SLP: ● To the best of their ability, students will learn to build relationships and communicate effectively as they apply the mathematical processes so they can work collaboratively on math problems while fostering healthy relationships ● To the best of their ability, students will learn to develop self-awareness and sense of identity as they apply the mathematical processes so they can see themselves as capable math learners, and strengthen their sense of ownership of their learning, as part of their emerging sense of identity and belonging

Instructional Strategies

As this is only a three-week program, it is critical that educators get to know the students in their classes through authentic and meaningful mathematical discourse. Instructional routines such as Notice & Wonder, Number Talks, and Connecting Representations are effective ways to embed stability and structure into mathematics experiences that expand their knowledge and understanding. Knowing how to engage in mathematical learning lessens students' feelings of anxiety and risk associated with engaging orally and publicly in mathematics learning. Teachers may wish to use the structures for Visual Patterns and How Many to promote number sense and fluency with counting and addition strategies. Whatever instructional routines are selected, they should be appropriate and responsive, and advance mathematical learning for every student in the class. The key is to use the routines consistently.

Additionally, High-Impact Instructional Practices in Mathematics should be embedded throughout the program. Learning Goals (LGs), Success Criteria (SC), and Descriptive Feedback are essential components of effective math instruction. Students should know and be able to communicate in their own words what they are learning and how they will know they have learned it. It is good practice to return to the LGs and SC during the consolidation phase of a math lesson and make explicit the learning that has occurred. Best practice is to craft learning goals that are responsive to the students in the class and co-construct success criteria with students as it allows their ways of approaching the learning goal to be seen as valid.

Below is a sample of a learning goal and success criteria aligned to a specific expectation for grades 7 and 8. When planning, consider where students are in their learning and what their specific goals should be for the lesson, day, and week.

TABLE 3 Planning Sample

<table>
<tr><td colspan="2">Overall Expectation:
B1. demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life</td></tr>
<tr><td>Grade 7 Specific Expectation:
B1.7 convert between fractions, decimal numbers, and percents</td><td>Grade 8 Specific Expectation:
B1.4 use fractions, decimal numbers, and percents, interchangeably and flexibly to solve problems</td></tr>
<tr><td colspan="2">Learning Goal:
We are learning to solve problems by using reasoning skills to select fractions, decimal numbers, and percentages when they are most useful.</td></tr>
<tr><td colspan="2">Success Criteria:
I can…
❑ Convert decimal numbers to percents and vice versa
❑ Convert decimal numbers to fractions and vice versa
❑ Mathematical Processes Connection: Reason about when each representation (i.e., fraction, decimal, and percentage) is most useful
❑ SEL Connection: Communicate my reasoning effectively to peers and teachers
❑ Solve problems involving decimal numbers, fractions, and percents</td></tr>
</table>

SAMPLE: Daily Schedule

Time	Learning Focus
9:00 am	Welcome Routines Morning meeting or Community Circle
9:15 am	Ice breaker activities and check-in. 5 – 15 minute block of time for Number strings, Number talks, or Math routines All which develop fluency, flexibility and mastery: FLUENCY THROUGH CONCEPTUAL UNDERSTANDING Minds-On Set up learning for the day - area of focus Determine pre-requisite skills
9:40 am	Math Centres Action Students will work through questions using different tools and manipulatives that focus on the topic of learning for the day
10:30 am	Fitness Break (math related learning activity that encompasses DPA)
11:00 am	Lesson Consolidation Based on the topic of learning for the day Interdisciplinary approach
11:30 am	Math Journals Independent Practice Students reflect on their learning by responding to a question related to the learning from the day.
12:00 noon	Break for Lunch
12:40 pm	Experiential Learning Activities with local partners. Math Games - these can include board games and card games Math Talk activities (For prompts, see list of resources for educators under Resources section)
2:00 pm	End of day routine Speak to parents

Assessment Strategies

Given the brevity of the program, feedback-based assessment is an effective and culturally responsive method of advancing student learning. Professional noticing in the moment as educators observe students' mathematical thinking is a powerful tool for informing the teachers' next steps to clarify conceptual understanding and prompt connections to prior knowledge.

Learning goals and success criteria; either co-constructed with students or expressed in student-friendly language should be visible and understood throughout the learning day. Creating a common understanding of learning goals and how (written as success criteria) to reach those goals provides context for giving descriptive, specific feedback in conversation with students. Learners at all times should be able to clearly communicate where they are in terms of meeting the learning goals.

At all times, assessment is an opportunity to communicate a students' progress and achievement through an asset-based lens that affirms the students' mathematical ideas, approaches, and experiences. It is an invitation for students to continue building fluency and flexibility as they explore increasingly complex mathematical concepts.

Suggestions to ensure triangulation of evidence of student achievement:

Observations	• Capture images and listen to what students are saying • Record on a rubric aligned to learning goals • Note knowledge & skills obtained - achievement chart
Conversations	• Voice record • Whiteboard • Questioning prompts • Math Talk prompts • Record on a rubric aligned to learning goals
Products	• Frayer Model • KWL Chart • Anticipation Guide • Student entrance and exit tickets • Student learning portfolio

Growing Success: Assessment, Evaluation, & Reporting in Ontario's Schools, K to Grade 12

Communicating Learning & Achievement

All too often in education, we focus on the gaps in learning and what students need to do to be more successful. Instead, we need to think of our students through an asset lens. This means viewing them as capable and creative individuals. As such, we are more apt to construct opportunities that capture their interest and engage them in learning because we are thinking about what they can do, not what they cannot do.

This is also important when communicating with students, parents and other educators. It creates a culture where we acknowledge strengths and expect success. It is the shared vision to adopt in order to set and implement worthwhile learning goals.

Opportunities to invite parents into the asset-lens conversation during the program sets a positive direction for successful learning. Since we know how important this is, give parents positive feedback whenever possible and offer activities for parents and their child to have fun with real world activities and games. Examples can be found on the Mathies website, as well as that of the Ministry of Education Parent Support Page.

Having similar conversations with educators during the program and into the fall is also important. Student learning needs to be celebrated and honoured. This program offers students the opportunity to deepen their understanding of mathematics and for educators to further apply high impact instructional practices in collaboration with other colleagues. Hence, to appropriately program plan, conversations need to start with what students can understand and demonstrate so that these assets can be used to help students achieve personal learning goals through co-constructed success criteria.

At the conclusion of the summer learning program, a report for each student should be written and provided to students and parents. A copy of this record of learning should also be shared with the receiving school in the fall. When writing the report, it is recommended to include student voice through self-assessment, growth in learning and next steps. Examples can include how the student was able to demonstrate learning through the use of a wide range of materials, representations and strategies in order to gain personal confidence in preparation for the grade 9 de-streamed math course.

Resources

Please note District School Boards may already be using specific resources to support the teaching and learning of mathematics. The resources shared below are relevant and useful for educators supporting all students in consolidating their conceptual understanding and developing procedural fluency.

For Educators	Student/Caregiver	Manipulatives

2020 Math Curriculum
• The Curriculum Context
• High-Impact Instructional Practices in Mathematics (Ontario MOE, 2020)
 	
• ***Paying Attention To*** **Monographs**
  ○ Algebraic Thinking
  ○ Proportional Reasoning
 	
• **Social Emotional Learning**
  ○ Yes, I can!
  ○ Strand A: SEL Skills & Mathematical Processes
  ○ 2020 Math Curriculum Key components & Sample Strategies
  ○ School Mental Health Ontario (SEL)
  ○ Jo Boaler Growth Mindset
 	
Classroom Resources
• Routines for Reasoning
• Fraction Talks
• Math Talks in Slides
• TIPS4RM, Edugains
• Fractions Pathways
• Math Processes - Edugains resources
• Gap Closing, Edugains
• OAME Lessons (Number, Coding, Financial Literacy)
• Tap Into Teen Minds 3-Act Math
• University of Waterloo CEMC
• Open Middle Math Tasks
• Classroom Chef repository of Math Talk prompts and Open Questions
	Applications
	• Desmos
	• Geogebra
	• Gizmos
	
	Virtual and/or concrete manipulatives
	
	Virtual or concrete whiteboard
		Virtual Manipulatives
		• Math Learning Center
		• Mathigon
		• Interactive Number Chart
		• Math Simulations
		
		Examples of manipulatives / tools
		• Relational (Cuisenaire) Rods
		• Fraction Strips
		• Pattern Blocks
		• Coloured Tiles
		• Algebra Tiles
		• Number Line
		• Graph Paper
		• White board & dry erase markers
		• Multiplication chart
		*Some Mathies virtual manipulatives are downloadable.

System-Level Planning for The Summer Learning Program

Questions to Consider:

A. What are your District School Board's numeracy goals?
B. How does this summer learning program align to your district's numeracy goal(s)?

C. Who are the students joining this summer learning program?
D. How will you identify student learning needs and next steps? What strengths do the students have in math and in learning?
E. What assessment tools and strategies will you use to assess student learning needs and growth in the summer learning program? How will you monitor student progress?

F. What are your Board's expectations for what and how this learning is communicated to home schools?
G. How do you plan to support and involve parents in your summer learning program?

H. What are the instructional strategies being highlighted in your district?
I. What are the assessment strategies and goals for your district?
J. How are you planning to support educators with instruction and assessment during the program? Will there be opportunities for growth and reflection?