THE ONTARIO CURRICULUM

GRADES 1–8

Mathematics 2020

This file is an extract and may not reflect or represent the full Ontario Curriculum.

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PDF versions of a curriculum include the following information from the Curriculum and Resources website:

- the Program Planning and Assessment and Evaluation sections of the Curriculum and Resources website that apply to all Ontario curriculum, Grades 1–12;
- the Curriculum Context that is specific to a discipline;
- the strands of the curriculum; and
- glossaries and appendices as applicable.

The Ontario Curriculum Grades 1–8: Mathematics, 2020

This curriculum policy replaces *The Ontario Curriculum, Grades 1–8: Mathematics, 2005*. Beginning in September 2020, all mathematics programs for Grades 1 to 8 will be based on the expectations outlined in this curriculum policy.

Version History:

Version Date	**Description**
June 23, 2020	Revised curriculum issued
August 21, 2020	Glossary and key concepts added
January 18, 2021	Examples and sample tasks added for strands A and F
January 18, 2021	Minor edits and corrections throughout
March 26, 2021	Examples and sample tasks added for Strand D
April 01, 2022	Examples and sample tasks added for Strand E
February 13, 2024	Examples and sample tasks added for Strand B

Program Planning and Assessment and Evaluation Content

Last updated: June 2023

This content is part of official issued curriculum providing the most up-to-date information (i.e., front matter). This content is applicable to all curriculum documents, Grades 1 to 12. Educators must consider this information to guide the implementation of curriculum and in creating the environment in which it is taught.

This curriculum policy replaces *The Ontario Curriculum, Grades 1–8: Mathematics, 2005*. Beginning in September 2020, all mathematics programs for Grades 1 to 8 will be based on the expectations outlined in this curriculum policy.

Contents

Une publication équivalente est disponible en français sous le titre suivant : *Le curriculum de l'Ontario de la 1re à la 8e année – Mathématiques* (2020)

Mathematics, Grade 1

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities

2. recognize sources of stress and cope with challenges	• ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope
4. build relationships and communicate effectively		4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key[1]. Different social-emotional learning skills may be applied with learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 1

As students explore the likelihood of events happening and use terms such as "impossible", "possible", and "certain" to describe this likelihood, they may *reflect* on and identify various emotions they are feeling. For example, if, in a real-life scenario, the likelihood of rain is certain, they may associate that with disappointment at having to alter their plans. On the other hand, they may feel relief that the plants will receive the water they need to grow. Students may articulate or discuss various strategies that they could use in different situations to help identify, validate, and manage their emotions. Strategies could include identifying alternative plans or approaches, developing and practising a script to express their frustration and efforts

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- In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.
- Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.
- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person's right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

to address things over which they have less control, keeping track of the time, making a list, and focusing on things over which they have more control rather than on things over which they have less control. Educators can also seek opportunities to develop their own skills and identify safe and caring people and culturally relevant resources that can support students as they deal with emotions that might arise (e.g., parent or other trusted adults, Elders, Métis Senators, knowledge holders, knowledge keepers, or outreach workers).

Grade 2

As students *represent* and *solve* fair-share problems, they may identify emotions that they feel in various scenarios, including those beyond the classroom, when objects are divided in different ways. For example: "When my friend broke the cookie to share it, there was a big piece and a small piece. My friend took the big piece and that made me upset. It was not a fair share!" When teaching students about fair-share problems, there is also an opportunity for educators to make connections to diverse perspectives, talk about equity language, and use culturally relevant resources while raising awareness of emotions connected to bigger-picture "fair-share" problems – for example, those that may arise in social studies as students learn about people, the environment, and global communities.

Grade 3

As students create and execute code that represents a mathematical situation, they may *reflect* on and identify various emotions they may be feeling about whether the code will work, such as pride, confusion, annoyance, apprehension, or excitement. Educators can support students by validating their emotions, making connections between the mathematical concepts students are coding and relevant experiences in their lives. For example, educators can explain that coding can involve a form of experimenting that is similar to learning how to throw a basketball into a net. If at first you miss, you can change the angle of your throw or where you shoot from. You can try something different, and with each adjustment, you will learn something new about what you are doing until you arrive at something that works. Educators should be aware that, as students go through the process of figuring out what works, they may experience a range of emotions. Students might also experience emotions connected to events outside the learning but show their feelings through the learning experience. It is important for educators to be reflective, patient, empathetic, and thoughtful about why students might be experiencing these emotions.

Stress Management and Coping

Grade 1

As students work on a problem that requires them to use subtraction, they may use *reasoning and proving* skills to cope with any feelings of uncertainty or nervousness. For example: "I don't know if my answer to this subtraction question is right because Maude has a different answer. That makes me feel nervous about getting started on checking my work or sharing it. However, I can think about addition to help me check my work, and, once I make a start at it, I may feel better. I can check the anchor chart for other tips on getting started."

Educators can support students with stress management and coping in a number of ways, including by:

- learning about and paying attention to students' contexts and lived realities so that they feel welcome and empowered in classroom spaces;
- building their skills in anti-discriminatory, anti-biased, and anti-racist instructional approaches to better understand and address the barriers students face;
- addressing discrimination and harassment when it arises to make school spaces less difficult for students to navigate;
- using language and exhibiting behaviours that build students' confidence; and
- identifying strategies that are culturally affirming and contextually relevant and that may be helpful in a range of situations inside and outside the classroom (e.g., deep breathing; guided imagery; stretching, pausing, and reflecting; incorporating dancing, singing, or music into daily routines; spending time outdoors; listening to stories from Elders, Métis Senators, knowledge holders, or knowledge keepers; paying attention to words of encouragement from mentors in the school community).

Grade 2

As students work in groups to solve a math problem involving equalities, they may need to manage any feelings of stress associated with working in a group or *figuring out the problem*. For example, to manage any challenges associated with working in the group, educators should reflect carefully about group dynamics and student relationships before placement. They may teach and give students an opportunity to practise protocols, such as taking turns suggesting ideas, clearly outlining group roles, or taking time to think on their own before the group work begins. To help with solving the problem itself, students may take deep breaths and then consider whether they have done a similar problem before, draw a picture of the problem, think about the various approaches they were taught to solve the problem, see what happens when they try out different numbers to determine whether expressions are equivalent, or act out the problem.

Grade 3

As students calculate the change required for simple cash transactions, they may *reflect* on the various *tools and strategies* they can use to help them think on the spot and manage any stress they may feel. It is important to remember that for many students, conversations about money and finances can be anxiety-inducing based on their context, their lived realities, and the systemic barriers they face. Further, thinking on the spot can be challenging for some students, so it is important to support them in understanding that feelings of stress can interfere with effective learning and information retrieval. To manage possible feelings of stress in such situations, educators need to be aware of both community and student relationships with money and their socio-economic conditions before engaging in the learning. Educators can support students in building awareness of the *tools and strategies* they can use to help themselves. For example, they can discuss financial inequality as a larger issue as well as teaching students to use manipulatives, the counting-up strategy, or open number lines. Students should also be encouraged to check their work, including with a calculator, to make connections to what they are learning about numbers. Students may practise giving themselves time to think – for example: "I'm going to think out loud and write this down to help me figure it out." Educators might have students reflect on their use of currency in terms of purpose (e.g., a purchase to buy beads to help a younger sibling decorate their regalia) and awareness (e.g., ensuring that they have the right amount of money to make a purchase).

Positive Motivation and Perseverance

Grade 1

As students count forward by 1s, 2s, 5s, and 10s, they may *select strategies* to help them keep going, such as using a hundreds chart, reciting counting rhymes and singing songs, and asking for hints. It may also help if, after scaffolding and teacher modelling, they remind themselves and their peers that they have done the exercise before, which means they have what they need to do it again. Educators can encourage students to reframe negative thoughts and experiences and give them opportunities to practise doing so. They can also provide supportive messaging for students and then encourage them to think about other supportive messages that may come from the world around them through various cultural and/or community-based teachings.

Grade 2

As students represent and solve problems involving whole numbers, they may learn to recognize that if one *tool or strategy* is not working, they should try another. For example, if they are struggling to represent a subtraction problem with base ten materials using rods and there are not enough rods, they could try showing the problem using a different *tool*, such as a number line or a bead string. To motivate students, educators can encourage them to estimate and guess when trying out solutions and to use self-talk, such as "I can do this!", and, in turn,

students can encourage their peers with words such as “I know you can do this!”, “You did this yesterday, so I know you can do it again!”, or “Take your time.” Students whose first language is not English can be encouraged to use their first language. Real-life scenarios can also be used to support students in solving the problem. After students have completed a problem, educators can guide them to reflect and note what strategies and encouraging words helped them to persist.

Grade 3

As students create and execute code that represents mathematical situations, they may show optimism that they can alter their code as necessary to produce the desired outcome by selecting the appropriate *tools and strategies*. They may feel confident about trying out different approaches, including estimating and guessing, to revise the code. This process – and students’ confidence – can be further strengthened if the coding exercises are reflective of students’ cultural and linguistic backgrounds.

Healthy Relationship Skills

Grade 1

As students learn about location and movement and give and follow directions for moving from one location to another, they may practise *communicating* respectfully and effectively through talk-aloud examples provided by the teacher and then by taking turns, listening attentively, and interacting effectively with one another. For example, a student using cut-out pieces to demonstrate movement might say to a classmate, “The dog is beside the chair. The chair is underneath the tree and there is a ball behind the chair. Please move the dog so that it is on the chair and please move the ball so that it is in front of the chair.” Educators may also use this opportunity to support students in building an understanding that communication can look different in different cultures.

Grade 2

As students prepare to collect data in different ways, they may reflect on how to *make connections* with other people and consider what strategies they may use when approaching peers and family members for information, such as always asking permission and respecting whether a person wishes to participate in their data collection or not. For example: “I’m collecting and organizing information for my math class, and I am asking people questions about their favourite physical activities. May I ask you some questions? If you do not want to answer, that is okay.” Educators can investigate with students the cultural protocols of their community with respect to sharing personal information and support students as they navigate

potential barriers. For example, in some cultures and communities, people may choose not to share information about some ceremonies and other cultural practices.

Grade 3

As students show relationships between multiplication and division and *make connections* through drawing, they may make broader connections between things in their daily lives. Educators need to be aware of student contexts and the social realities that they come from. For example, students may consider the relationship between their actions and the environment: “My family no longer uses plastic water bottles. A few years ago, we used two plastic water bottles every day, and then we had fourteen water bottles in the recycle bin at the end of the week.” Or: “In our community, we can drink water from the tap, so we use refillable water bottles when we need them and don’t have to recycle any plastic. But not all communities in Canada have clean drinking water.” In this context, educators may want to introduce students to a clean-water advocate and/or water protector.

Self-Awareness and Sense of Identity

Grade 1

As students learn about the value of Canadian currency, they may *reflect* on and make observations about the people and objects on various bills and coins, and they may *make connections* to their own sense of identity. For example: “I learned about Viola Desmond, the woman on the ten-dollar bill. I learned that she was a successful Black businesswoman and is the first Canadian woman to appear on a bill that people use regularly. By challenging unfair rules and standing up for herself, she made a big difference for others.” Or: “I see the eagle feather on the ten-dollar bill. For many First Nations people, the eagle represents truth, power, and freedom because it can fly higher and see farther than any other bird.” For educators, this is an opportunity to name inequality, raise awareness, prompt questions about what symbols and people are included and not included on Canadian currency, and support students in making personal connections.

Grade 2

As students create and interpret simple maps of familiar places, they may make personal *connections* to the places, *reflecting* on their existing knowledge and building awareness of themselves and others. Students may make or describe maps of their route to school and highlight spots that might elicit different emotions, such as happiness, safety, or fear. Educators can consider resources and supports that may be needed to address issues that could arise related to locations where students may have felt, or currently feel, unsafe or afraid. To build

connections and awareness, they can introduce students to information about the treaty territory and community histories within these maps.

Grade 3

As students determine the mean and identify the mode(s) of various sets of data about different populations and groups of people, they may *reflect* and then *make connections* between themselves and the broader community. They can build their understanding of different populations and groups and respectfully consider ways in which they themselves are similar or different. For example, students might look at data from the school climate survey examining student, parent, and staff perceptions about health and safety in their school community, and reflect on how the data compares with their own perceptions. Educators should be cognizant of the effect that seeing this data may have on some students (e.g., if the data presented is about students' sense of belonging at school, and a student is struggling with this, it may negatively affect their sense of self) and should be prepared to provide access to further support if needed, such as addressing the discrimination or harassment that might be leading to such feelings.

Critical and Creative Thinking

Grade 1

As students identify, create, and make predictions about patterns, including those in real-life contexts, they may make *connections* to numbers, shapes, letters, movements, sounds, and objects in their environment. For example: "In the logo I see on that cup, I see triangles inside triangles inside triangles. If I turn it on its side, I can see even more shapes. If I continue this pattern, I wonder how many triangles there would be altogether?"

Grade 2

As students identify different ways to represent the same amount of Canadian money, they can *select different tools and strategies* to help them clarify their thinking. For example, they may draw pictures of the different representations or use concrete and digital play money and then trade coins to find different ways to represent the same amount. They may also *reflect* on how they know they have all of the combinations – for example, by making an organized list. When teaching students about money, it is critical for educators to analyse and contextualize the relationship between the value of currency and students' cultural values, emphasizing sharing, community, and respect for others.

Grade 3

As students measure objects using one unit, estimate what the count would be when using a smaller unit, and explain why larger units produce smaller counts, they may critically *reflect* on the *reasoning and proving* skills they have used.

B. Number

Overall expectations

By the end of Grade 1, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 1, students will:

Whole Numbers

B1.1 read and represent whole numbers up to and including 50, and describe various ways they are used in everyday life

B1.2 compose and decompose whole numbers up to and including 50, using a variety of tools and strategies, in various contexts

B1.3 compare and order whole numbers up to and including 50, in various contexts

B1.4 estimate the number of objects in collections of up to 50, and verify their estimates by counting

B1.5 count to 50 by 1s, 2s, 5s, and 10s, using a variety of tools and strategies

Fractions

B1.6 use drawings to represent and solve fair-share problems that involve 2 and 4 sharers, respectively, and have remainders of 1 or 2

B1.7 recognize that one half and two fourths of the same whole are equal, in fair-sharing contexts

B1.8 use drawings to compare and order unit fractions representing the individual portions that result when a whole is shared by different numbers of sharers, up to a maximum of 10

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 1, students will:

Properties and Relationships

B2.1 use the properties of addition and subtraction, and the relationship between addition and subtraction, to solve problems and check calculations

Math Facts

B2.2 recall and demonstrate addition facts for numbers up to 10, and related subtraction facts

Mental Math

B2.3 use mental math strategies, including estimation, to add and subtract whole numbers that add up to no more than 20, and explain the strategies used

Addition and Subtraction

B2.4 use objects, diagrams, and equations to represent, describe, and solve situations involving addition and subtraction of whole numbers that add up to no more than 50

Multiplication and Division

B2.5 represent and solve equal-group problems where the total number of items is no more than 10, including problems in which each group is a half, using tools and drawings

C. Algebra

Overall expectations

By the end of Grade 1, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 1, students will:

Patterns

C1.1 identify and describe the regularities in a variety of patterns, including patterns found in real-life contexts

C1.2 create and translate patterns using movements, sounds, objects, shapes, letters, and numbers

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in patterns

C1.4 create and describe patterns to illustrate relationships among whole numbers up to 50

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 1, students will:

Variables

C2.1 identify quantities that can change and quantities that always remain the same in real-life contexts

Equalities and Inequalities

C2.2 determine whether given pairs of addition and subtraction expressions are equivalent or not

C2.3 identify and use equivalent relationships for whole numbers up to 50, in various contexts

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 1, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves sequential events

C3.2 read and alter existing code, including code that involves sequential events, and describe how changes to the code affect the outcomes

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **possible real-life situations:**
  - creating possible seating arrangements for an event to be hosted in the gym
  - collaborating with community partners to organize a community event (e.g., storytelling festival, community clean-up day)

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation that they can relate to, such as determining the seating arrangement for guests at a class event to be held in the gym (e.g., ceremony, concert, assembly).

Have students brainstorm questions that need to be answered, such as how many chairs will be needed and how the chairs should be arranged. It is important to honour student voice and student questions, as well as to encourage students to listen to and consider the questions of their peers.

Analyse the situation with students by supporting them in making assumptions, such as that all the students in the class will invite at least one guest.

Have students think about what will remain the same, such as the number of students in the class, and think about what can vary, such as the number of guests that are invited.

Have students determine and gather the information needed to solve the problem. Students may say that they need to survey their classmates to figure out how many guests they would like to invite.

Have students identify possible representations, tools, technologies, or strategies that could be used to help create a model for the arrangement of the chairs. Some students may create a diagram or use cubes to show their arrangement. Others may arrange the chairs in rows or around a table. Some may even create a pattern with their arrangement.

Pose questions to students to support them in analysing their chair arrangement model. Some possible questions are:

- Are all the exits in the gym accessible?
- Is there space in the arrangement to allow ease of movement for someone who uses a wheelchair or if someone arrives with a stroller?
    - If the answer to any of these questions is no, have students adjust their models and reassess.

Have students share their models with the class and discuss the benefits of each of the models.

D. Data

Overall expectations

By the end of Grade 1, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 1, students will:

Data Collection and Organization

D1.1 sort sets of data about people or things according to one attribute, and describe rules used for sorting

D1.2 collect data through observations, experiments, and interviews to answer questions of interest that focus on a single piece of information; record the data using methods of their choice; and organize the data in tally tables

Data Visualization

D1.3 display sets of data, using one-to-one correspondence, in concrete graphs and pictographs with proper sources, titles, and labels

Data Analysis

D1.4 order categories of data from greatest to least frequency for various data sets displayed in tally tables, concrete graphs, and pictographs

D1.5 analyse different sets of data presented in various ways, including in tally tables, concrete graphs, and pictographs, by asking and answering questions about the data and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 1, students will:

Probability

D2.1 use mathematical language, including the terms “impossible”, “possible”, and “certain”, to describe the likelihood of events happening, and use that likelihood to make predictions and informed decisions

D2.2 make and test predictions about the likelihood that the categories in a data set from one population will have the same frequencies in data collected from a different population of the same size

E. Spatial Sense

Overall expectations

By the end of Grade 1, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 1, students will:

Geometric Reasoning

E1.1 sort three-dimensional objects and two-dimensional shapes according to one attribute at a time, and identify the sorting rule being used

E1.2 construct three-dimensional objects, and identify two-dimensional shapes contained within structures and objects

E1.3 construct and describe two-dimensional shapes and three-dimensional objects that have matching halves

Location and Movement

E1.4 describe the relative locations of objects or people, using positional language

E1.5 give and follow directions for moving from one location to another

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 1, students will:

Attributes

E2.1 identify measurable attributes of two-dimensional shapes and three-dimensional objects, including length, area, mass, capacity, and angle

E2.2 compare several everyday objects and order them according to length, area, mass, and capacity

Time

E2.3 read the date on a calendar, and use a calendar to identify days, weeks, months, holidays, and seasons

F. Financial Literacy

Overall expectations

By the end of Grade 1, students will:

F1. Money and Finances

demonstrate an understanding of the value of Canadian currency

Specific expectations

By the end of Grade 1, students will:

Money Concepts

F1.1 identify the various Canadian coins up to 50¢ and coins and bills up to $50, and compare their values

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
For informational purposes only, not part of official issued curriculum.

Mathematics, Grade 2

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key[2]. Different social-emotional learning skills may be applied with

[2]

• In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.

• Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.

learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 1

As students explore the likelihood of events happening and use terms such as “impossible”, “possible”, and “certain” to describe this likelihood, they may *reflect* on and identify various emotions they are feeling. For example, if, in a real-life scenario, the likelihood of rain is certain, they may associate that with disappointment at having to alter their plans. On the other hand, they may feel relief that the plants will receive the water they need to grow. Students may articulate or discuss various strategies that they could use in different situations to help identify, validate, and manage their emotions. Strategies could include identifying alternative plans or approaches, developing and practising a script to express their frustration and efforts to address things over which they have less control, keeping track of the time, making a list, and focusing on things over which they have more control rather than on things over which they have less control. Educators can also seek opportunities to develop their own skills and identify safe and caring people and culturally relevant resources that can support students as they deal with emotions that might arise (e.g., parent or other trusted adults, Elders, Métis Senators, knowledge holders, knowledge keepers, or outreach workers).

Grade 2

As students *represent* and *solve* fair-share problems, they may identify emotions that they feel in various scenarios, including those beyond the classroom, when objects are divided in different ways. For example: “When my friend broke the cookie to share it, there was a big piece and a small piece. My friend took the big piece and that made me upset. It was not a fair

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- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person’s right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

share!" When teaching students about fair-share problems, there is also an opportunity for educators to make connections to diverse perspectives, talk about equity language, and use culturally relevant resources while raising awareness of emotions connected to bigger-picture "fair-share" problems – for example, those that may arise in social studies as students learn about people, the environment, and global communities.

Grade 3

As students create and execute code that represents a mathematical situation, they may *reflect* on and identify various emotions they may be feeling about whether the code will work, such as pride, confusion, annoyance, apprehension, or excitement. Educators can support students by validating their emotions, making connections between the mathematical concepts students are coding and relevant experiences in their lives. For example, educators can explain that coding can involve a form of experimenting that is similar to learning how to throw a basketball into a net. If at first you miss, you can change the angle of your throw or where you shoot from. You can try something different, and with each adjustment, you will learn something new about what you are doing until you arrive at something that works. Educators should be aware that, as students go through the process of figuring out what works, they may experience a range of emotions. Students might also experience emotions connected to events outside the learning but show their feelings through the learning experience. It is important for educators to be reflective, patient, empathetic, and thoughtful about why students might be experiencing these emotions.

Stress Management and Coping

Grade 1

As students work on a problem that requires them to use subtraction, they may use *reasoning and proving* skills to cope with any feelings of uncertainty or nervousness. For example: "I don't know if my answer to this subtraction question is right because Maude has a different answer. That makes me feel nervous about getting started on checking my work or sharing it. However, I can think about addition to help me check my work, and, once I make a start at it, I may feel better. I can check the anchor chart for other tips on getting started."

Educators can support students with stress management and coping in a number of ways, including by:

- learning about and paying attention to students' contexts and lived realities so that they feel welcome and empowered in classroom spaces;
- building their skills in anti-discriminatory, anti-biased, and anti-racist instructional approaches to better understand and address the barriers students face;

- addressing discrimination and harassment when it arises to make school spaces less difficult for students to navigate;
- using language and exhibiting behaviours that build students' confidence; and
- identifying strategies that are culturally affirming and contextually relevant and that may be helpful in a range of situations inside and outside the classroom (e.g., deep breathing; guided imagery; stretching, pausing, and reflecting; incorporating dancing, singing, or music into daily routines; spending time outdoors; listening to stories from Elders, Métis Senators, knowledge holders, or knowledge keepers; paying attention to words of encouragement from mentors in the school community).

Grade 2

As students work in groups to solve a math problem involving equalities, they may need to manage any feelings of stress associated with working in a group or *figuring out the problem*. For example, to manage any challenges associated with working in the group, educators should reflect carefully about group dynamics and student relationships before placement. They may teach and give students an opportunity to practise protocols, such as taking turns suggesting ideas, clearly outlining group roles, or taking time to think on their own before the group work begins. To help with solving the problem itself, students may take deep breaths and then consider whether they have done a similar problem before, draw a picture of the problem, think about the various approaches they were taught to solve the problem, see what happens when they try out different numbers to determine whether expressions are equivalent, or act out the problem.

Grade 3

As students calculate the change required for simple cash transactions, they may *reflect* on the various *tools and strategies* they can use to help them think on the spot and manage any stress they may feel. It is important to remember that for many students, conversations about money and finances can be anxiety-inducing based on their context, their lived realities, and the systemic barriers they face. Further, thinking on the spot can be challenging for some students, so it is important to support them in understanding that feelings of stress can interfere with effective learning and information retrieval. To manage possible feelings of stress in such situations, educators need to be aware of both community and student relationships with money and their socio-economic conditions before engaging in the learning. Educators can support students in building awareness of the *tools and strategies* they can use to help themselves. For example, they can discuss financial inequality as a larger issue as well as teaching students to use manipulatives, the counting-up strategy, or open number lines. Students should also be encouraged to check their work, including with a calculator, to make connections to what they are learning about numbers. Students may practise giving themselves

time to think – for example: “I’m going to think out loud and write this down to help me figure it out.” Educators might have students reflect on their use of currency in terms of purpose (e.g., a purchase to buy beads to help a younger sibling decorate their regalia) and awareness (e.g., ensuring that they have the right amount of money to make a purchase).

Positive Motivation and Perseverance

Grade 1

As students count forward by 1s, 2s, 5s, and 10s, they may *select strategies* to help them keep going, such as using a hundreds chart, reciting counting rhymes and singing songs, and asking for hints. It may also help if, after scaffolding and teacher modelling, they remind themselves and their peers that they have done the exercise before, which means they have what they need to do it again. Educators can encourage students to reframe negative thoughts and experiences and give them opportunities to practise doing so. They can also provide supportive messaging for students and then encourage them to think about other supportive messages that may come from the world around them through various cultural and/or community-based teachings.

Grade 2

As students represent and solve problems involving whole numbers, they may learn to recognize that if one *tool or strategy* is not working, they should try another. For example, if they are struggling to represent a subtraction problem with base ten materials using rods and there are not enough rods, they could try showing the problem using a different *tool*, such as a number line or a bead string. To motivate students, educators can encourage them to estimate and guess when trying out solutions and to use self-talk, such as “I can do this!”, and, in turn, students can encourage their peers with words such as “I know you can do this!”, “You did this yesterday, so I know you can do it again!”, or “Take your time.” Students whose first language is not English can be encouraged to use their first language. Real-life scenarios can also be used to support students in solving the problem. After students have completed a problem, educators can guide them to reflect and note what strategies and encouraging words helped them to persist.

Grade 3

As students create and execute code that represents mathematical situations, they may show optimism that they can alter their code as necessary to produce the desired outcome by selecting the appropriate *tools and strategies*. They may feel confident about trying out different approaches, including estimating and guessing, to revise the code. This process – and

students' confidence – can be further strengthened if the coding exercises are reflective of students' cultural and linguistic backgrounds.

Healthy Relationship Skills

Grade 1

As students learn about location and movement and give and follow directions for moving from one location to another, they may practise *communicating* respectfully and effectively through talk-aloud examples provided by the teacher and then by taking turns, listening attentively, and interacting effectively with one another. For example, a student using cut-out pieces to demonstrate movement might say to a classmate, "The dog is beside the chair. The chair is underneath the tree and there is a ball behind the chair. Please move the dog so that it is on the chair and please move the ball so that it is in front of the chair." Educators may also use this opportunity to support students in building an understanding that communication can look different in different cultures.

Grade 2

As students prepare to collect data in different ways, they may reflect on how to *make connections* with other people and consider what strategies they may use when approaching peers and family members for information, such as always asking permission and respecting whether a person wishes to participate in their data collection or not. For example: "I'm collecting and organizing information for my math class, and I am asking people questions about their favourite physical activities. May I ask you some questions? If you do not want to answer, that is okay." Educators can investigate with students the cultural protocols of their community with respect to sharing personal information and support students as they navigate potential barriers. For example, in some cultures and communities, people may choose not to share information about some ceremonies and other cultural practices.

Grade 3

As students show relationships between multiplication and division and *make connections* through drawing, they may make broader connections between things in their daily lives. Educators need to be aware of student contexts and the social realities that they come from. For example, students may consider the relationship between their actions and the environment: "My family no longer uses plastic water bottles. A few years ago, we used two plastic water bottles every day, and then we had fourteen water bottles in the recycle bin at the end of the week." Or: "In our community, we can drink water from the tap, so we use refillable water bottles when we need them and don't have to recycle any plastic. But not all

communities in Canada have clean drinking water." In this context, educators may want to introduce students to a clean-water advocate and/or water protector.

Self-Awareness and Sense of Identity

Grade 1

As students learn about the value of Canadian currency, they may *reflect* on and make observations about the people and objects on various bills and coins, and they may *make connections* to their own sense of identity. For example: "I learned about Viola Desmond, the woman on the ten-dollar bill. I learned that she was a successful Black businesswoman and is the first Canadian woman to appear on a bill that people use regularly. By challenging unfair rules and standing up for herself, she made a big difference for others." Or: "I see the eagle feather on the ten-dollar bill. For many First Nations people, the eagle represents truth, power, and freedom because it can fly higher and see farther than any other bird." For educators, this is an opportunity to name inequality, raise awareness, prompt questions about what symbols and people are included and not included on Canadian currency, and support students in making personal connections.

Grade 2

As students create and interpret simple maps of familiar places, they may make personal *connections* to the places, *reflecting* on their existing knowledge and building awareness of themselves and others. Students may make or describe maps of their route to school and highlight spots that might elicit different emotions, such as happiness, safety, or fear. Educators can consider resources and supports that may be needed to address issues that could arise related to locations where students may have felt, or currently feel, unsafe or afraid. To build connections and awareness, they can introduce students to information about the treaty territory and community histories within these maps.

Grade 3

As students determine the mean and identify the mode(s) of various sets of data about different populations and groups of people, they may *reflect* and then *make connections* between themselves and the broader community. They can build their understanding of different populations and groups and respectfully consider ways in which they themselves are similar or different. For example, students might look at data from the school climate survey examining student, parent, and staff perceptions about health and safety in their school community, and reflect on how the data compares with their own perceptions. Educators should be cognizant of the effect that seeing this data may have on some students (e.g., if the data presented is about students' sense of belonging at school, and a student is struggling with

this, it may negatively affect their sense of self) and should be prepared to provide access to further support if needed, such as addressing the discrimination or harassment that might be leading to such feelings.

Critical and Creative Thinking

Grade 1

As students identify, create, and make predictions about patterns, including those in real-life contexts, they may make *connections* to numbers, shapes, letters, movements, sounds, and objects in their environment. For example: “In the logo I see on that cup, I see triangles inside triangles inside triangles. If I turn it on its side, I can see even more shapes. If I continue this pattern, I wonder how many triangles there would be altogether?”

Grade 2

As students identify different ways to represent the same amount of Canadian money, they can *select different tools and strategies* to help them clarify their thinking. For example, they may draw pictures of the different representations or use concrete and digital play money and then trade coins to find different ways to represent the same amount. They may also *reflect* on how they know they have all of the combinations – for example, by making an organized list. When teaching students about money, it is critical for educators to analyse and contextualize the relationship between the value of currency and students’ cultural values, emphasizing sharing, community, and respect for others.

Grade 3

As students measure objects using one unit, estimate what the count would be when using a smaller unit, and explain why larger units produce smaller counts, they may critically *reflect* on the *reasoning and proving* skills they have used.

B. Number

Overall expectations

By the end of Grade 2, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 2, students will:

Whole Numbers

B1.1 read, represent, compose, and decompose whole numbers up to and including 200, using a variety of tools and strategies, and describe various ways they are used in everyday life

B1.2 compare and order whole numbers up to and including 200, in various contexts

B1.3 estimate the number of objects in collections of up to 200 and verify their estimates by counting

B1.4 count to 200, including by 20s, 25s, and 50s, using a variety of tools and strategies

B1.5 describe what makes a number even or odd

Fractions

B1.6 use drawings to represent, solve, and compare the results of fair-share problems that involve sharing up to 10 items among 2, 3, 4, and 6 sharers, including problems that result in whole numbers, mixed numbers, and fractional amounts

B1.7 recognize that one third and two sixths of the same whole are equal, in fair-sharing contexts

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 2, students will:

Properties and Relationships

B2.1 use the properties of addition and subtraction, and the relationships between addition and multiplication and between subtraction and division, to solve problems and check calculations

Math Facts

B2.2 recall and demonstrate addition facts for numbers up to 20, and related subtraction facts

Mental Math

B2.3 use mental math strategies, including estimation, to add and subtract whole numbers that add up to no more than 50, and explain the strategies used

Addition and Subtraction

B2.4 use objects, diagrams, and equations to represent, describe, and solve situations involving addition and subtraction of whole numbers that add up to no more than 100

Multiplication and Division

B2.5 represent multiplication as repeated equal groups, including groups of one half and one fourth, and solve related problems, using various tools and drawings

B2.6 represent division of up to 12 items as the equal sharing of a quantity, and solve related problems, using various tools and drawings

C. Algebra

Overall expectations

By the end of Grade 2, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 2, students will:

Patterns

C1.1 identify and describe a variety of patterns involving geometric designs, including patterns found in real-life contexts

C1.2 create and translate patterns using various representations, including shapes and numbers

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in patterns represented with shapes and numbers

C1.4 create and describe patterns to illustrate relationships among whole numbers up to 100

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 2, students will:

Variables

C2.1 identify when symbols are being used as variables, and describe how they are being used

Equalities and Inequalities

C2.2 determine what needs to be added to or subtracted from addition and subtraction expressions to make them equivalent

C2.3 identify and use equivalent relationships for whole numbers up to 100, in various contexts

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 2, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves sequential and concurrent events

C3.2 read and alter existing code, including code that involves sequential and concurrent events, and describe how changes to the code affect the outcomes

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from

other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **possible real-life situations:**
  - organizing a class celebration of all the various cultures of the students in the class
  - planning a nutritious breakfast program that the majority of Grade 2 students will enjoy

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as planning a nutritious breakfast program for all the Grade 2 classes.

Have students brainstorm questions that need to be answered, such as: How many students are in the Grade 2 classes? Do students prefer hot or cold breakfasts? What kind of fruit do students prefer? Do students prefer juice or milk? Do we need to consider dietary restrictions? Do we need to consider allergies? Who can prepare the breakfast? Who can deliver the

breakfast? It is important to honour student voice and student questions, as well as to encourage students to listen to and consider the questions of their peers.

Analyse the situation with students by supporting them in identifying assumptions, such as: most students will have breakfast every day, at least one student will be absent from each classroom every day, it is likely that one student from each classroom will not feel like eating the breakfast every day, and so on.

Have students think about what will remain the same, such as the number of students in each class, and what can vary, such as the number of students in class each day (due to absences), the days of the week that parents or other volunteers are available to prepare hot food, the time it will take to prepare the food, and so on.

Have students determine and gather the information needed to solve the problem. For example, they may say they need to survey all Grade 2 students to determine their breakfast food preferences, or survey all Grade 2 parents or other volunteers to see if anyone is available to help with preparing the food, and so on.

Have students identify and use possible representations, tools, technologies, or strategies to help create a model for their breakfast program.

Pose questions to students to support them in analysing their model for the breakfast program. Possible questions include:

- Are the most popular breakfast choices represented in the model?
- Have we accounted for dietary restrictions and allergies?
- Does the model account for the availability of parents or other volunteers?
    - If the answer to any of these questions is no, have students adjust their models and reassess.

Have students share their models with the class and discuss the benefits of each. As a class, they could vote on which model would be the best to adopt. As an extension, students could present their model to the parent council.

D. Data

Overall expectations

By the end of Grade 2, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 2, students will:

Data Collection and Organization

D1.1 sort sets of data about people or things according to two attributes, using tables and logic diagrams, including Venn and Carroll diagrams

D1.2 collect data through observations, experiments, and interviews to answer questions of interest that focus on two pieces of information, and organize the data in two-way tally tables

Data Visualization

D1.3 display sets of data, using one-to-one correspondence, in concrete graphs, pictographs, line plots, and bar graphs with proper sources, titles, and labels

Data Analysis

D1.4 identify the mode(s), if any, for various data sets presented in concrete graphs, pictographs, line plots, bar graphs, and tables, and explain what this measure indicates about the data

D1.5 analyse different sets of data presented in various ways, including in logic diagrams, line plots, and bar graphs, by asking and answering questions about the data and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 2, students will:

Probability

D2.1 use mathematical language, including the terms “impossible”, “possible”, and “certain”, to describe the likelihood of complementary events happening, and use that likelihood to make predictions and informed decisions

D2.2 make and test predictions about the likelihood that the mode(s) of a data set from one population will be the same for data collected from a different population

E. Spatial Sense

Overall expectations

By the end of Grade 2, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 2, students will:

Geometric Reasoning

E1.1 sort and identify two-dimensional shapes by comparing number of sides, side lengths, angles, and number of lines of symmetry

E1.2 compose and decompose two-dimensional shapes, and show that the area of a shape remains constant regardless of how its parts are rearranged

E1.3 identify congruent lengths and angles in two-dimensional shapes by mentally and physically matching them, and determine if the shapes are congruent

Location and Movement

E1.4 create and interpret simple maps of familiar places

E1.5 describe the relative positions of several objects and the movements needed to get from one object to another

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 2, students will:

Length

E2.1 choose and use non-standard units appropriately to measure lengths, and describe the inverse relationship between the size of a unit and the number of units needed

E2.2 explain the relationship between centimetres and metres as units of length, and use benchmarks for these units to estimate lengths

E2.3 measure and draw lengths in centimetres and metres, using a measuring tool, and recognize the impact of starting at points other than zero

Time

E2.4 use units of time, including seconds, minutes, hours, and non-standard units, to describe the duration of various events

F. Financial Literacy

Overall expectations

By the end of Grade 2, students will:

F1. Money and Finances

demonstrate an understanding of the value of Canadian currency

Specific expectations

By the end of Grade 2, students will:

Money Concepts

F1.1 identify different ways of representing the same amount of money up to Canadian 200¢ using various combinations of coins, and up to $200 using various combinations of $1 and $2 coins and $5, $10, $20, $50, and $100 bills

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

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Mathematics, Grade 3

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- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

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The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key[3]. Different social-emotional learning skills may be applied with

[3]

• In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.

• Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.

learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 1

As students explore the likelihood of events happening and use terms such as “impossible”, “possible”, and “certain” to describe this likelihood, they may *reflect* on and identify various emotions they are feeling. For example, if, in a real-life scenario, the likelihood of rain is certain, they may associate that with disappointment at having to alter their plans. On the other hand, they may feel relief that the plants will receive the water they need to grow. Students may articulate or discuss various strategies that they could use in different situations to help identify, validate, and manage their emotions. Strategies could include identifying alternative plans or approaches, developing and practising a script to express their frustration and efforts to address things over which they have less control, keeping track of the time, making a list, and focusing on things over which they have more control rather than on things over which they have less control. Educators can also seek opportunities to develop their own skills and identify safe and caring people and culturally relevant resources that can support students as they deal with emotions that might arise (e.g., parent or other trusted adults, Elders, Métis Senators, knowledge holders, knowledge keepers, or outreach workers).

Grade 2

As students *represent* and *solve* fair-share problems, they may identify emotions that they feel in various scenarios, including those beyond the classroom, when objects are divided in different ways. For example: “When my friend broke the cookie to share it, there was a big piece and a small piece. My friend took the big piece and that made me upset. It was not a fair

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- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person’s right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

share!" When teaching students about fair-share problems, there is also an opportunity for educators to make connections to diverse perspectives, talk about equity language, and use culturally relevant resources while raising awareness of emotions connected to bigger-picture "fair-share" problems – for example, those that may arise in social studies as students learn about people, the environment, and global communities.

Grade 3

As students create and execute code that represents a mathematical situation, they may *reflect* on and identify various emotions they may be feeling about whether the code will work, such as pride, confusion, annoyance, apprehension, or excitement. Educators can support students by validating their emotions, making connections between the mathematical concepts students are coding and relevant experiences in their lives. For example, educators can explain that coding can involve a form of experimenting that is similar to learning how to throw a basketball into a net. If at first you miss, you can change the angle of your throw or where you shoot from. You can try something different, and with each adjustment, you will learn something new about what you are doing until you arrive at something that works. Educators should be aware that, as students go through the process of figuring out what works, they may experience a range of emotions. Students might also experience emotions connected to events outside the learning but show their feelings through the learning experience. It is important for educators to be reflective, patient, empathetic, and thoughtful about why students might be experiencing these emotions.

Stress Management and Coping

Grade 1

As students work on a problem that requires them to use subtraction, they may use *reasoning and proving* skills to cope with any feelings of uncertainty or nervousness. For example: "I don't know if my answer to this subtraction question is right because Maude has a different answer. That makes me feel nervous about getting started on checking my work or sharing it. However, I can think about addition to help me check my work, and, once I make a start at it, I may feel better. I can check the anchor chart for other tips on getting started."

Educators can support students with stress management and coping in a number of ways, including by:

- learning about and paying attention to students' contexts and lived realities so that they feel welcome and empowered in classroom spaces;
- building their skills in anti-discriminatory, anti-biased, and anti-racist instructional approaches to better understand and address the barriers students face;

- addressing discrimination and harassment when it arises to make school spaces less difficult for students to navigate;
- using language and exhibiting behaviours that build students' confidence; and
- identifying strategies that are culturally affirming and contextually relevant and that may be helpful in a range of situations inside and outside the classroom (e.g., deep breathing; guided imagery; stretching, pausing, and reflecting; incorporating dancing, singing, or music into daily routines; spending time outdoors; listening to stories from Elders, Métis Senators, knowledge holders, or knowledge keepers; paying attention to words of encouragement from mentors in the school community).

Grade 2

As students work in groups to solve a math problem involving equalities, they may need to manage any feelings of stress associated with working in a group or *figuring out the problem*. For example, to manage any challenges associated with working in the group, educators should reflect carefully about group dynamics and student relationships before placement. They may teach and give students an opportunity to practise protocols, such as taking turns suggesting ideas, clearly outlining group roles, or taking time to think on their own before the group work begins. To help with solving the problem itself, students may take deep breaths and then consider whether they have done a similar problem before, draw a picture of the problem, think about the various approaches they were taught to solve the problem, see what happens when they try out different numbers to determine whether expressions are equivalent, or act out the problem.

Grade 3

As students calculate the change required for simple cash transactions, they may *reflect* on the various *tools and strategies* they can use to help them think on the spot and manage any stress they may feel. It is important to remember that for many students, conversations about money and finances can be anxiety-inducing based on their context, their lived realities, and the systemic barriers they face. Further, thinking on the spot can be challenging for some students, so it is important to support them in understanding that feelings of stress can interfere with effective learning and information retrieval. To manage possible feelings of stress in such situations, educators need to be aware of both community and student relationships with money and their socio-economic conditions before engaging in the learning. Educators can support students in building awareness of the *tools and strategies* they can use to help themselves. For example, they can discuss financial inequality as a larger issue as well as teaching students to use manipulatives, the counting-up strategy, or open number lines. Students should also be encouraged to check their work, including with a calculator, to make connections to what they are learning about numbers. Students may practise giving themselves

time to think – for example: “I’m going to think out loud and write this down to help me figure it out.” Educators might have students reflect on their use of currency in terms of purpose (e.g., a purchase to buy beads to help a younger sibling decorate their regalia) and awareness (e.g., ensuring that they have the right amount of money to make a purchase).

Positive Motivation and Perseverance

Grade 1

As students count forward by 1s, 2s, 5s, and 10s, they may *select strategies* to help them keep going, such as using a hundreds chart, reciting counting rhymes and singing songs, and asking for hints. It may also help if, after scaffolding and teacher modelling, they remind themselves and their peers that they have done the exercise before, which means they have what they need to do it again. Educators can encourage students to reframe negative thoughts and experiences and give them opportunities to practise doing so. They can also provide supportive messaging for students and then encourage them to think about other supportive messages that may come from the world around them through various cultural and/or community-based teachings.

Grade 2

As students represent and solve problems involving whole numbers, they may learn to recognize that if one *tool or strategy* is not working, they should try another. For example, if they are struggling to represent a subtraction problem with base ten materials using rods and there are not enough rods, they could try showing the problem using a different *tool*, such as a number line or a bead string. To motivate students, educators can encourage them to estimate and guess when trying out solutions and to use self-talk, such as “I can do this!”, and, in turn, students can encourage their peers with words such as “I know you can do this!”, “You did this yesterday, so I know you can do it again!”, or “Take your time.” Students whose first language is not English can be encouraged to use their first language. Real-life scenarios can also be used to support students in solving the problem. After students have completed a problem, educators can guide them to reflect and note what strategies and encouraging words helped them to persist.

Grade 3

As students create and execute code that represents mathematical situations, they may show optimism that they can alter their code as necessary to produce the desired outcome by selecting the appropriate *tools and strategies*. They may feel confident about trying out different approaches, including estimating and guessing, to revise the code. This process – and

students' confidence – can be further strengthened if the coding exercises are reflective of students' cultural and linguistic backgrounds.

Healthy Relationship Skills

Grade 1

As students learn about location and movement and give and follow directions for moving from one location to another, they may practise *communicating* respectfully and effectively through talk-aloud examples provided by the teacher and then by taking turns, listening attentively, and interacting effectively with one another. For example, a student using cut-out pieces to demonstrate movement might say to a classmate, "The dog is beside the chair. The chair is underneath the tree and there is a ball behind the chair. Please move the dog so that it is on the chair and please move the ball so that it is in front of the chair." Educators may also use this opportunity to support students in building an understanding that communication can look different in different cultures.

Grade 2

As students prepare to collect data in different ways, they may reflect on how to *make connections* with other people and consider what strategies they may use when approaching peers and family members for information, such as always asking permission and respecting whether a person wishes to participate in their data collection or not. For example: "I'm collecting and organizing information for my math class, and I am asking people questions about their favourite physical activities. May I ask you some questions? If you do not want to answer, that is okay." Educators can investigate with students the cultural protocols of their community with respect to sharing personal information and support students as they navigate potential barriers. For example, in some cultures and communities, people may choose not to share information about some ceremonies and other cultural practices.

Grade 3

As students show relationships between multiplication and division and *make connections* through drawing, they may make broader connections between things in their daily lives. Educators need to be aware of student contexts and the social realities that they come from. For example, students may consider the relationship between their actions and the environment: "My family no longer uses plastic water bottles. A few years ago, we used two plastic water bottles every day, and then we had fourteen water bottles in the recycle bin at the end of the week." Or: "In our community, we can drink water from the tap, so we use refillable water bottles when we need them and don't have to recycle any plastic. But not all

communities in Canada have clean drinking water." In this context, educators may want to introduce students to a clean-water advocate and/or water protector.

Self-Awareness and Sense of Identity

Grade 1

As students learn about the value of Canadian currency, they may *reflect* on and make observations about the people and objects on various bills and coins, and they may *make connections* to their own sense of identity. For example: "I learned about Viola Desmond, the woman on the ten-dollar bill. I learned that she was a successful Black businesswoman and is the first Canadian woman to appear on a bill that people use regularly. By challenging unfair rules and standing up for herself, she made a big difference for others." Or: "I see the eagle feather on the ten-dollar bill. For many First Nations people, the eagle represents truth, power, and freedom because it can fly higher and see farther than any other bird." For educators, this is an opportunity to name inequality, raise awareness, prompt questions about what symbols and people are included and not included on Canadian currency, and support students in making personal connections.

Grade 2

As students create and interpret simple maps of familiar places, they may make personal *connections* to the places, *reflecting* on their existing knowledge and building awareness of themselves and others. Students may make or describe maps of their route to school and highlight spots that might elicit different emotions, such as happiness, safety, or fear. Educators can consider resources and supports that may be needed to address issues that could arise related to locations where students may have felt, or currently feel, unsafe or afraid. To build connections and awareness, they can introduce students to information about the treaty territory and community histories within these maps.

Grade 3

As students determine the mean and identify the mode(s) of various sets of data about different populations and groups of people, they may *reflect* and then *make connections* between themselves and the broader community. They can build their understanding of different populations and groups and respectfully consider ways in which they themselves are similar or different. For example, students might look at data from the school climate survey examining student, parent, and staff perceptions about health and safety in their school community, and reflect on how the data compares with their own perceptions. Educators should be cognizant of the effect that seeing this data may have on some students (e.g., if the data presented is about students' sense of belonging at school, and a student is struggling with

this, it may negatively affect their sense of self) and should be prepared to provide access to further support if needed, such as addressing the discrimination or harassment that might be leading to such feelings.

Critical and Creative Thinking

Grade 1

As students identify, create, and make predictions about patterns, including those in real-life contexts, they may make *connections* to numbers, shapes, letters, movements, sounds, and objects in their environment. For example: “In the logo I see on that cup, I see triangles inside triangles inside triangles. If I turn it on its side, I can see even more shapes. If I continue this pattern, I wonder how many triangles there would be altogether?”

Grade 2

As students identify different ways to represent the same amount of Canadian money, they can *select different tools and strategies* to help them clarify their thinking. For example, they may draw pictures of the different representations or use concrete and digital play money and then trade coins to find different ways to represent the same amount. They may also *reflect* on how they know they have all of the combinations – for example, by making an organized list. When teaching students about money, it is critical for educators to analyse and contextualize the relationship between the value of currency and students’ cultural values, emphasizing sharing, community, and respect for others.

Grade 3

As students measure objects using one unit, estimate what the count would be when using a smaller unit, and explain why larger units produce smaller counts, they may critically *reflect* on the *reasoning and proving* skills they have used.

B. Number

Overall expectations

By the end of Grade 3, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 3, students will:

Whole Numbers

B1.1 read, represent, compose, and decompose whole numbers up to and including 1000, using a variety of tools and strategies, and describe various ways they are used in everyday life

B1.2 compare and order whole numbers up to and including 1000, in various contexts

B1.3 round whole numbers to the nearest ten or hundred, in various contexts

B1.4 count to 1000, including by 50s, 100s, and 200s, using a variety of tools and strategies

B1.5 use place value when describing and representing multi-digit numbers in a variety of ways, including with base ten materials

Fractions

B1.6 use drawings to represent, solve, and compare the results of fair-share problems that involve sharing up to 20 items among 2, 3, 4, 5, 6, 8, and 10 sharers, including problems that result in whole numbers, mixed numbers, and fractional amounts

B1.7 represent and solve fair-share problems that focus on determining and using equivalent fractions, including problems that involve halves, fourths, and eighths; thirds and sixths; and fifths and tenths

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 3, students will:

Properties and Relationships

B2.1 use the properties of operations, and the relationships between multiplication and division, to solve problems and check calculations

Math Facts

B2.2 recall and demonstrate multiplication facts of 2, 5, and 10, and related division facts

Mental Math

B2.3 use mental math strategies, including estimation, to add and subtract whole numbers that add up to no more than 1000, and explain the strategies used

Addition and Subtraction

B2.4 demonstrate an understanding of algorithms for adding and subtracting whole numbers by making connections to and describing the way other tools and strategies are used to add and subtract

B2.5 represent and solve problems involving the addition and subtraction of whole numbers that add up to no more than 1000, using various tools and algorithms

Multiplication and Division

B2.6 represent multiplication of numbers up to 10 × 10 and division up to 100 ÷ 10, using a variety of tools and drawings, including arrays

B2.7 represent and solve problems involving multiplication and division, including problems that involve groups of one half, one fourth, and one third, using tools and drawings

B2.8 represent the connection between the numerator of a fraction and the repeated addition of the unit fraction with the same denominator using various tools and drawings, and standard fractional notation

B2.9 use the ratios of 1 to 2, 1 to 5, and 1 to 10 to scale up numbers and to solve problems

C. Algebra

Overall expectations

By the end of Grade 3, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 3, students will:

Patterns

C1.1 identify and describe repeating elements and operations in a variety of patterns, including patterns found in real-life contexts

C1.2 create and translate patterns that have repeating elements, movements, or operations using various representations, including shapes, numbers, and tables of values

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in patterns that have repeating elements, movements, or operations

C1.4 create and describe patterns to illustrate relationships among whole numbers up to 1000

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 3, students will:

Variables

C2.1 describe how variables are used, and use them in various contexts as appropriate

Equalities and Inequalities

C2.2 determine whether given sets of addition, subtraction, multiplication, and division expressions are equivalent or not

C2.3 identify and use equivalent relationships for whole numbers up to 1000, in various contexts

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 3, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves sequential, concurrent, and repeating events

C3.2 read and alter existing code, including code that involves sequential, concurrent, and repeating events, and describe how changes to the code affect the outcomes

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **possible real-life situations:**
  - designing a vegetable garden to meet personal or community needs
  - planning a class read-a-thon of culturally relevant books

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as designing a vegetable garden for the school community.

Have students brainstorm questions that need to be answered, such as: Where can we put the garden? What do we want to grow in the garden? What size can the garden be? How do we measure the size of the garden? It is important to honour student voice and student questions, as well as to encourage students to listen and consider the questions of their peers.

Analyse the situation with students by supporting them in making assumptions, such as: The garden will need a row for each type of vegetable they want to plant, and there will need to be space between the rows. Some vegetables will need more space than others to grow, and some will take longer to grow than others. Most of the vegetables will need a lot of sun. They will need access to water for the garden. The garden will benefit from bees visiting it.

Have students determine and gather the information needed to plan their garden, then revisit their assumptions to inform the design of their garden.

Have students identify possible representations, tools, technologies, or strategies that they could use to create a model of their garden. Have them identify the lengths of the rows, the space between the rows, and the garden's perimeter.

Pose questions to students to support them in analysing their model. A possible question is: "Does your garden have enough space for you to stand while weeding it?" If the answer is no, have students adjust their models and reassess.

Have students share their models with the class and discuss the different features of their gardens. For example, what if they wanted to put a fence around the garden? Which garden has the smallest perimeter? Which garden has the largest perimeter? How does the perimeter affect the rows? Which garden has the greatest diversity of vegetables? Which garden will be the easiest to tend and why?

D. Data

Overall expectations

By the end of Grade 3, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 3, students will:

Data Collection and Organization

D1.1 sort sets of data about people or things according to two and three attributes, using tables and logic diagrams, including Venn, Carroll, and tree diagrams, as appropriate

D1.2 collect data through observations, experiments, and interviews to answer questions of interest that focus on qualitative and quantitative data, and organize the data using frequency tables

Data Visualization

D1.3 display sets of data, using many-to-one correspondence, in pictographs and bar graphs with proper sources, titles, and labels, and appropriate scales

Data Analysis

D1.4 determine the mean and identify the mode(s), if any, for various data sets involving whole numbers, and explain what each of these measures indicates about the data

D1.5 analyse different sets of data presented in various ways, including in frequency tables and in graphs with different scales, by asking and answering questions about the data and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 3, students will:

Probability

D2.1 use mathematical language, including the terms “impossible”, “unlikely”, “equally likely”, “likely”, and “certain”, to describe the likelihood of events happening, and use that likelihood to make predictions and informed decisions

D2.2 make and test predictions about the likelihood that the mean and the mode(s) of a data set will be the same for data collected from different populations

E. Spatial Sense

Overall expectations

By the end of Grade 3, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 3, students will:

Geometric Reasoning

E1.1 sort, construct, and identify cubes, prisms, pyramids, cylinders, and cones by comparing their faces, edges, vertices, and angles

E1.2 compose and decompose various structures, and identify the two-dimensional shapes and three-dimensional objects that these structures contain

E1.3 identify congruent lengths, angles, and faces of three-dimensional objects by mentally and physically matching them, and determine if the objects are congruent

Location and Movement

E1.4 give and follow multistep instructions involving movement from one location to another, including distances and half- and quarter-turns

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 3, students will:

Length, Mass, and Capacity

E2.1 use appropriate units of length to estimate, measure, and compare the perimeters of polygons and curved shapes, and construct polygons with a given perimeter

E2.2 explain the relationships between millimetres, centimetres, metres, and kilometres as metric units of length, and use benchmarks for these units to estimate lengths

E2.3 use non-standard units appropriately to estimate, measure, and compare capacity, and explain the effect that overfilling or underfilling, and gaps between units, have on accuracy

E2.4 compare, estimate, and measure the mass of various objects, using a pan balance and non-standard units

E2.5 use various units of different sizes to measure the same attribute of a given item, and demonstrate that even though using different-sized units produces a different count, the size of the attribute remains the same

Time

E2.6 use analog and digital clocks and timers to tell time in hours, minutes, and seconds

Area

E2.7 compare the areas of two-dimensional shapes by matching, covering, or decomposing and recomposing the shapes, and demonstrate that different shapes can have the same area

E2.8 use appropriate non-standard units to measure area, and explain the effect that gaps and overlaps have on accuracy

E2.9 use square centimetres (cm^2) and square metres (m^2) to estimate, measure, and compare the areas of various two-dimensional shapes, including those with curved sides

F. Financial Literacy

Overall expectations

By the end of Grade 3, students will:

F1. Money and Finances

demonstrate an understanding of the value and use of Canadian currency

Specific expectations

By the end of Grade 3, students will:

Money Concepts

F1.1 estimate and calculate the change required for various simple cash transactions involving whole-dollar amounts and amounts of less than one dollar

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
For informational purposes only, not part of official issued curriculum.

Mathematics, Grade 4

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key.[4] Different social-emotional learning skills may be applied with

[4]

• In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.

• Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.

learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 4

As students analyse different sets of data, they may *make connections* to the content by considering what emotions the various representations evoke. In their analysis, they may consider how the data has been presented to inspire hope or shame or to prompt reflection and questioning. They may reflect on how different design elements (e.g., fonts, colours, images) or different types of graphs are used to evoke different feelings. To promote deeper levels of connection to the content, educators can encourage students to explore data sets that are about topics relevant to their lives, including data on attendance at local events in celebration of National Indigenous Peoples Day or the Lunar New Year, or data on attendance at school sporting events.

Grade 5

As students learn about the concept of credit and debt and describe their effects on financial decisions, they may *reflect* on the emotions that different circumstances invoke in them. Money can be an emotional topic because it is often connected to social and financial inequalities that are beyond students' control. Individual circumstances may emerge that may evoke strong emotions, such as shame, jealousy, or feelings of exclusion. If students can learn ways to name and understand their feelings about money, they may be able to better articulate injustice as they observe or experience it and make more informed financial decisions that are under their control. It is critical for educators to remember that the concepts of credit and debt may need a contextual and cultural focus that is respectful and that not all transactions involve

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- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person's right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

money, since the cultures of a family, community, and country may have varying viewpoints on these practices.

Grade 6

As students use appropriate metric units to solve problems that involve conversion, they may identify and *communicate* emotions they feel. For example: "I was surprised that the number in metres was so small after I converted the measurement from millimetres to centimetres, and then to metres. It's amazing to see how much the number changes – millimetres are a lot smaller than metres." Educators should also be prepared to address heightened emotions due to some students' direct experiences with systemic inequalities that may arise when working with related math problems (e.g., when practising conversions using food as an example, be aware of the impact on and sensitivity of students who may be experiencing food insecurity).

Stress Management and Coping

Grade 4

As students create an infographic of a data set, they may *problem solve* and apply a range of strategies to avoid getting "stuck" or to get themselves "unstuck". They can pause to regroup before continuing or they can adjust their learning environment. For example: "I love trying to figure out really challenging problems, but if I get stuck and feel myself getting frustrated, it helps if I put away the problem, go outside for a break, and then come back to it later. If I need to get it done right away, I can ask my teacher for a hint or for help in selecting a graph, or I can review anchor charts in the classroom that might help jog my thinking. One of my friends likes to switch to a different problem or work on the parts of the problem they know how to complete. Another friend likes to work in a very quiet space, whole another one finds it helpful to listen to music while they work." Educators can also offer students focused and responsive stress management techniques that promote holistic ways of looking at problems. They can ask students to think about the problem and how it affects them physically, emotionally, intellectually, and spiritually and to make connections between these different states of being. Educators can also encourage students to support and affirm the work of their peers using symbols and languages that are specific to them.

Grade 5

As students perform different types of transformations, moving objects in particular ways and seeing how they look from different angles, they may *reflect* on the benefit of looking at a situation in their own lives in a different way, to help make it easier to cope with. For example: "I didn't think it was possible, but now that I've taken a step back and looked at my situation from another angle, I see there is a way of making it work and I am feeling less stressed about

this." In another situation, students might also make observations like this: "This situation is a result of unfair rules or practices that limit my ability to succeed. If we can fix some of the rules, then maybe more people will have a chance to be successful." Educators can also encourage students to think about situations from the perspective of a family member, a community member, or a friend. What would they say? What advice would they give?

Grade 6

As students do probability experiments that they may find challenging, they can find it helpful to *represent* the possible outcomes in concrete or pictorial ways. For example: "I find it stressful when things are unclear. When I can write my thinking down, I can start to figure out what I think I don't know and then work towards making my thinking clearer. This makes me feel more confident about solving the problem." It is also important for students to know that symbolic and graphic representations that are culturally affirming are welcome.

Positive Motivation and Perseverance

Grade 4

As students use the row-and-column structure of an array to determine the area of a rectangle, they may *make connections* to other learning, such as laying out paper squares to cover a shape to determine whether the area of the shape can be found by multiplying the side lengths. For example: "I kept laying out paper squares to cover the area, trying to keep them straight and organized in rows and columns. As I was doing this, I realized that I could use multiplication instead of laying out every square individually. I built a row, saw how many rows could fit, and used this information to figure out how many squares it would take. That made it way quicker and easier for me to figure out the area. I wrote my strategy as a formula and shared it with the class."

Grade 5

As students learn to analyse a variety of data sets by asking questions, identifying any biases, making convincing arguments, challenging preconceived notions, and drawing conclusions, they can *reason and prove* that by continuing to ask questions, dig deeper, and probe further, they will get better information and be empowered to make more informed decisions. Working with meaningful data can contribute to motivation. For example, educators can offer alternative perspectives to students using carefully cultivated resources and creating opportunities to amplify multiple voices (e.g., analysing data on income levels and health care services in urban centres and in First Nations, Métis, and/or Inuit communities). Students should be encouraged to think critically about the results, why they are important, and how they might respond.

Grade 6

As students identify some of the factors that may help or interfere with reaching financial goals, they may *reflect* on and explore the concept of needs and wants, considering the barriers that they and others may experience as well as potential ways in which positive motivation and perseverance can be used to address these barriers. Because of social and financial inequalities that are beyond students' control, sensitivity is needed to recognize the range of experiences and access to money among students in the class. Educators should use hypothetical situations and sample budgets to raise awareness in all students of systemic issues that may present large barriers to reaching financial goals (e.g., food security, affordable housing).

Healthy Relationship Skills

Grade 4

As students identify key factors and personal realities and values to consider when making basic decisions related to earning, spending, saving, investing, and donating, they may *reflect* on their own lives and their relationships with others in the community and realize that everything is interconnected. They may consider how the ability to contribute more or less in one area affects other areas and that, similarly, in relationships, one action can affect other actions. For example: "If I save more, I have more money to invest, to donate, or use to help others. One action has an effect on another. In relationships people's actions always have effects, positive or negative, on those around them." Because of social and financial inequalities that may be beyond students' control, it is important for educators to recognize and be sensitive to the range of experiences and financial resources of students and their families. Educators should be prepared to have culturally inclusive conversations and resources available to support students, because financial topics could trigger issues related to food security, housing, and safety.

Grade 5

As students play a math game involving fractions, decimals, and whole numbers, they can *communicate* positively and show patience with one another so that any players who may take longer than the others to figure out the answers feel respected. They can also build understanding of differences in how games can be approached and played. Educators can include basic words from different languages spoken by students to encourage respectful communicative practices among students when they are working together.

Grade 6

As students examine elements in shrinking and growing patterns and in patterns with missing elements, they may *make connections* to their relationships with others and consider the

importance of consistent and regular practices of communication. For example: “When my friend and I message back and forth, if I miss a message, then my friend might make assumptions and our communication could go off track.”

Self-Awareness and Sense of Identity

Grade 4

As students learn to analyse and classify patterns as repeating, growing, or other, they can *make connections* to their own patterns of behaviour – for example, to their pattern of being physically active regularly for health and personal fitness. Students may track the distance they travel (e.g., run, wheel, or bike) each day or the length of time they can hold a strong plank position. As they track these measurements over the course of two weeks, they can *reflect* on whether their numbers show repeating, growing, or other types of patterns and make connections to what this may mean in terms of their health and personal fitness. For example, being able to run, wheel, or bike for longer or hold a strong plank position for longer could contribute to students’ goals of improving their personal health and fitness. Educators can adopt a holistic approach to real-life scenarios and have students consider the effects of being regularly physically active at a physical, emotional, intellectual, and spiritual (meaning consciousness) level.

Grade 5

As students share mental math strategies that can be used to estimate sums and differences of decimal numbers, they may *reflect* and acknowledge that different people use different mental math strategies and that some ways of thinking are unique to each individual, and that’s okay. They may consider which mental math strategies might work particularly well in a particular situation for them when doing calculations. Educators can respectfully challenge students to think about the validity of the strategies from other perspectives. Educators can also use this opportunity to explore a range of strategies that different students may be familiar with and connect them to a range of cultural experiences. For example, the Oksapmin of Papua New Guinea have a counting system that uses body parts to express numbers from 1 to 27. Students may also be familiar with the “stick” method of doing multiplication, which is a method taught in some parts of the world.

Grade 6

As students track different aspects of their physical and mental health and use a variety of graphs and data visualization tools to show what they have learned, they may *reflect* on this information in a holistic way. For example: “I am using a table to track my screen time in class and a step-counter app to track the number of steps I take at school each day. I am displaying

all of this data as a broken-line graph to show the change over time. I am also keeping track of how screen time and physical activity make me feel. Looking at all of this information together, I can see a connection between my screen time, my physical activity, and my feelings." For some students, reflection may include drawing on cultural connections and specific teachings from their community (e.g., family members, community leaders, community cultural workers, Elders, Métis Senators, knowledge keepers, and knowledge holders).

Critical and Creative Thinking

Grade 4

As students read, represent, compare, and order decimal numbers in a variety of contexts, they may *select different tools and strategies* to approach each problem, such as drawing images or using models that show the numbers, estimating the final result, and comparing numbers to look for patterns. For example: "When I use decimal strips, it helps me figure out what order the numbers go in." It is also important for educators to promote risk-taking in a safe environment. When students are supported as they learn that deeper thinking results from trying and failing, they are more likely to try again.

Grade 5

As students work in groups to create and execute code for various mathematical situations, they can use *reasoning and proving* to recognize that there are different ways of solving the same problem. For example: "Looking at how we did it and how other groups did it, I can see that there are many ways to get to the same result. I can then reflect back on my own work and think about my next steps."

Grade 6

As students solve multi-step problems that involve whole numbers, decimal numbers, and fractions, they may use a variety of *problem-solving strategies* to deepen their understanding. They may first determine what information they already know and then identify what is unknown. They may capture their thinking by making lists and diagrams, breaking down a problem into smaller parts, and checking their calculations. Educators should be prepared to contextualize multi-step problems so that students can make connections to prior learning.

B. Number

Overall expectations

By the end of Grade 4, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 4, students will:

Whole Numbers

B1.1 read, represent, compose, and decompose whole numbers up to and including 10 000, using appropriate tools and strategies, and describe various ways they are used in everyday life

B1.2 compare and order whole numbers up to and including 10 000, in various contexts

B1.3 round whole numbers to the nearest ten, hundred, or thousand, in various contexts

Fractions and Decimals

B1.4 represent fractions from halves to tenths using drawings, tools, and standard fractional notation, and explain the meanings of the denominator and the numerator

B1.5 use drawings and models to represent, compare, and order fractions representing the individual portions that result from two different fair-share scenarios involving any combination of 2, 3, 4, 5, 6, 8, and 10 sharers

B1.6 count to 10 by halves, thirds, fourths, fifths, sixths, eighths, and tenths, with and without the use of tools

B1.7 read, represent, compare, and order decimal tenths, in various contexts

B1.8 round decimal numbers to the nearest whole number, in various contexts

B1.9 describe relationships and show equivalences among fractions and decimal tenths, in various contexts

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 4, students will:

Properties and Relationships

B2.1 use the properties of operations, and the relationships between addition, subtraction, multiplication, and division, to solve problems involving whole numbers, including those requiring more than one operation, and check calculations

Math Facts

B2.2 recall and demonstrate multiplication facts for 1 × 1 to 10 × 10, and related division facts

Mental Math

B2.3 use mental math strategies to multiply whole numbers by 10, 100, and 1000, divide whole numbers by 10, and add and subtract decimal tenths, and explain the strategies used

Addition and Subtraction

B2.4 represent and solve problems involving the addition and subtraction of whole numbers that add up to no more than 10 000 and of decimal tenths, using appropriate tools and strategies, including algorithms

Multiplication and Division

B2.5 represent and solve problems involving the multiplication of two- or three-digit whole numbers by one-digit whole numbers and by 10, 100, and 1000, using appropriate tools, including arrays

B2.6 represent and solve problems involving the division of two- or three-digit whole numbers by one-digit whole numbers, expressing any remainder as a fraction when appropriate, using appropriate tools, including arrays

B2.7 represent the relationship between the repeated addition of a unit fraction and the multiplication of that unit fraction by a whole number, using tools, drawings, and standard fractional notation

B2.8 show simple multiplicative relationships involving whole-number rates, using various tools and drawings

C. Algebra

Overall expectations

By the end of Grade 4, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 4, students will:

Patterns

C1.1 identify and describe repeating and growing patterns, including patterns found in real-life contexts

C1.2 create and translate repeating and growing patterns using various representations, including tables of values and graphs

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in repeating and growing patterns

C1.4 create and describe patterns to illustrate relationships among whole numbers and decimal tenths

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 4, students will:

Variables

C2.1 identify and use symbols as variables in expressions and equations

Equalities and Inequalities

C2.2 solve equations that involve whole numbers up to 50 in various contexts, and verify solutions

C2.3 solve inequalities that involve addition and subtraction of whole numbers up to 20, and verify and graph the solutions

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 4, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves sequential, concurrent, repeating, and nested events

C3.2 read and alter existing code, including code that involves sequential, concurrent, repeating, and nested events, and describe how changes to the code affect the outcomes

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **possible real-life situations:**
  - designing the use of a schoolyard for different types of outdoor activities
  - designing a quilt of a specific dimension

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model back against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as sectioning off the schoolyard for different types of outdoor activities.

Have students brainstorm questions that need to be answered, such as: What activities are to be offered? What part of the schoolyard is needed for each activity? For example, this activity needs a wall or this acticity needs a basketball hoop. It is important to honour student voice and student questions, as well as to encourage students to listen and consider the questions of their peers.

Analyse the situation with students by supporting them in making assumptions, such as that all the sections of the schoolyard will be rectangular. Also have them consider what can vary, such as the area of each section, and the number of activities being offered.

Have students determine and gather the information needed to solve the problem. They may want to conduct a school survey to determine the types of activities to offer. They might want to determine how many people will participate in the different activities. They may ask to measure the dimensions of the schoolyard.

Have students identify and use representations, tools, technologies, or strategies to create a model of the schoolyard, identifying the dimensions of the rectangular sections and their areas.

Pose questions to students to support them in analysing their model. A possible question is “Do you have enough area for each section to run the activity planned for that section?” If the answer is no, have them adjust their models and reassess.

D. Data

Overall expectations

By the end of Grade 4, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 4, students will:

Data Collection and Organization

D1.1 describe the difference between qualitative and quantitative data, and describe situations where each would be used

D1.2 collect data from different primary and secondary sources to answer questions of interest that involve comparing two or more sets of data, and organize the data in frequency tables and stem-and-leaf plots

Data Visualization

D1.3 select from among a variety of graphs, including multiple-bar graphs, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs

D1.4 create an infographic about a data set, representing the data in appropriate ways, including in frequency tables, stem-and-leaf plots, and multiple-bar graphs, and incorporating any other relevant information that helps to tell a story about the data

Data Analysis

D1.5 determine the mean and the median and identify the mode(s), if any, for various data sets involving whole numbers, and explain what each of these measures indicates about the data

D1.6 analyse different sets of data presented in various ways, including in stem-and-leaf plots and multiple-bar graphs, by asking and answering questions about the data and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 4, students will:

Probability

D2.1 use mathematical language, including the terms “impossible”, “unlikely”, “equally likely”, “likely”, and “certain”, to describe the likelihood of events happening, represent this likelihood on a probability line, and use it to make predictions and informed decisions

D2.2 make and test predictions about the likelihood that the mean, median, and mode(s) of a data set will be the same for data collected from different populations

E. Spatial Sense

Overall expectations

By the end of Grade 4, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 4, students will:

Geometric Reasoning

E1.1 identify geometric properties of rectangles, including the number of right angles, parallel and perpendicular sides, and lines of symmetry

Location and Movement

E1.2 plot and read coordinates in the first quadrant of a Cartesian plane, and describe the translations that move a point from one coordinate to another

E1.3 describe and perform translations and reflections on a grid, and predict the results of these transformations

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 4, students will:

The Metric System

E2.1 explain the relationships between grams and kilograms as metric units of mass, and between litres and millilitres as metric units of capacity, and use benchmarks for these units to estimate mass and capacity

E2.2 use metric prefixes to describe the relative size of different metric units, and choose appropriate units and tools to measure length, mass, and capacity

Time

E2.3 solve problems involving elapsed time by applying the relationships between different units of time

Angles

E2.4 identify angles and classify them as right, straight, acute, or obtuse

Area

E2.5 use the row and column structure of an array to measure the areas of rectangles and to show that the area of any rectangle can be found by multiplying its side lengths

E2.6 apply the formula for the area of a rectangle to find the unknown measurement when given two of the three

F. Financial Literacy

Overall expectations

By the end of Grade 4, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 4, students will:

Money Concepts

F1.1 identify various methods of payment that can be used to purchase goods and services

F1.2 estimate and calculate the cost of transactions involving multiple items priced in whole-dollar amounts, not including sales tax, and the amount of change needed when payment is made in cash, using mental math

Financial Management

F1.3 explain the concepts of spending, saving, earning, investing, and donating, and identify key factors to consider when making basic decisions related to each

F1.4 explain the relationship between spending and saving, and describe how spending and saving behaviours may differ from one person to another

Consumer and Civic Awareness

F1.5 describe some ways of determining whether something is reasonably priced and therefore a good purchase

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
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Mathematics, Grade 5

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

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This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key.[5] Different social-emotional learning skills may be applied with

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• In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.

• Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.

learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 4

As students analyse different sets of data, they may *make connections* to the content by considering what emotions the various representations evoke. In their analysis, they may consider how the data has been presented to inspire hope or shame or to prompt reflection and questioning. They may reflect on how different design elements (e.g., fonts, colours, images) or different types of graphs are used to evoke different feelings. To promote deeper levels of connection to the content, educators can encourage students to explore data sets that are about topics relevant to their lives, including data on attendance at local events in celebration of National Indigenous Peoples Day or the Lunar New Year, or data on attendance at school sporting events.

Grade 5

As students learn about the concept of credit and debt and describe their effects on financial decisions, they may *reflect* on the emotions that different circumstances invoke in them. Money can be an emotional topic because it is often connected to social and financial inequalities that are beyond students' control. Individual circumstances may emerge that may evoke strong emotions, such as shame, jealousy, or feelings of exclusion. If students can learn ways to name and understand their feelings about money, they may be able to better articulate injustice as they observe or experience it and make more informed financial decisions that are under their control. It is critical for educators to remember that the concepts of credit and debt may need a contextual and cultural focus that is respectful and that not all transactions involve

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- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person's right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

money, since the cultures of a family, community, and country may have varying viewpoints on these practices.

Grade 6

As students use appropriate metric units to solve problems that involve conversion, they may identify and *communicate* emotions they feel. For example: "I was surprised that the number in metres was so small after I converted the measurement from millimetres to centimetres, and then to metres. It's amazing to see how much the number changes – millimetres are a lot smaller than metres." Educators should also be prepared to address heightened emotions due to some students' direct experiences with systemic inequalities that may arise when working with related math problems (e.g., when practising conversions using food as an example, be aware of the impact on and sensitivity of students who may be experiencing food insecurity).

Stress Management and Coping

Grade 4

As students create an infographic of a data set, they may *problem solve* and apply a range of strategies to avoid getting "stuck" or to get themselves "unstuck". They can pause to regroup before continuing or they can adjust their learning environment. For example: "I love trying to figure out really challenging problems, but if I get stuck and feel myself getting frustrated, it helps if I put away the problem, go outside for a break, and then come back to it later. If I need to get it done right away, I can ask my teacher for a hint or for help in selecting a graph, or I can review anchor charts in the classroom that might help jog my thinking. One of my friends likes to switch to a different problem or work on the parts of the problem they know how to complete. Another friend likes to work in a very quiet space, whole another one finds it helpful to listen to music while they work." Educators can also offer students focused and responsive stress management techniques that promote holistic ways of looking at problems. They can ask students to think about the problem and how it affects them physically, emotionally, intellectually, and spiritually and to make connections between these different states of being. Educators can also encourage students to support and affirm the work of their peers using symbols and languages that are specific to them.

Grade 5

As students perform different types of transformations, moving objects in particular ways and seeing how they look from different angles, they may *reflect* on the benefit of looking at a situation in their own lives in a different way, to help make it easier to cope with. For example: "I didn't think it was possible, but now that I've taken a step back and looked at my situation from another angle, I see there is a way of making it work and I am feeling less stressed about

this." In another situation, students might also make observations like this: "This situation is a result of unfair rules or practices that limit my ability to succeed. If we can fix some of the rules, then maybe more people will have a chance to be successful." Educators can also encourage students to think about situations from the perspective of a family member, a community member, or a friend. What would they say? What advice would they give?

Grade 6

As students do probability experiments that they may find challenging, they can find it helpful to *represent* the possible outcomes in concrete or pictorial ways. For example: "I find it stressful when things are unclear. When I can write my thinking down, I can start to figure out what I think I don't know and then work towards making my thinking clearer. This makes me feel more confident about solving the problem." It is also important for students to know that symbolic and graphic representations that are culturally affirming are welcome.

Positive Motivation and Perseverance

Grade 4

As students use the row-and-column structure of an array to determine the area of a rectangle, they may *make connections* to other learning, such as laying out paper squares to cover a shape to determine whether the area of the shape can be found by multiplying the side lengths. For example: "I kept laying out paper squares to cover the area, trying to keep them straight and organized in rows and columns. As I was doing this, I realized that I could use multiplication instead of laying out every square individually. I built a row, saw how many rows could fit, and used this information to figure out how many squares it would take. That made it way quicker and easier for me to figure out the area. I wrote my strategy as a formula and shared it with the class."

Grade 5

As students learn to analyse a variety of data sets by asking questions, identifying any biases, making convincing arguments, challenging preconceived notions, and drawing conclusions, they can *reason and prove* that by continuing to ask questions, dig deeper, and probe further, they will get better information and be empowered to make more informed decisions. Working with meaningful data can contribute to motivation. For example, educators can offer alternative perspectives to students using carefully cultivated resources and creating opportunities to amplify multiple voices (e.g., analysing data on income levels and health care services in urban centres and in First Nations, Métis, and/or Inuit communities). Students should be encouraged to think critically about the results, why they are important, and how they might respond.

Grade 6

As students identify some of the factors that may help or interfere with reaching financial goals, they may *reflect* on and explore the concept of needs and wants, considering the barriers that they and others may experience as well as potential ways in which positive motivation and perseverance can be used to address these barriers. Because of social and financial inequalities that are beyond students' control, sensitivity is needed to recognize the range of experiences and access to money among students in the class. Educators should use hypothetical situations and sample budgets to raise awareness in all students of systemic issues that may present large barriers to reaching financial goals (e.g., food security, affordable housing).

Healthy Relationship Skills

Grade 4

As students identify key factors and personal realities and values to consider when making basic decisions related to earning, spending, saving, investing, and donating, they may *reflect* on their own lives and their relationships with others in the community and realize that everything is interconnected. They may consider how the ability to contribute more or less in one area affects other areas and that, similarly, in relationships, one action can affect other actions. For example: "If I save more, I have more money to invest, to donate, or use to help others. One action has an effect on another. In relationships people's actions always have effects, positive or negative, on those around them." Because of social and financial inequalities that may be beyond students' control, it is important for educators to recognize and be sensitive to the range of experiences and financial resources of students and their families. Educators should be prepared to have culturally inclusive conversations and resources available to support students, because financial topics could trigger issues related to food security, housing, and safety.

Grade 5

As students play a math game involving fractions, decimals, and whole numbers, they can *communicate* positively and show patience with one another so that any players who may take longer than the others to figure out the answers feel respected. They can also build understanding of differences in how games can be approached and played. Educators can include basic words from different languages spoken by students to encourage respectful communicative practices among students when they are working together.

Grade 6

As students examine elements in shrinking and growing patterns and in patterns with missing elements, they may *make connections* to their relationships with others and consider the

importance of consistent and regular practices of communication. For example: “When my friend and I message back and forth, if I miss a message, then my friend might make assumptions and our communication could go off track.”

Self-Awareness and Sense of Identity

Grade 4

As students learn to analyse and classify patterns as repeating, growing, or other, they can *make connections* to their own patterns of behaviour – for example, to their pattern of being physically active regularly for health and personal fitness. Students may track the distance they travel (e.g., run, wheel, or bike) each day or the length of time they can hold a strong plank position. As they track these measurements over the course of two weeks, they can *reflect* on whether their numbers show repeating, growing, or other types of patterns and make connections to what this may mean in terms of their health and personal fitness. For example, being able to run, wheel, or bike for longer or hold a strong plank position for longer could contribute to students’ goals of improving their personal health and fitness. Educators can adopt a holistic approach to real-life scenarios and have students consider the effects of being regularly physically active at a physical, emotional, intellectual, and spiritual (meaning consciousness) level.

Grade 5

As students share mental math strategies that can be used to estimate sums and differences of decimal numbers, they may *reflect* and acknowledge that different people use different mental math strategies and that some ways of thinking are unique to each individual, and that’s okay. They may consider which mental math strategies might work particularly well in a particular situation for them when doing calculations. Educators can respectfully challenge students to think about the validity of the strategies from other perspectives. Educators can also use this opportunity to explore a range of strategies that different students may be familiar with and connect them to a range of cultural experiences. For example, the Oksapmin of Papua New Guinea have a counting system that uses body parts to express numbers from 1 to 27. Students may also be familiar with the “stick” method of doing multiplication, which is a method taught in some parts of the world.

Grade 6

As students track different aspects of their physical and mental health and use a variety of graphs and data visualization tools to show what they have learned, they may *reflect* on this information in a holistic way. For example: “I am using a table to track my screen time in class and a step-counter app to track the number of steps I take at school each day. I am displaying

all of this data as a broken-line graph to show the change over time. I am also keeping track of how screen time and physical activity make me feel. Looking at all of this information together, I can see a connection between my screen time, my physical activity, and my feelings." For some students, reflection may include drawing on cultural connections and specific teachings from their community (e.g., family members, community leaders, community cultural workers, Elders, Métis Senators, knowledge keepers, and knowledge holders).

Critical and Creative Thinking

Grade 4

As students read, represent, compare, and order decimal numbers in a variety of contexts, they may *select different tools and strategies* to approach each problem, such as drawing images or using models that show the numbers, estimating the final result, and comparing numbers to look for patterns. For example: "When I use decimal strips, it helps me figure out what order the numbers go in." It is also important for educators to promote risk-taking in a safe environment. When students are supported as they learn that deeper thinking results from trying and failing, they are more likely to try again.

Grade 5

As students work in groups to create and execute code for various mathematical situations, they can use *reasoning and proving* to recognize that there are different ways of solving the same problem. For example: "Looking at how we did it and how other groups did it, I can see that there are many ways to get to the same result. I can then reflect back on my own work and think about my next steps."

Grade 6

As students solve multi-step problems that involve whole numbers, decimal numbers, and fractions, they may use a variety of *problem-solving strategies* to deepen their understanding. They may first determine what information they already know and then identify what is unknown. They may capture their thinking by making lists and diagrams, breaking down a problem into smaller parts, and checking their calculations. Educators should be prepared to contextualize multi-step problems so that students can make connections to prior learning.

B. Number

Overall expectations

By the end of Grade 5, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 5, students will:

Whole Numbers

B1.1 read, represent, compose, and decompose whole numbers up to and including 100 000, using appropriate tools and strategies, and describe various ways they are used in everyday life

B1.2 compare and order whole numbers up to and including 100 000, in various contexts

Fractions, Decimals, and Percents

B1.3 represent equivalent fractions from halves to twelfths, including improper fractions and mixed numbers, using appropriate tools, in various contexts

B1.4 compare and order fractions from halves to twelfths, including improper fractions and mixed numbers, in various contexts

B1.5 read, represent, compare, and order decimal numbers up to hundredths, in various contexts

B1.6 round decimal numbers to the nearest tenth, in various contexts

B1.7 describe relationships and show equivalences among fractions, decimal numbers up to hundredths, and whole number percents, using appropriate tools and drawings, in various contexts

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 5, students will:

Properties and Relationships

B2.1 use the properties of operations, and the relationships between operations, to solve problems involving whole numbers and decimal numbers, including those requiring more than one operation, and check calculations

Math Facts

B2.2 recall and demonstrate multiplication facts from 0 × 0 to 12 × 12, and related division facts

Mental Math

B2.3 use mental math strategies to multiply whole numbers by 0.1 and 0.01 and estimate sums and differences of decimal numbers up to hundredths, and explain the strategies used

Addition and Subtraction

B2.4 represent and solve problems involving the addition and subtraction of whole numbers that add up to no more than 100 000, and of decimal numbers up to hundredths, using appropriate tools, strategies, and algorithms

B2.5 add and subtract fractions with like denominators, in various contexts

Multiplication and Division

B2.6 represent and solve problems involving the multiplication of two-digit whole numbers by two-digit whole numbers using the area model and using algorithms, and make connections between the two methods

B2.7 represent and solve problems involving the division of three-digit whole numbers by two-digit whole numbers using the area model and using algorithms, and make connections between the two methods, while expressing any remainder appropriately

B2.8 multiply and divide one-digit whole numbers by unit fractions, using appropriate tools and drawings

B2.9 represent and create equivalent ratios and rates, using a variety of tools and models, in various contexts

C. Algebra

Overall expectations

By the end of Grade 5, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 5, students will:

Patterns

C1.1 identify and describe repeating, growing, and shrinking patterns, including patterns found in real-life contexts

C1.2 create and translate growing and shrinking patterns using various representations, including tables of values and graphs

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in repeating, growing, and shrinking patterns

C1.4 create and describe patterns to illustrate relationships among whole numbers and decimal tenths and hundredths

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 5, students will:

Variables and Expressions

C2.1 translate among words, algebraic expressions, and visual representations that describe equivalent relationships

C2.2 evaluate algebraic expressions that involve whole numbers

Equalities and Inequalities

C2.3 solve equations that involve whole numbers up to 100 in various contexts, and verify solutions

Equalities and Inequalities

C2.4 solve inequalities that involve one operation and whole numbers up to 50, and verify and graph the solutions

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 5, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves conditional statements and other control structures

C3.2 read and alter existing code, including code that involves conditional statements and other control structures, and describe how changes to the code affect the outcomes

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **real-life situations:**
  - planning a fundraiser for a charity
  - maximizing seating capacity in a venue

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model back against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as planning a fundraiser to support a local charity.

Have students brainstorm questions that need to be answered, such as: Which charity or charities should they support? What will they do to raise funds? What will the fundraising goal be? It is important to honour student voice and student questions, as well as encourage students to listen to and consider the questions of their peers.

Analyse the situation with students by supporting them in making assumptions, such as that all the students in Grade 5 will want to participate in raising funds.

Have students think about what will remain the same, such as their fundraising goal, and what can vary, such as the length of time to run the fundraiser, whom they will target to support them, and what goods or services will be offered to raise the funds.

Have students determine and gather the information needed to solve the problem. Students may say that they need to research local charities and determine what types of fundraisers have been successful in the past.

Have students identify and use representations, tools, technologies, or strategies to create a model for their fundraiser that includes time frame, identification of goods or services being offered, target group, and projected funds raised.

Pose questions to students to support them in analysing their model. Possible questions are:

- Will the selected goods and services appeal to a wide range of people in the target group?
- Is the selected good or service feasible? For example, selling perishable goods or offering a service that is impractical for Grade 5 students to do may not be the best choice.
    - If the answer to any of these questions is no, have them adjust their models and reassess.

Have students share their models with the class and discuss the different fundraiser possibilities and the difference they can make to their chosen charities.

D. Data

Overall expectations

By the end of Grade 5, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 5, students will:

Data Collection and Organization

D1.1 explain the importance of various sampling techniques for collecting a sample of data that is representative of a population

D1.2 collect data, using appropriate sampling techniques as needed, to answer questions of interest about a population, and organize the data in relative-frequency tables

Data Visualization

D1.3 select from among a variety of graphs, including stacked-bar graphs, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs

D1.4 create an infographic about a data set, representing the data in appropriate ways, including in relative-frequency tables and stacked-bar graphs, and incorporating any other relevant information that helps to tell a story about the data

Data Analysis

D1.5 determine the mean and the median and identify the mode(s), if any, for various data sets involving whole numbers and decimal numbers, and explain what each of these measures indicates about the data

D1.6 analyse different sets of data presented in various ways, including in stacked-bar graphs and in misleading graphs, by asking and answering questions about the data, challenging preconceived notions, and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 5, students will:

Probability

D2.1 use fractions to express the probability of events happening, represent this probability on a probability line, and use it to make predictions and informed decisions

D2.2 determine and compare the theoretical and experimental probabilities of an event happening

E. Spatial Sense

Overall expectations

By the end of Grade 5, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 5, students will:

Geometric Reasoning

E1.1 identify geometric properties of triangles, and construct different types of triangles when given side or angle measurements

E1.2 identify and construct congruent triangles, rectangles, and parallelograms

E1.3 draw top, front, and side views of objects, and match drawings with objects

Location and Movement

E1.4 plot and read coordinates in the first quadrant of a Cartesian plane using various scales, and describe the translations that move a point from one coordinate to another

E1.5 describe and perform translations, reflections, and rotations up to 180° on a grid, and predict the results of these transformations

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 5, students will:

The Metric System

E2.1 use appropriate metric units to estimate and measure length, area, mass, and capacity

E2.2 solve problems that involve converting larger metric units into smaller ones, and describe the base ten relationships among metric units

Angles

E2.3 compare angles and determine their relative size by matching them and by measuring them using appropriate non-standard units

E2.4 explain how protractors work, use them to measure and construct angles up to 180°, and use benchmark angles to estimate the size of other angles

Area

E2.5 use the area relationships among rectangles, parallelograms, and triangles to develop the formulas for the area of a parallelogram and the area of a triangle, and solve related problems

E2.6 show that two-dimensional shapes with the same area can have different perimeters, and solve related problems

F. Financial Literacy

Overall expectations

By the end of Grade 5, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 5, students will:

Money Concepts

F1.1 describe several ways money can be transferred among individuals, organizations, and businesses

F1.2 estimate and calculate the cost of transactions involving multiple items priced in dollars and cents, including sales tax, using various strategies

Financial Management

F1.3 design sample basic budgets to manage finances for various earning and spending scenarios

F1.4 explain the concepts of credit and debt, and describe how financial decisions may be impacted by each

Consumer and Civic Awareness

F1.5 calculate unit rates for various goods and services, and identify which rates offer the best value

F1.6 describe the types of taxes that are collected by the different levels of government in Canada, and explain how tax revenue is used to provide services in the community

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
For informational purposes only, not part of official issued curriculum.

Mathematics, Grade 6

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
5. develop self-awareness and sense of identity		5. 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
6. think critically and creatively		6. make connections between math and everyday contexts to help them make informed judgements and decisions

Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key.[6] Different social-emotional learning skills may be applied with

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• In order for SEL to be impactful, supportive, anti-racist, and anti-discriminatory, the teaching and learning approach must take into account and address the lived realities, racial and other disparities, and educator biases that affect students' experiences in Ontario schools.

• Approaches to SEL must be mediated through respectful conversations about students' lived realities, inequity, bias, discrimination, and harassment.

learning from a variety of expectations in connection with a range of mathematical processes to achieve the learning goals. It is important to note that the *student responses* are provided only to indicate the content and scope of the intended learning. They are not written in language that represents the typical parlance or vocabulary of students.

Identification and Management of Emotions

Grade 4

As students analyse different sets of data, they may *make connections* to the content by considering what emotions the various representations evoke. In their analysis, they may consider how the data has been presented to inspire hope or shame or to prompt reflection and questioning. They may reflect on how different design elements (e.g., fonts, colours, images) or different types of graphs are used to evoke different feelings. To promote deeper levels of connection to the content, educators can encourage students to explore data sets that are about topics relevant to their lives, including data on attendance at local events in celebration of National Indigenous Peoples Day or the Lunar New Year, or data on attendance at school sporting events.

Grade 5

As students learn about the concept of credit and debt and describe their effects on financial decisions, they may *reflect* on the emotions that different circumstances invoke in them. Money can be an emotional topic because it is often connected to social and financial inequalities that are beyond students' control. Individual circumstances may emerge that may evoke strong emotions, such as shame, jealousy, or feelings of exclusion. If students can learn ways to name and understand their feelings about money, they may be able to better articulate injustice as they observe or experience it and make more informed financial decisions that are under their control. It is critical for educators to remember that the concepts of credit and debt may need a contextual and cultural focus that is respectful and that not all transactions involve

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- Effective approaches to SEL provide students with tools to navigate and challenge oppressive, racist, and discriminatory spaces, thus building their skills and having a positive impact on their academic achievement and well-being.
- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person's right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

money, since the cultures of a family, community, and country may have varying viewpoints on these practices.

Grade 6

As students use appropriate metric units to solve problems that involve conversion, they may identify and *communicate* emotions they feel. For example: "I was surprised that the number in metres was so small after I converted the measurement from millimetres to centimetres, and then to metres. It's amazing to see how much the number changes – millimetres are a lot smaller than metres." Educators should also be prepared to address heightened emotions due to some students' direct experiences with systemic inequalities that may arise when working with related math problems (e.g., when practising conversions using food as an example, be aware of the impact on and sensitivity of students who may be experiencing food insecurity).

Stress Management and Coping

Grade 4

As students create an infographic of a data set, they may *problem solve* and apply a range of strategies to avoid getting "stuck" or to get themselves "unstuck". They can pause to regroup before continuing or they can adjust their learning environment. For example: "I love trying to figure out really challenging problems, but if I get stuck and feel myself getting frustrated, it helps if I put away the problem, go outside for a break, and then come back to it later. If I need to get it done right away, I can ask my teacher for a hint or for help in selecting a graph, or I can review anchor charts in the classroom that might help jog my thinking. One of my friends likes to switch to a different problem or work on the parts of the problem they know how to complete. Another friend likes to work in a very quiet space, whole another one finds it helpful to listen to music while they work." Educators can also offer students focused and responsive stress management techniques that promote holistic ways of looking at problems. They can ask students to think about the problem and how it affects them physically, emotionally, intellectually, and spiritually and to make connections between these different states of being. Educators can also encourage students to support and affirm the work of their peers using symbols and languages that are specific to them.

Grade 5

As students perform different types of transformations, moving objects in particular ways and seeing how they look from different angles, they may *reflect* on the benefit of looking at a situation in their own lives in a different way, to help make it easier to cope with. For example: "I didn't think it was possible, but now that I've taken a step back and looked at my situation from another angle, I see there is a way of making it work and I am feeling less stressed about

this." In another situation, students might also make observations like this: "This situation is a result of unfair rules or practices that limit my ability to succeed. If we can fix some of the rules, then maybe more people will have a chance to be successful." Educators can also encourage students to think about situations from the perspective of a family member, a community member, or a friend. What would they say? What advice would they give?

Grade 6

As students do probability experiments that they may find challenging, they can find it helpful to *represent* the possible outcomes in concrete or pictorial ways. For example: "I find it stressful when things are unclear. When I can write my thinking down, I can start to figure out what I think I don't know and then work towards making my thinking clearer. This makes me feel more confident about solving the problem." It is also important for students to know that symbolic and graphic representations that are culturally affirming are welcome.

Positive Motivation and Perseverance

Grade 4

As students use the row-and-column structure of an array to determine the area of a rectangle, they may *make connections* to other learning, such as laying out paper squares to cover a shape to determine whether the area of the shape can be found by multiplying the side lengths. For example: "I kept laying out paper squares to cover the area, trying to keep them straight and organized in rows and columns. As I was doing this, I realized that I could use multiplication instead of laying out every square individually. I built a row, saw how many rows could fit, and used this information to figure out how many squares it would take. That made it way quicker and easier for me to figure out the area. I wrote my strategy as a formula and shared it with the class."

Grade 5

As students learn to analyse a variety of data sets by asking questions, identifying any biases, making convincing arguments, challenging preconceived notions, and drawing conclusions, they can *reason and prove* that by continuing to ask questions, dig deeper, and probe further, they will get better information and be empowered to make more informed decisions. Working with meaningful data can contribute to motivation. For example, educators can offer alternative perspectives to students using carefully cultivated resources and creating opportunities to amplify multiple voices (e.g., analysing data on income levels and health care services in urban centres and in First Nations, Métis, and/or Inuit communities). Students should be encouraged to think critically about the results, why they are important, and how they might respond.

Grade 6

As students identify some of the factors that may help or interfere with reaching financial goals, they may *reflect* on and explore the concept of needs and wants, considering the barriers that they and others may experience as well as potential ways in which positive motivation and perseverance can be used to address these barriers. Because of social and financial inequalities that are beyond students' control, sensitivity is needed to recognize the range of experiences and access to money among students in the class. Educators should use hypothetical situations and sample budgets to raise awareness in all students of systemic issues that may present large barriers to reaching financial goals (e.g., food security, affordable housing).

Healthy Relationship Skills

Grade 4

As students identify key factors and personal realities and values to consider when making basic decisions related to earning, spending, saving, investing, and donating, they may *reflect* on their own lives and their relationships with others in the community and realize that everything is interconnected. They may consider how the ability to contribute more or less in one area affects other areas and that, similarly, in relationships, one action can affect other actions. For example: "If I save more, I have more money to invest, to donate, or use to help others. One action has an effect on another. In relationships people's actions always have effects, positive or negative, on those around them." Because of social and financial inequalities that may be beyond students' control, it is important for educators to recognize and be sensitive to the range of experiences and financial resources of students and their families. Educators should be prepared to have culturally inclusive conversations and resources available to support students, because financial topics could trigger issues related to food security, housing, and safety.

Grade 5

As students play a math game involving fractions, decimals, and whole numbers, they can *communicate* positively and show patience with one another so that any players who may take longer than the others to figure out the answers feel respected. They can also build understanding of differences in how games can be approached and played. Educators can include basic words from different languages spoken by students to encourage respectful communicative practices among students when they are working together.

Grade 6

As students examine elements in shrinking and growing patterns and in patterns with missing elements, they may *make connections* to their relationships with others and consider the

importance of consistent and regular practices of communication. For example: “When my friend and I message back and forth, if I miss a message, then my friend might make assumptions and our communication could go off track.”

Self-Awareness and Sense of Identity

Grade 4

As students learn to analyse and classify patterns as repeating, growing, or other, they can *make connections* to their own patterns of behaviour – for example, to their pattern of being physically active regularly for health and personal fitness. Students may track the distance they travel (e.g., run, wheel, or bike) each day or the length of time they can hold a strong plank position. As they track these measurements over the course of two weeks, they can *reflect* on whether their numbers show repeating, growing, or other types of patterns and make connections to what this may mean in terms of their health and personal fitness. For example, being able to run, wheel, or bike for longer or hold a strong plank position for longer could contribute to students’ goals of improving their personal health and fitness. Educators can adopt a holistic approach to real-life scenarios and have students consider the effects of being regularly physically active at a physical, emotional, intellectual, and spiritual (meaning consciousness) level.

Grade 5

As students share mental math strategies that can be used to estimate sums and differences of decimal numbers, they may *reflect* and acknowledge that different people use different mental math strategies and that some ways of thinking are unique to each individual, and that’s okay. They may consider which mental math strategies might work particularly well in a particular situation for them when doing calculations. Educators can respectfully challenge students to think about the validity of the strategies from other perspectives. Educators can also use this opportunity to explore a range of strategies that different students may be familiar with and connect them to a range of cultural experiences. For example, the Oksapmin of Papua New Guinea have a counting system that uses body parts to express numbers from 1 to 27. Students may also be familiar with the “stick” method of doing multiplication, which is a method taught in some parts of the world.

Grade 6

As students track different aspects of their physical and mental health and use a variety of graphs and data visualization tools to show what they have learned, they may *reflect* on this information in a holistic way. For example: “I am using a table to track my screen time in class and a step-counter app to track the number of steps I take at school each day. I am displaying

all of this data as a broken-line graph to show the change over time. I am also keeping track of how screen time and physical activity make me feel. Looking at all of this information together, I can see a connection between my screen time, my physical activity, and my feelings." For some students, reflection may include drawing on cultural connections and specific teachings from their community (e.g., family members, community leaders, community cultural workers, Elders, Métis Senators, knowledge keepers, and knowledge holders).

Critical and Creative Thinking

Grade 4

As students read, represent, compare, and order decimal numbers in a variety of contexts, they may *select different tools and strategies* to approach each problem, such as drawing images or using models that show the numbers, estimating the final result, and comparing numbers to look for patterns. For example: "When I use decimal strips, it helps me figure out what order the numbers go in." It is also important for educators to promote risk-taking in a safe environment. When students are supported as they learn that deeper thinking results from trying and failing, they are more likely to try again.

Grade 5

As students work in groups to create and execute code for various mathematical situations, they can use *reasoning and proving* to recognize that there are different ways of solving the same problem. For example: "Looking at how we did it and how other groups did it, I can see that there are many ways to get to the same result. I can then reflect back on my own work and think about my next steps."

Grade 6

As students solve multi-step problems that involve whole numbers, decimal numbers, and fractions, they may use a variety of *problem-solving strategies* to deepen their understanding. They may first determine what information they already know and then identify what is unknown. They may capture their thinking by making lists and diagrams, breaking down a problem into smaller parts, and checking their calculations. Educators should be prepared to contextualize multi-step problems so that students can make connections to prior learning.

B. Number

Overall expectations

By the end of Grade 6, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 6, students will:

Rational Numbers

B1.1 read and represent whole numbers up to and including one million, using appropriate tools and strategies, and describe various ways they are used in everyday life

B1.2 read and represent integers, using a variety of tools and strategies, including horizontal and vertical number lines

B1.3 compare and order integers, decimal numbers, and fractions, separately and in combination, in various contexts

Fractions, Decimals, and Percents

B1.4 read, represent, compare, and order decimal numbers up to thousandths, in various contexts

B1.5 round decimal numbers, both terminating and repeating, to the nearest tenth, hundredth, or whole number, as applicable, in various contexts

B1.6 describe relationships and show equivalences among fractions and decimal numbers up to thousandths, using appropriate tools and drawings, in various contexts

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 6, students will:

Properties and Relationships

B2.1 use the properties of operations, and the relationships between operations, to solve problems involving whole numbers, decimal numbers, fractions, ratios, rates, and whole number percents, including those requiring multiple steps or multiple operations

Math Facts

B2.2 understand the divisibility rules and use them to determine whether numbers are divisible by 2, 3, 4, 5, 6, 8, 9, and 10

Mental Math

B2.3 use mental math strategies to calculate percents of whole numbers, including 1%, 5%, 10%, 15%, 25%, and 50%, and explain the strategies used

Addition and Subtraction

B2.4 represent and solve problems involving the addition and subtraction of whole numbers and decimal numbers, using estimation and algorithms

B2.5 add and subtract fractions with like and unlike denominators, using appropriate tools, in various contexts

Multiplication and Division

B2.6 represent composite numbers as a product of their prime factors, including through the use of factor trees

B2.7 represent and solve problems involving the multiplication of three-digit whole numbers by decimal tenths, using algorithms

B2.8 represent and solve problems involving the division of three-digit whole numbers by decimal tenths, using appropriate tools, strategies, and algorithms, and expressing remainders as appropriate

B2.9 multiply whole numbers by proper fractions, using appropriate tools and strategies

B2.10 divide whole numbers by proper fractions, using appropriate tools and strategies

B2.11 represent and solve problems involving the division of decimal numbers up to thousandths by whole numbers up to 10, using appropriate tools and strategies

B2.12 solve problems involving ratios, including percents and rates, using appropriate tools and strategies

C. Algebra

Overall expectations

By the end of Grade 6, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 6, students will:

Patterns

C1.1 identify and describe repeating, growing, and shrinking patterns, including patterns found in real-life contexts, and specify which growing patterns are linear

C1.2 create and translate repeating, growing, and shrinking patterns using various representations, including tables of values, graphs, and, for linear growing patterns, algebraic expressions and equations

C1.3 determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in repeating, growing, and shrinking patterns, and use algebraic representations of the pattern rules to solve for unknown values in linear growing patterns

C1.4 create and describe patterns to illustrate relationships among whole numbers and decimal numbers

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 6, students will:

Variables and Expressions

C2.1 add monomials with a degree of 1 that involve whole numbers, using tools

C2.2 evaluate algebraic expressions that involve whole numbers and decimal tenths

Equalities and Inequalities

C2.3 solve equations that involve multiple terms and whole numbers in various contexts, and verify solutions

C2.4 solve inequalities that involve two operations and whole numbers up to 100 and verify and graph the solutions

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 6, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing efficient code, including code that involves conditional statements and other control structures

C3.2 read and alter existing code, including code that involves conditional statements and other control structures, and describe how changes to the code affect the outcomes and the efficiency of the code

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **real-life situations:**
  - planning an art exhibition
  - planning a nutritionally balanced and cost-efficient lunch program
  - planning the details for a school fun day

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model back against the real-life situation and adjusting as necessary.

- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Tell students that they will be making a plan to create and hold an exhibition of Kindergarten art for Earth Day, using the mathematical modelling process.

Have students brainstorm questions that need to be answered mathematically, such as: Given the timeframe, what kind of art projects might the Kindergarten students do? Students could conduct a survey of Kindergarten students to determine what project each of them would like to do, for example, a papier mâché sculpture, a macramé wall hanging, or a painting.

After the class has surveyed the Kindergarten students, they will need to consider logistics such as:

- How long will it take to create the art?
- What materials will be needed?
- Do we have enough materials in the school?

Analyse the situation with students by supporting them in making assumptions, such as that each Kindergarten student will create one item.

Put students in groups that will each focus on one type of art project. In their groups, students will need to develop a list of what supplies will be needed for each piece of art that the Kindergarten students will be making.

For example, papier mâché sculptures are made with newspaper and a flour and water paste. Students could research the best size for the strips of paper to make papier mâché and estimate the number of strips needed for one layer, and how many layers produce the best result for when the Kindergarten students make their sculptures. They could also investigate the best ratio of flour to water to make the paste.

Students might also develop a prototype for the papier mâché sculptures that the Kindergarten students will be making in order to assist in determining the total amount of materials that will be needed. They could start with drawing the top, front, and side views of their prototype sculpture, then determine the surface area that their sculpture will have before they begin to

apply the newspaper strips. They should also keep track of how much newspaper and paste they use to make the prototype, as well as the number of layers they apply.

After they have completed their investigation including making a prototype if desired, have students come together to decide what would be a reasonable list of materials for sculptures of various sizes (e.g., something that sits on a desk and is no more than 10 cm tall, something that sits on the floor and is no more than 50 cm tall). Ideally, when a Kindergarten student is asked how big they would like their sculpture to be, the model represented by the list should predict how much paper and paste (flour and water) will be needed to create it.

Students should also consider how much space will be needed to effectively display the sculptures the Kindergarten students have made for the exhibit.

In a similar way, other groups can focus on the other kinds of art that will be made for the exhibition, for example, macramé wall hangings or paintings.

Have students share their models with the class and work collaboratively to develop a plan to make the exhibition happen. This will involve deciding on other details, such as who will be invited, the floor plan and route for the exhibit, and so on.

D. Data

Overall expectations

By the end of Grade 6, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 6, students will:

Data Collection and Organization

D1.1 describe the difference between discrete and continuous data, and provide examples of each

D1.2 collect qualitative data and discrete and continuous quantitative data to answer questions of interest about a population, and organize the sets of data as appropriate, including using intervals

Data Visualization

D1.3 select from among a variety of graphs, including histograms and broken-line graphs, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs

D1.4 create an infographic about a data set, representing the data in appropriate ways, including in tables, histograms, and broken-line graphs, and incorporating any other relevant information that helps to tell a story about the data

Data Analysis

D1.5 determine the range as a measure of spread and the measures of central tendency for various data sets, and use this information to compare two or more data sets

D1.6 analyse different sets of data presented in various ways, including in histograms and broken-line graphs and in misleading graphs, by asking and answering questions about the data, challenging preconceived notions, and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 6, students will:

Probability

D2.1 use fractions, decimals, and percents to express the probability of events happening, represent this probability on a probability line, and use it to make predictions and informed decisions

D2.2 determine and compare the theoretical and experimental probabilities of two independent events happening

E. Spatial Sense

Overall expectations

By the end of Grade 6, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 6, students will:

Geometric Reasoning

E1.1 create lists of the geometric properties of various types of quadrilaterals, including the properties of the diagonals, rotational symmetry, and line symmetry

E1.2 construct three-dimensional objects when given their top, front, and side views

Location and Movement

E1.3 plot and read coordinates in all four quadrants of a Cartesian plane, and describe the translations that move a point from one coordinate to another

E1.4 describe and perform combinations of translations, reflections, and rotations up to 360° on a grid, and predict the results of these transformations

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 6, students will:

The Metric System

E2.1 measure length, area, mass, and capacity using the appropriate metric units, and solve problems that require converting smaller units to larger ones and vice versa

Angles

E2.2 use a protractor to measure and construct angles up to 360°, and state the relationship between angles that are measured clockwise and those that are measured counterclockwise

E2.3 use the properties of supplementary angles, complementary angles, opposite angles, and interior and exterior angles to solve for unknown angle measures

Area and Surface Area

E2.4 determine the areas of trapezoids, rhombuses, kites, and composite polygons by decomposing them into shapes with known areas

E2.5 create and use nets to demonstrate the relationship between the faces of prisms and pyramids and their surface areas

E2.6 determine the surface areas of prisms and pyramids by calculating the areas of their two-dimensional faces and adding them together

F. Financial Literacy

Overall expectations

By the end of Grade 6, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 6, students will:

Money Concepts

F1.1 describe the advantages and disadvantages of various methods of payment that can be used to purchase goods and services

Financial Management

F1.2 identify different types of financial goals, including earning and saving goals, and outline some key steps in achieving them

F1.3 identify and describe various factors that may help or interfere with reaching financial goals

Consumer and Civic Awareness

F1.4 explain the concept of interest rates, and identify types of interest rates and fees associated with different accounts and loans offered by various banks and other financial institutions

F1.5 describe trading, lending, borrowing, and donating as different ways to distribute financial and other resources among individuals and organizations

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
For informational purposes only, not part of official issued curriculum.

Mathematics, Grade 7

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
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Examples

The examples illustrate ways to support students in developing social-emotional learning skills while engaging with the mathematical processes (shown in each example in italics) to deepen their learning of mathematical knowledge, concepts, and skills. Culturally responsive and relevant pedagogy is key.[7] Different social-emotional learning skills may be applied with

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Identification and Management of Emotions

Grade 7

As students read or alter existing code, they may *reflect* on and identify emotions they may be feeling, such as anticipation, frustration, excitement, and satisfaction. For example: "When we are altering the code using subprograms, I need to stay calm, knowing that we may have to make a few tweaks before we get it right. It helps me to take a few deep breaths while we are working. When we figure out how the subprogram can be used to solve a bigger problem, I feel so excited!" Educators can consider incorporating music and words of wisdom from students' personal role models as part of the math program, to support students in managing their emotions.

Grade 8

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Positive Motivation and Perseverance

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a breath and remind myself that I can think about this as integers first. I can think about the strategies I know about working with them and then think about the variable part. And I see that the anchor chart reminds me to gather like terms. I know that when I'm done, I have strategies for checking my work, such as substituting my solution in for the variable."

Healthy Relationship Skills

Grade 7

As students draw top, front, and side views as well as perspective views of objects, they can *reflect* on the value of looking at things from different perspectives, including when interacting with their classmates. For example: "When I flip this object around and see it from your perspective, I can see that it looks completely different. Looking at things from different perspectives and paying attention to the thinking of others allow me to notice different things." Educators can promote safe risk-taking by encouraging students to see things from other perspectives by using protocols that promote respectful interactions. Listening to all voices can help spark new ideas and help students consider things they may not have thought of on our own.

Grade 8

As students display data in an infographic to tell a story, they can *communicate* and build awareness and understanding of others, including the things they may have in common with other groups and the things that may make other groups unique. For example: "This infographic shows relationships between poverty, geography, race and ethnicity, access to nature, and health. It makes me wonder about and reflect on the different factors and how they affect people's experiences." It is important for educators to provide opportunities for students to apply communication skills and create real-life infographics that focus on global issues and community realities (e.g., support for youth empowerment programs taking action against climate change or social injustices – racism, homophobia, and poverty).

Self-Awareness and Sense of Identity

Grade 7

As students identify and compare exchange rates and convert foreign currencies to Canadian dollars and vice versa, they may *reflect* on their personal connections to other countries and cultures, their values and experiences, and how these affect their sense of identity. Making connections to the learning in history and geography, students can also reflect on economic power imbalances between countries, domestic and global poverty, and the effects of historical

processes such as colonialism on their sense of identity. Developing critical-thinking skills in mathematics can help students make these connections.

Grade 8

As students reproduce drawings at different scales, calculating lengths and areas using different ratios, they may take a standard drawing – for example, of a furnished room – and then *select tools and strategies*, such as a design and drafting application or paper cutouts, to make scaled objects and models to personalize the room to reflect their identity, preferences, and style. Consider the range of students' potential living situations (e.g., students living in multi-generational homes and sharing a bedroom). Students may not want to share information about their own housing situation, so the exercise should be kept hypothetical and could also be applied to school, the outdoors, or another setting.

Critical and Creative Thinking

Grade 7

As students examine different data sets and consider the sources, check for bias, and draw conclusions, they may *make connections* to their own experience, look for more background information when needed, and ask questions. It is important for educators to collaborate and consult with community groups, representatives, and leaders (e.g., Indigenous and Black community leaders or organizations) to ensure that the data sets provided authenticate students' experience and do not further marginalize students and communities.

Grade 8

As students make a financial plan that considers financial goals, income, expenses, and tax implications, they may use a variety of *tools* to make informed decisions based on their analysis of the data collected. Tools could include T-charts to compare the pros and cons of various expenditures and income-generation ideas, spreadsheets to track income and expenses, and calculators to track tax implications. Educators should be aware that students will have a range of financial circumstances and pressures and that there may be conflicts between students' goals and their current means, as well as systemic factors that contribute to those circumstances and pressures. They can plan to support students in learning about the concrete steps that they could take to move towards their goals.

B. Number

Overall expectations

By the end of Grade 7, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 7, students will:

Rational Numbers

B1.1 represent and compare whole numbers up to and including one billion, including in expanded form using powers of ten, and describe various ways they are used in everyday life

B1.2 identify and represent perfect squares, and determine their square roots, in various contexts

B1.3 read, represent, compare, and order rational numbers, including positive and negative fractions and decimal numbers to thousandths, in various contexts

Fractions, Decimals, and Percents

B1.4 use equivalent fractions to simplify fractions, when appropriate, in various contexts

B1.5 generate fractions and decimal numbers between any two quantities

B1.6 round decimal numbers to the nearest tenth, hundredth, or whole number, as applicable, in various contexts

B1.7 convert between fractions, decimal numbers, and percents, in various contexts

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 7, students will:

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

Math Facts

B2.2 understand and recall commonly used percents, fractions, and decimal equivalents

Mental Math

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

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

Multiplication and Division

B2.6 determine the greatest common factor for a variety of whole numbers up to 144 and the lowest common multiple for two and three whole numbers

B2.7 evaluate and express repeated multiplication of whole numbers using exponential notation, in various contexts

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

B2.10 identify proportional and non-proportional situations and apply proportional reasoning to solve problems

C. Algebra

Overall expectations

By the end of Grade 7, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 7, students will:

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 predictions, and identify 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

C1.4 create and describe patterns to illustrate relationships among integers

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equalities, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 7, students will:

Variables and Expressions

C2.1 add and subtract monomials with a degree of 1 that involve whole numbers, using tools

C2.2 evaluate algebraic expressions that involve whole numbers and decimal numbers

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

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 7, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing efficient code, including code that involves events influenced by a defined count and/or subprogram and other control structures

C3.2 read and alter existing code, including code that involves events influenced by a defined count and/or subprogram and other control structures, and describe how changes to the code affect the outcomes and the efficiency of the code

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **real-life situations:**
  - designing a container to maximize its functionality and minimize the cost
  - remodelling a room within a set budget

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model back against the real-life situation and adjusting as necessary.

- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as designing a possible container in a way that maximizes its purpose and minimizes the cost, for example, designing a container to hold the classroom craft supplies that does not take up any more space than necessary.

Have students brainstorm questions that need to be answered, such as: What is the largest item that needs to fit in the container? Do all of the items need to be standing up, or can they be placed on their sides? Can some items be stored outside the container? It is important to honour student voice and student questions, as well as to encourage students to listen to and consider the questions of their peers.

Analyse the situation with students by supporting them in making assumptions, such as that the container needs to hold as many of the craft supplies as possible.
Have students think about what will remain the same, such as the items that are to be stored in the container, and what can vary, such as the dimensions of the container.

Have students determine and gather the information needed to solve the problem. Students may say that they need to identify all the items that need to be stored in the container and get approximate measurements for all the items.

Have students identify and use representations, tools, technologies, or strategies to create a model for their container that allows them to identify all the dimensions, the volume, and the surface area.

Pose questions to students to support them in analysing their model. Possible questions are:

- Does your container hold all the items that were identified as needing to go in the container?
- Are all the items in the container easy to access?
- Does the container fit in the designated space?

If the answer to any of these questions is no, have them adjust their models and reassess.

Have students share their models with the class, discuss the different container options, and determine which of the containers has the maximum volume with the least amount of surface area.

D. Data

Overall expectations

By the end of Grade 7, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 7, students will:

Data Collection and Organization

D1.1 explain why percentages are used to represent the distribution of a variable for a population or sample in large sets of data, and provide examples

D1.2 collect qualitative data and discrete and continuous quantitative data to answer questions of interest, and organize the sets of data as appropriate, including using percentages

Data Visualization

D1.3 select from among a variety of graphs, including circle graphs, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs

D1.4 create an infographic about a data set, representing the data in appropriate ways, including in tables and circle graphs, and incorporating any other relevant information that helps to tell a story about the data

Data Analysis

D1.5 determine the impact of adding or removing data from a data set on a measure of central tendency, and describe how these changes alter the shape and distribution of the data

D1.6 analyse different sets of data presented in various ways, including in circle graphs and in misleading graphs, by asking and answering questions about the data, challenging preconceived notions, and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 7, students will:

Probability

D2.1 describe the difference between independent and dependent events, and explain how their probabilities differ, providing examples

D2.2 determine and compare the theoretical and experimental probabilities of two independent events happening and of two dependent events happening

E. Spatial Sense

Overall expectations

By the end of Grade 7, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 7, students will:

Geometric Reasoning

E1.1 describe and classify cylinders, pyramids, and prisms according to their geometric properties, including plane and rotational symmetry

E1.2 draw top, front, and side views, as well as perspective views, of objects and physical spaces, using appropriate scales

Location and Movement

E1.3 perform dilations and describe the similarity between the image and the original shape

E1.4 describe and perform translations, reflections, and rotations on a Cartesian plane, and predict the results of these transformations

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 7, students will:

The Metric System

E2.1 describe the differences and similarities between volume and capacity, and apply the relationship between millilitres (mL) and cubic centimetres (cm^3) to solve problems

E2.2 solve problems involving perimeter, area, and volume that require converting from one metric unit of measurement to another

Circles

E2.3 use the relationships between the radius, diameter, and circumference of a circle to explain the formula for finding the circumference and to solve related problems

E2.4 construct circles when given the radius, diameter, or circumference

E2.5 show the relationships between the radius, diameter, and area of a circle, and use these relationships to explain the formula for measuring the area of a circle and to solve related problems

Volume and Surface Area

E2.6 represent cylinders as nets and determine their surface area by adding the areas of their parts

E2.7 show that the volume of a prism or cylinder can be determined by multiplying the area of its base by its height, and apply this relationship to find the area of the base, volume, and height of prisms and cylinders when given two of the three measurements

F. Financial Literacy

Overall expectations

By the end of Grade 7, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 7, students will:

Money Concepts

F1.1 identify and compare exchange rates, and convert foreign currencies to Canadian dollars and vice versa

Financial Management

F1.2 identify and describe various reliable sources of information that can help with planning for and reaching a financial goal

F1.3 create, track, and adjust sample budgets designed to meet longer-term financial goals for various scenarios

F1.4 identify various societal and personal factors that may influence financial decision making, and describe the effects that each might have

Consumer and Civic Awareness

F1.5 explain how interest rates can impact savings, investments, and the cost of borrowing to pay for goods and services over time

F1.6 compare interest rates and fees for different accounts and loans offered by various financial institutions, and determine the best option for different scenarios

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
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Mathematics, Grade 8

Expectations by strand

Note

Strand A
Learning related to Strand A: Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes occurs in the context of learning related to the other strands. As educators develop lessons and plan learning activities, they should consider:

- where there are opportunities to teach and reinforce social-emotional learning skills in order to help every student develop confidence, cope with challenges, think critically, and develop a positive identity as a math learner
- how the mathematical processes can be highlighted so that students are actively engaged in applying these processes throughout the program
- how instruction and the learning environment are designed to be culturally responsive and relevant

Examples
The examples laid out in the curriculum are intended to guide teachers in thinking about how the learning for each expectation might be positioned and demonstrated. In planning students' learning experiences, it is important for teachers to ensure that learning experiences are culturally reflective of students' lived realities in the community and in the world around them. It is also important to acknowledge and affirm the multiple ways of knowing and doing that students may bring to the classroom.

Sample Tasks
The sample tasks laid out in the curriculum are intended to be illustrations only, and should be replaced or supplemented with tasks and learning contexts that are affirming of, relevant to, and reflective of students' lives and backgrounds, and that provide students with the opportunity to learn about diverse cultures and communities in a respectful and informed way. Such opportunities may include the examination of social and economic justice concerns (e.g., racism, classism, sexism), health issues, environmental aspects, and so on, as appropriate.

A. Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes

Note: Beginning in the 2021–22 school year, schools are asked not to assess, evaluate or report on the overall expectations related to social-emotional learning skills in *The Ontario Curriculum, Grades 1–8, Mathematics (2020)* and *The Ontario Curriculum, Grades 1–8, Health and Physical Education (2019)*. It is the ministry's expectation that instruction of the social-emotional learning skills will continue while educators engage in ongoing professional learning.

This strand focuses on students' development and application of social-emotional learning skills to support their learning of math concepts and skills, foster their overall well-being and ability to learn, and help them build resilience and thrive as math learners. As they develop SEL skills, students demonstrate a greater ability to understand and apply the mathematical processes, which are critical to supporting learning in mathematics. In all grades of the mathematics program, the learning related to this strand takes place in the context of learning related to all other strands, and it should be assessed and evaluated within these contexts.

Overall expectations

Throughout this grade, in order to promote a positive identity as a math learner, to foster well-being and the ability to learn, build resilience, and thrive, students will:

A1. Social-Emotional Learning (SEL) Skills and the Mathematical Processes

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

To the best of their ability, students will learn to:	**… as they apply the mathematical processes:**	**… so they can:**
1. identify and manage emotions	• ***problem solving:*** develop, select, and apply problem-solving strategies • ***reasoning and proving:*** develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments • ***reflecting:*** demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their	1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities
2. recognize sources of stress and cope with challenges		2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience
3. maintain positive motivation and perseverance		3. recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope

4. build relationships and communicate effectively	results are reasonable, by recording their thinking in a math journal) • ***connecting:*** make connections among mathematical concepts, procedures, and representations, and relate mathematical ideas to other contexts (e.g., other curriculum areas, daily life, sports) • ***communicating:*** express and understand mathematical thinking, and engage in mathematical arguments using everyday language, language resources as necessary, appropriate mathematical terminology, a variety of representations, and mathematical conventions • ***representing:*** select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs), and apply them to solve problems • ***selecting tools and strategies:*** select and use a variety of concrete, visual, and electronic learning tools and appropriate strategies to investigate mathematical ideas and to solve problems	4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way foster healthy relationships
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- Human rights principles and the Education Act recognize the importance of creating a climate of understanding of and mutual respect for the dignity and worth of each person, so that each person can contribute fully to the development and well-being of their community. Indeed, human rights law guarantees a person's right to equal treatment in education. It requires educators and school leaders to actively prevent discrimination and harassment and respond appropriately when they do occur, to create an inclusive environment, to remove barriers that limit the ability of students, and to provide accommodations where necessary.

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Grade 8

As students consider ways to create, track, and adjust sample budgets to meet longer-term financial goals, they may *reflect* on aspects of managing money that are stressful for them and look for solutions that will help. For example: “Thinking about managing money can be stressful because of the number of calculations involved. Learning how to use a spreadsheet made a difference for me because it helped me easily keep track of things.” Even when using sample budgets, educators should be mindful that these types of exercises may be stressful for some students because of personal or family financial stresses (e.g., creating budgets when food security and adequate housing are an issue may induce negative or stressful feelings). Educators may reflect and support students as they consider how math could be used as a tool to address the injustices that contribute to personal and family financial stresses.

Positive Motivation and Perseverance

Grade 7

As students multiply and divide fractions and decimal numbers in various contexts, they may use *problem-solving strategies* such as using smaller numbers to check your thinking. For example: “I felt overwhelmed when I first looked at the numbers I had to work with, but then I thought I could check out my strategy using smaller numbers to make sure I was on the right track with my thinking.” Another effective strategy students may use when working with decimals is to think of the numbers in terms of something tangible like money or measurement of distance. Even if the problem has nothing to do with money or distance, applying it to something that is tangible can make it easier to solve.

Grade 8

As students solve algebraic equations, they may use *reasoning and proving* and a range of strategies to persevere. For example: “Solving $3m + 4 = -5m + 2m$ seems really hard. I can take

a breath and remind myself that I can think about this as integers first. I can think about the strategies I know about working with them and then think about the variable part. And I see that the anchor chart reminds me to gather like terms. I know that when I'm done, I have strategies for checking my work, such as substituting my solution in for the variable."

Healthy Relationship Skills

Grade 7

As students draw top, front, and side views as well as perspective views of objects, they can *reflect* on the value of looking at things from different perspectives, including when interacting with their classmates. For example: "When I flip this object around and see it from your perspective, I can see that it looks completely different. Looking at things from different perspectives and paying attention to the thinking of others allow me to notice different things." Educators can promote safe risk-taking by encouraging students to see things from other perspectives by using protocols that promote respectful interactions. Listening to all voices can help spark new ideas and help students consider things they may not have thought of on our own.

Grade 8

As students display data in an infographic to tell a story, they can *communicate* and build awareness and understanding of others, including the things they may have in common with other groups and the things that may make other groups unique. For example: "This infographic shows relationships between poverty, geography, race and ethnicity, access to nature, and health. It makes me wonder about and reflect on the different factors and how they affect people's experiences." It is important for educators to provide opportunities for students to apply communication skills and create real-life infographics that focus on global issues and community realities (e.g., support for youth empowerment programs taking action against climate change or social injustices – racism, homophobia, and poverty).

Self-Awareness and Sense of Identity

Grade 7

As students identify and compare exchange rates and convert foreign currencies to Canadian dollars and vice versa, they may *reflect* on their personal connections to other countries and cultures, their values and experiences, and how these affect their sense of identity. Making connections to the learning in history and geography, students can also reflect on economic power imbalances between countries, domestic and global poverty, and the effects of historical

processes such as colonialism on their sense of identity. Developing critical-thinking skills in mathematics can help students make these connections.

Grade 8

As students reproduce drawings at different scales, calculating lengths and areas using different ratios, they may take a standard drawing – for example, of a furnished room – and then *select tools and strategies*, such as a design and drafting application or paper cutouts, to make scaled objects and models to personalize the room to reflect their identity, preferences, and style. Consider the range of students' potential living situations (e.g., students living in multi-generational homes and sharing a bedroom). Students may not want to share information about their own housing situation, so the exercise should be kept hypothetical and could also be applied to school, the outdoors, or another setting.

Critical and Creative Thinking

Grade 7

As students examine different data sets and consider the sources, check for bias, and draw conclusions, they may *make connections* to their own experience, look for more background information when needed, and ask questions. It is important for educators to collaborate and consult with community groups, representatives, and leaders (e.g., Indigenous and Black community leaders or organizations) to ensure that the data sets provided authenticate students' experience and do not further marginalize students and communities.

Grade 8

As students make a financial plan that considers financial goals, income, expenses, and tax implications, they may use a variety of *tools* to make informed decisions based on their analysis of the data collected. Tools could include T-charts to compare the pros and cons of various expenditures and income-generation ideas, spreadsheets to track income and expenses, and calculators to track tax implications. Educators should be aware that students will have a range of financial circumstances and pressures and that there may be conflicts between students' goals and their current means, as well as systemic factors that contribute to those circumstances and pressures. They can plan to support students in learning about the concrete steps that they could take to move towards their goals.

B. Number

Overall expectations

By the end of Grade 8, students will:

B1. Number Sense

demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

Specific expectations

By the end of Grade 8, students will:

Rational and Irrational Numbers

B1.1 represent and compare very large and very small numbers, including through the use of scientific notation, and describe various ways they are used in everyday life

B1.2 describe, compare, and order numbers in the real number system (rational and irrational numbers), separately and in combination, in various contexts

B1.3 estimate and calculate square roots, in various contexts

Fractions, Decimals, and Percents

B1.4 use fractions, decimal numbers, and percents, including percents of more than 100% or less than 1%, interchangeably and flexibly to solve a variety of problems

B2. Operations

use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

Specific expectations

By the end of Grade 8, students will:

Properties and Relationships

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

Math Facts

B2.2 understand and recall commonly used square numbers and their square roots

Mental Math

B2.3 use mental math strategies to multiply and divide whole numbers and decimal numbers up to thousandths by powers of ten, and explain the strategies used

Addition and Subtraction

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

B2.6 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

B2.8 compare proportional situations and determine unknown values in proportional situations, and apply proportional reasoning to solve problems in various contexts

C. Algebra

Overall expectations

By the end of Grade 8, students will:

C1. Patterns and Relationships

identify, describe, extend, create, and make predictions about a variety of patterns, including those found in real-life contexts

Specific expectations

By the end of Grade 8, students will:

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 predictions, and identify 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

C1.4 create and describe patterns to illustrate relationships among rational numbers

C2. Equations and Inequalities

demonstrate an understanding of variables, expressions, equations, and inequalities, and apply this understanding in various contexts

Specific expectations

By the end of Grade 8, students will:

Variables and Expressions

C2.1 add and subtract monomials with a degree of 1, and add binomials with a degree of 1 that involve integers, using tools

C2.2 evaluate algebraic expressions that involve rational numbers

Equalities and Inequalities

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

C3. Coding

solve problems and create computational representations of mathematical situations using coding concepts and skills

Specific expectations

By the end of Grade 8, students will:

Coding Skills

C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves the analysis of data in order to inform and communicate decisions

C3.2 read and alter existing code involving the analysis of data in order to inform and communicate decisions, and describe how changes to the code affect the outcomes and the efficiency of the code

C4. Mathematical Modelling

apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

This overall expectation has no specific expectations. Mathematical modelling is an iterative and interconnected process that is applied to various contexts, allowing students to bring in learning from other strands. Students' demonstration of the process of mathematical modelling, as they apply concepts and skills learned in other strands, is assessed and evaluated.

Read more about the mathematical modelling process.

Teacher supports

Examples

- **real-life situations:**
  - remodelling a room or constructing a structure within a budget
  - reviewing and strategizing water consumption levels
  - developing a strategy to reduce waste at school

Key concepts

- The process of mathematical modelling requires: understanding the problem; analysing the situation; creating a mathematical model; and analysing and assessing the model.

Note

- A mathematical modelling task is different from a real-life application due to the cyclic nature of modelling, which involves examining a problem from outside mathematics, modelling it, and then checking the model back against the real-life situation and adjusting as necessary.
- The process of mathematical modelling should not be confused with using a "model" to represent or solve a problem that does not require the whole process.
- Mathematical modelling tasks can be utilized in many ways and can support students with making connections among many mathematical concepts across the math strands and across other curricula.

Sample tasks

Provide students with a real-life situation, such as conducting a schoolyard cleanup day.

Have students brainstorm questions that need to be answered, such as: What types of costs are involved in doing a schoolyard cleanup? How can costs be reduced? How many people need to take part to efficiently carry out the cleanup? What safety concerns do we need to think about?

Analyse the situation with students by helping them make assumptions, such as that all of the classes in the school will help on cleanup day.

Have students think about what will remain the same, such as the areas that need to be attended to and the kinds of items that can be recycled or donated, and think about what can vary, such as the cost of supplies for cleanup and the number of items that can be recycled or donated.

Have students determine and gather the information needed to solve the problem. They may say they need to identify the supplies needed for the cleanup and research the prices of those supplies, determine the recycling policies for their area, and find local charity shops that take donations and research what they accept.

Have students identify and use representations, tools, technologies, or strategies to create a model for their schoolyard cleanup day.

Pose questions to support students in analysing their model. Possible questions might be:

- Have you considered the safety of all the students, for example, in your selection of sanitization products?
- Have you thought about the most appropriate assignments for each grade level?
- Have you considered making arrangements for donations and recycling to be delivered or picked up? Are there costs involved?
- Have you thought about how to celebrate the school's accomplishment, for example, by inviting the local newspaper to do a story?

If the answer to any of these questions is no, have students adjust their models and reassess.

Have students share their models with the class and discuss the different options for conducting the schoolyard cleanup.

D. Data

Overall expectations

By the end of Grade 8, students will:

D1. Data Literacy

manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

Specific expectations

By the end of Grade 8, students will:

Data Collection and Organization

D1.1 identify situations involving one-variable data and situations involving two-variable data, and explain when each type of data is needed

D1.2 collect continuous data to answer questions of interest involving two variables, and organize the data sets as appropriate in a table of values

Data Visualization

D1.3 select from among a variety of graphs, including scatter plots, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs

D1.4 create an infographic about a data set, representing the data in appropriate ways, including in tables and scatter plots, and incorporating any other relevant information that helps to tell a story about the data

Data Analysis

D1.5 use mathematical language, including the terms “strong”, “weak”, “none”, “positive”, and “negative”, to describe the relationship between two variables for various data sets with and without outliers

D1.6 analyse different sets of data presented in various ways, including in scatter plots and in misleading graphs, by asking and answering questions about the data, challenging preconceived notions, and drawing conclusions, then make convincing arguments and informed decisions

D2. Probability

describe the likelihood that events will happen, and use that information to make predictions

Specific expectations

By the end of Grade 8, students will:

Probability

D2.1 solve various problems that involve probability, using appropriate tools and strategies, including Venn and tree diagrams

D2.2 determine and compare the theoretical and experimental probabilities of multiple independent events happening and of multiple dependent events happening

E. Spatial Sense

Overall expectations

By the end of Grade 8, students will:

E1. Geometric and Spatial Reasoning

describe and represent shape, location, and movement by applying geometric properties and spatial relationships in order to navigate the world around them

Specific expectations

By the end of Grade 8, students will:

Geometric Reasoning

E1.1 identify geometric properties of tessellating shapes and identify the transformations that occur in the tessellations

E1.2 make objects and models using appropriate scales, given their top, front, and side views or their perspective views

E1.3 use scale drawings to calculate actual lengths and areas, and reproduce scale drawings at different ratios

Location and Movement

E1.4 describe and perform translations, reflections, rotations, and dilations on a Cartesian plane, and predict the results of these transformations

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 8, students will:

The Metric System

E2.1 represent very large (mega, giga, tera) and very small (micro, nano, pico) metric units using models, base ten relationships, and exponential notation

Lines and Angles

E2.2 solve problems involving angle properties, including the properties of intersecting and parallel lines and of polygons

Length, Area, and Volume

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

E2.4 describe the Pythagorean relationship using various geometric models, and apply the theorem to solve problems involving an unknown side length for a given right triangle

F. Financial Literacy

Overall expectations

By the end of Grade 8, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 8, students will:

Money Concepts

F1.1 describe some advantages and disadvantages of various methods of payment that can be used when dealing with multiple currencies and exchange rates

Financial Management

F1.2 create a financial plan to reach a long-term financial goal, accounting for income, expenses, and tax implications

F1.3 identify different ways to maintain a balanced budget, and use appropriate tools to track all income and spending, for several different scenarios

F1.4 determine the growth of simple and compound interest at various rates using digital tools, and explain the impact interest has on long-term financial planning

Consumer and Civic Awareness

F1.5 compare various ways for consumers to get more value for their money when spending, including taking advantage of sales and customer loyalty and incentive programs, and determine the best choice for different scenarios

F1.6 compare interest rates, annual fees, and rewards and other incentives offered by various credit card companies and consumer contracts to determine the best value and the best choice for different scenarios

Strand overviews

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand A – Social-Emotional Learning (SEL) Skills in Mathematics and The Mathematical Processes

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand B – Number

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand C – Algebra

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand D – Data

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand E – Spatial Sense

Ontario Mathematics Curriculum Expectations, Grades 1–8, 2020: Strand F – Financial Literacy

Information for parents

A parent's guide to Mathematics, Grades 1–8 (2020)For informational purposes only, not part of official issued curriculum.
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