Mathematics, Grade 5

Expectations by strand

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

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

<table>
<tr><th>To the best of their ability, students will learn to:</th><th>… as they apply the mathematical processes:</th><th>… so they can:</th></tr>
<tr><td>1. identify and manage emotions</td><td rowspan="5">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 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.,</td><td>1. express and manage their feelings, and show understanding of the feelings of others, as they engage positively in mathematics activities</td></tr>
<tr><td>2. recognize sources of stress and cope with challenges</td><td>2. work through challenging math problems, understanding that their resourcefulness in using various strategies to respond to stress is helping them build personal resilience</td></tr>
<tr><td>3. maintain positive motivation and perseverance</td><td>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</td></tr>
<tr><td>4. build relationships and communicate effectively</td><td>4. work collaboratively on math problems – expressing their thinking, listening to the thinking of others, and practising inclusivity – and in that way fostering healthy relationships</td></tr>
<tr><td>5. develop self-awareness and sense of identity</td><td>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</td></tr>
</table>

6. think critically and creatively	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	6. make connections between math and everyday contexts to help them make informed judgements and decisions

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:

B1.1 Whole Numbers

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

Teacher supports

Key concepts

- Reading numbers involves interpreting them as a quantity when they are expressed in words, in standard notation, in expanded notation, or on a number line.
- The numerals 0 to 9 are used to form numbers. They are referred to as the digits in a number, and each digit corresponds to a place value. For example, with the number 45 107, the digit 4 represents 4 ten thousands, the digit 5 represents 5 thousands, the digit 1 represents 1 hundred, the digit 0 represents 0 tens, and the digit 7 represents 7 ones.

- There are patterns to the way numbers are formed. Each place value period repeats the 0 to 9 counting sequence. Any quantity, no matter how great, can be described in terms of its place value.
- A number can be represented in expanded form as 34 187 = 30 000 + 4000 + 100 + 80 + 7, or as 3 × 10 000 + 4 × 1000 + 1 × 100 + 3 × 10 + 7, to show place value relationships.
- Numbers can be composed and decomposed in various ways, including by place value.
- Numbers are composed when two or more numbers are combined to create a larger number. For example, the numbers 100 and 2 can be composed to make the sum 102 or the product 200.
- Numbers can be decomposed as a sum of numbers. For example, 53 125 can be decomposed into 50 000 and 3000 and 100 and 25.
- Numbers can be decomposed into their factors. For example, 81 can be decomposed into the factors 1, 3, 9, 27, and 81.
- Numbers are used throughout the day, in various ways and contexts. Most often numbers describe and compare quantities. They express magnitude, and provide a way to answer questions such as “how much?” and “how much more?”.

Note

- Every strand of mathematics relies on numbers.
- Numbers may have cultural significance.
- Seeing how a quantity relates to other quantities helps in understanding the magnitude, or “how muchness”, of a number.
- Closed number lines with appropriate scales can be used to represent numbers as a position on a number line or as a distance from zero. Depending on the number, estimation may be needed to represent it on a number line.
- Partial number lines can be used to show the position of a number relative to other numbers.
- Composing and decomposing numbers in a variety of ways can support students in becoming flexible with their mental math strategies.
- Open number lines can be used to show the composition or decomposition of large numbers without drawing the number line to scale.
- It is important for students to understand key aspects of place value. For example:
    - The order of the digits makes a difference. The number 21 385 describes a different quantity than 82 153.
    - The *place* (or position) of a digit determines its *value* (*place value*). The 5 in 51 981, for example, has a value of 50 000, not 5. To determine the value of a digit in a number, multiply the value of the digit by the value of its place. For example, in the number 15 236, the 5 represents 5000 (5 × 1000), and the 2 represents 200 (2 × 100).

- Expanded notation represents the values of each digit separately, as a sum. Using expanded form, 7287 is written 7287 = 7000 + 200 + 80 + 7 or 7 × 1000 + 2 × 100 + 8 × 10 + 7 × 1.
- A zero in a column indicates that there are no groups of that size in the number. It serves as a placeholder and holds the other digits in their correct "place". For example, 189 means 1 hundred, 8 tens, and 9 ones, but 1089 means 1 thousand, 0 hundreds, 8 tens, and 9 ones.
- The value of the digits in each of the positions follows a "times 10" multiplicative pattern, when moving right to left. For example, 50 is 10 times greater than 500, and 500 is 10 times greater than 50. Conversely, a "divide ten" pattern is observed when moving from left to right. For example, 500 is 10 times smaller than 5000, and 50 is 10 times smaller than 500.
- Going from left to right, a "hundreds-tens-ones" pattern repeats within each period (units, thousands, millions, billions, and so on). Exposure to this larger pattern and the names of the periods – into millions and beyond – satisfies a natural curiosity around "big numbers", although students at this grade do not need to work beyond 100 000.

- The number "seventy-eight thousand thirty-seven" is written as "78 037", and not "78 000 37" (as if being spelled out with numbers). Listening for the period name (seventy-eight *thousand*) gives structure to the number and signals where a digit belongs. If there are no groups of that place value in a number, 0 is used to describe that amount, holding the other digits in their correct place.

Place Value Patterns

one billions	hundred millions	ten millions	one millions	hundred thousands	ten thousands	one thousands	hundreds	tens	ones

B1.2 Whole Numbers

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

Teacher supports

Key concepts

- Numbers are compared and ordered according to their "how muchness" or magnitude.
- Numbers with the same units can be compared directly (e.g., 72 cm^2 compared to 62 cm^2). Numbers that do not show a unit are assumed to have units of ones (e.g., 75 and 12 are considered as 75 ones and 12 ones).

- Sometimes numbers without the same unit can be compared, such as 6200 kilometres and 6200 metres. Knowing that the unit *kilometre* is greater than the unit *metre*, and knowing that 6200 kilometres is greater than 6200 metres can allow one to infer that 6200 kilometres is a greater distance than 6200 metres.
- Sometimes numbers without the same unit may need to be rewritten to have the same unit in order to be compared. For example, 12 metres and 360 centimetres can be compared as 1200 centimetres and 360 centimetres. Therefore, 12 metres is greater than 360 centimetres.
- Benchmark numbers can be used to compare quantities. For example, 41 320 is less 50 000 and 62 000 is greater than 50 000, so 41 320 is less than 62 000.
- Numbers can be compared by their place value. For example, when comparing 82 150 and 84 150, the greatest place value where the numbers differ is compared. For this example, 2 thousands (from 82 150) and 4 thousands (from 84 150) are compared. Since 4 thousand is greater than 2 thousand, then 84 150 is greater than 82 150.
- Numbers can be ordered in ascending order – from least to greatest – or can be ordered in descending order – from greatest to least.

Note

- Numbers can be compared proportionally. For example, 100 000 is 10 times greater than 10 000; it is also 100 times greater than 1000. It would take 1000 hundred-dollar bills to make $100 000.
- Depending on the context of the problem, numbers can be compared additively or multiplicatively.

B1.3 Fractions, Decimals, and Percents

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

Teacher supports

Key concepts

- Equivalent fractions describe the same relationship or quantity.
- When working with fractions as a quotient, equivalent fractions are ones that have the same result when the numerators are divided by the denominators.
- When working with fractions as a part of a whole, the partitions of the fraction can be split or merged to create equivalent fractions. The whole remains the same size.

- When working with fractions as a comparison, the ratios between the numerator and the denominator of equivalent fractions are equal.

Note

- Models and tools can be used to develop understanding of equivalent fractions. For example:
  - Fraction strips or other partitioned models, such as fraction circles, can be used to create the same area as the original fraction using split or merged partitions.
  - Strips of paper can be folded to show the splitting of partitions to create equivalence.
  - A double number line or a ratio table can be used to show equivalent fractions based on different scales.

- A fraction is a number that conveys a relationship between two quantities.
- A fraction can represent a quotient (division):
  - It shows the relationship between the number of wholes (numerator) and the number of partitions the whole is being divided into (denominator).
  - For example, 3 granola bars (3 wholes) are shared equally with 4 people (number of partitions), which can be expressed as $\frac{3}{4}$.

- A fraction can represent a part of a whole:
  - It shows the relationship between the number of parts selected (numerator) and the total number of parts in one whole (denominator).
  - For example, if 1 granola bar (1 whole) is partitioned into 4 pieces (partitions), each piece is one fourth ($\frac{1}{4}$) of the granola bar. Two pieces are 2 one fourths ($\frac{2}{4}$) of the granola bar, three pieces are 3 one fourths ($\frac{3}{4}$) of the granola bar, and four pieces are four one fourths ($\frac{4}{4}$) of the granola bar.

- A fraction can represent a comparison:
  - It shows the relationship between two parts of the same whole. The numerator is one part and the denominator is the other part.
  - For example, a bag has 3 red beads and 2 yellow beads. The fraction $\frac{2}{3}$ represents that there are two thirds as many yellow beads as red beads. The fraction $\frac{3}{2}$, which is $1\frac{1}{2}$ as a mixed number, represents that there are 1 and one half times more red beads than yellow beads.

- A fraction can represent an operator:
  - When considering fractions as an operator, the fraction increases or decreases a quantity by a factor.
  - For example, in the case of $\frac{3}{4}$ of a granola bar, $\frac{3}{4}$ of \$100, or $\frac{3}{4}$ of a rectangle, the fraction reduces the original quantity to $\frac{3}{4}$ its original size.

B1.4 Fractions, Decimals, and Percents

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

Teacher supports

Key concepts

- When working with fractions as parts of a whole, the fractions are compared to the same whole.
- Fractions can be compared spatially by using models to represent the fractions. If an area model is chosen, then the areas that the fractions represent are compared. If a linear model is chosen, then the lengths that the fractions represent are compared.
- If two fractions have the same denominator then the numerators can be compared. In this case the numerator with the greater value is the greater fraction because the number of parts considered is greater (e.g., $\frac{2}{3} > \frac{1}{3}$).
- If two fractions have the same numerators, then the denominators can be compared. In this case the denominator with the greater value is the smaller fraction because the size of each partition of the whole is smaller (e.g., $\frac{5}{6} < \frac{5}{3}$).
- Fractions can be compared by using the benchmark of "half" and considering each fraction relative to it. For example, $\frac{5}{6}$ is greater than $\frac{3}{8}$ because $\frac{5}{6}$ is greater than one half and $\frac{3}{8}$ is less than one half.
- Fractions can be ordered in ascending order – least to greatest – or in descending order – greatest to least.

Note:

- The choice of model used to compare fractions may be influenced by the context of the problem. For example:

- a linear model may be chosen when the problem is dealing with comparing things involving length, like lengths of a ribbon or distances.
- an area model may be chosen when the problem is dealing with comparing the area of two-dimensional shapes, like a garden or a flag.

B1.5 Fractions, Decimals, and Percents

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

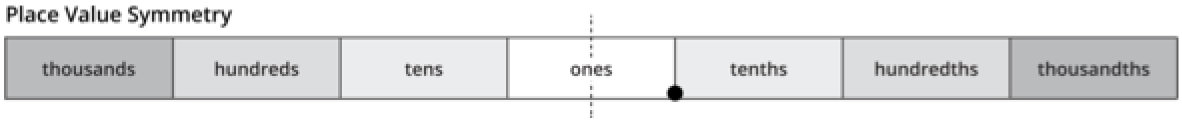
Teacher supports

Key concepts

- The place value of the first position to the right of the decimal point is tenths. The second position to the right of the decimal point is hundredths.
- Decimal numbers can be less than one (e.g., 0.65) or greater than one (e.g., 24.72).
- The one whole needs to be shown or explicitly indicated when decimal numbers are represented visually since their representation is relative to the whole.
- Decimal numbers can be compared and ordered by identifying the size of the decimal number visually relative to 1 whole. Using knowledge of fractions (e.g., $\frac{2}{10} > \frac{15}{100}$ or thinking about money (e.g., \$2.50 is more than \$2.05), are helpful strategies when comparing decimal numbers.

Note

- Between any two consecutive whole numbers are other numbers. Decimals are how the base ten number system shows these "in-between" numbers. For example, the number 3.62 describes a quantity between 3 and 4 and, more precisely, between 3.6 and 3.7.
- Decimals are sometimes called *decimal fractions* because they represent fractions with denominators of 10, 100, 1000, and so on. The first decimal place represents tenths, the second represents hundredths, and so on. Columns can be added indefinitely to describe smaller and smaller partitions. Decimals, like fractions, have what could be considered a numerator (a count of units) and a denominator (the value of the unit); however, with decimals, only the numerator is visible. The denominator (or unit) is "hidden" within the place value convention.
- The decimal point indicates the location of the unit. The unit is always to the left of the decimal point. There is symmetry around the *ones* column, so tens are matched by tenths, and hundreds are matched by hundredths. Note that the symmetry does not revolve around the *decimal*, so there is no "oneth".



- Between any two places in the base ten system, there is a constant 10:1 ratio, and this is true for decimals as well. If a digit shifts one space to the right it becomes one tenth as great, and if it shifts two spaces to the right it becomes one hundredth as great. So, 0.05 is one tenth as great as 0.5 and one hundredth as great as 5. It also means that 5 is 100 times as great as 0.05, in the same way that there are 100 nickels ($0.05) in $5.00.
- As with whole numbers, a zero in a decimal indicates that there are no groups of that size in the number:
    - 5.07 means 5 ones, 0 tenths, 7 hundredths.
    - 5.10 means 5 ones, 1 tenth, 0 hundredths.
    - 5.1 (five and one tenth) and 5.10 (5 and 10 hundredths) are equivalent (although writing zero in the tenths and hundredths position can indicate the precision of a measurement; for example, the race was won by 5.00 seconds and the winning time was 19.29 seconds).
- Decimals are read in a variety of ways in everyday life. Decimals like 2.5 are commonly read as two point five; in math, the term *pi* (π) is commonly approximated as three point one four; the decimal in baseball averages is typically ignored; and decimals used in numbered lists function merely as labels, like in a numbered list. However, to reinforce the decimal's connection to fractions, and to make visible its place value denominator, it is recommended that decimals be read as their fraction equivalent. So, 2.57 should be read as "2 and 57 hundredths".
- Decimals can be compared and ordered like any other numbers, including fractions. Like fractions, decimals describe an amount that is relative to the whole.
- Many of the tools that are used to represent whole numbers can also be used to represent decimal numbers. It is important to emphasize 1 whole to recognize the representation in tenths and hundredths and not as wholes. For example, a base ten rod that was used to represent 10 ones can be used to represent 1 whole that is partitioned into tenths, and a base ten flat that was used to represent 100 ones can be used to represent 1 whole that is partitioned into hundredths.

B1.6 Fractions, Decimals, and Percents

round decimal numbers to the nearest tenth, in various contexts

Teacher supports

Key concepts

- Rounding makes a number simpler to work with and is often used when estimating computations, measuring, and making quick comparisons.
- Rounding compares a number to a given reference point – is it closer to this or to that? For example, is 1.75 closer to 1 or to 2? Is 1.84 closer to 1.8 or to 1.9?
    - Rounding 56.23 to the nearest tenth becomes 56.2, since 56.23 is closer to 56.2 than 56.3 (it is three hundredths away from 56.2 versus seven hundredths away from 56.3).
    - Rounding 56.28 to the nearest tenth becomes 56.3, since 56.28 is closer to 56.3 than 56.2.
    - If a decimal hundredth is exactly between two decimal tenths, the convention is to round up, unless the context suggests differently (e.g., 56.25 is rounded to 56.3.)
- In the absence of a context, numbers are typically rounded around the midpoint.

Note

- As with whole numbers, rounding decimal numbers involves making decisions about the level of precision needed. Whether a number is rounded up or down depends on the context and whether an overestimate or an underestimate is preferred.

B1.7 Fractions, Decimals, and Percents

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

Teacher supports

Key concepts

- Fractions, decimals, and percents all describe relationships to a whole. While fractions may use any number as a denominator, decimal units are in powers of ten (tenths, hundredths, and so on) and percents express a rate out of 100 ("percent" means "per hundred"). For both decimals and percents, the "denominator" (the value of the unit or the divisor) is hidden within the convention itself (i.e., the place value convention and the percent sign).
- Percent is a special rate, "per 100", and can be represented with the symbol %. The whole is partitioned into 100 equal parts. Each part is one percent, or 1%, of the whole.

- The unit fraction $\frac{1}{100}$ expressed as a quotient is $1 \div 100$ and the result is 0.01, which is read as one hundredth. This unit fraction and its decimal equivalent are equal to 1%.
    - Any fraction can be expressed as a fraction with a denominator of 100.
    - A decimal hundredth can be rewritten as a whole number percent (e.g., 0.56 = 56%).
    - If a fraction or decimal number can be expressed as a hundredth, it can be expressed as a whole number percent. For example, $\frac{4}{5}$ is equivalent to $\frac{80}{100}$, and 0.8 is equivalent to 0.80, and they are both equivalent to 80%.
- Common benchmark percentages include:
    - 1% = $\frac{1}{100}$ = 0.01
    - 10%, 20%, 30%, … = $\frac{1}{10}, \frac{2}{10}, \frac{3}{10}$, … = 0.1, 0.2, 0.3, …
    - 20% = $\frac{1}{5}$ or $\frac{2}{10}$ = 0.2
    - 25% = $\frac{1}{4}$ = 0.25
    - 50% = $\frac{1}{2}$ = 0.5
    - 75% = $\frac{3}{4}$ = 0.75
    - 100% = 1 = 1.00
- A percent can be greater than 100% (e.g., 150% = $\frac{150}{100}$ = 1.50).
- Some fractions are easier than others to express with a denominator of 100.

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:

B2.1 Properties and Relationships

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

Teacher supports

Key concepts

- The *commutative* property holds true for addition and for multiplication. The order in which the numbers are added or multiplied does not matter; the results will be the same (e.g., 45 + 62 = 62 + 45 and 12 × 6 = 6 × 12).
- The *associative* property holds true for addition and for multiplication. The pairs of numbers first added or multiplied does not matter; the results will be the same. For example, (24 + 365) + 15 = 24 + (365 + 15). Similarly, (12 × 3) × 5 = 12 × (3 × 5).
- The *distributive* property can be used to determine the product of two numbers. For example, to determine 12 × 7 the 12 can be rewritten as 10 and 2 and the sum of their products is determined (i.e., 12 ×7 = (10 + 2) × 7, which is (10 × 7) + (2 × 7)).
- Addition and subtraction are inverse operations. Any subtraction question can be thought of as an addition question (e.g., 154 – 48 = ? is the same as 48 + ? = 154). This inverse relationship can be used to perform and check calculations.
- Multiplication and division are inverse operations. Any division question can be thought of as a multiplication question, unless 0 is involved (e.g., 132 ÷ 11 = ? is the same as ? × 11 = 132) and vice versa. This inverse relationship can be used to perform and check calculations.
- Sometimes a property may be used to check an answer. For example, 12 × 7 may be first determined using the distributive property as (10 × 7) + (2 × 7). The factors could also be decomposed as 2 × 6 × 7 and the associative property applied: 2 × (6 × 7) to verify the results.
- Sometimes the reverse operation may be used to check an answer. For example, 32 ÷ 4 = 8 could be checked by multiplying 4 and 8 to determine if it equals 32.

Note

- This expectation supports most other expectations in the Number strand and is applied throughout the grade. Whether working with numbers or operations, recognizing and applying properties and relationships builds a strong foundation for doing mathematics.

- When addition is used to solve a subtraction question, this is often referred to as finding the missing addend.
- Addition and subtraction strategies can be used to think about and solve multiplication and division questions (see **SEs B2.6** and **B2.7**).
- The context of a problem may influence how students think about performing the calculations.
- Operation sense involves the ability to represent situations with symbols and numbers. Understanding the meaning of the operations, and the relationships between and amongst them, enables one to choose the operation that most closely represents a situation and most efficiently solves the problem given the tools at hand.
- Solving problems with more than one operation involves similar processes to solving problems with a single operation. For both types of problems:

  - Identify the actions and quantities in a problem and what is known and unknown.
  - Represent the actions and quantities with a diagram (physically or mentally).
  - Choose the operation(s) that match the actions to write the equation.
  - Solve by using the diagram (counting) or the equation (calculating).

- In multi-operation problems, sometimes known as two-step problems, there is an *ultimate* question (asking for the final answer or result being sought), and a *hidden* question (a step or calculation that must be taken to get to the final result). Identifying both questions is a critical part of solving these types of problems.
- The actions in a situation inform the choice of operation. The same operation can describe different situations:

  - Does the situation involve changing (joining, separating), combining, or comparing? Then the situation can be represented with addition and subtraction.
  - Does the situation involve equal groups (or rates), ratio comparisons, or arrays? Then the situation can be represented with multiplication and division.

- Representing a situation as an equation is often helpful for solving a problem. Identifying what is known and unknown in a situation informs how an equation is structured:

  - For addition and subtraction, is the start, change, or result unknown? Addition determines an unknown result. Subtraction determines an unknown starting amount or the amount of change.
  - For multiplication and division, is the total, the number of groups, or the size of the groups unknown? Multiplication names the unknown total (the product). Division determines either the unknown number of groups (quotative or grouping division) or the unknown size of each group (partitive or sharing division).

B2.2 Math Facts

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

Teacher supports

Key concepts

- The identity principle states that when multiplying an amount by 1 or dividing an amount by 1, the amount stays the same (e.g., $1 \times 5 = 5$ and $5 \div 1 = 5$).
- The facts of 1, 2, 5, and 10 can be used to determine the facts for other numbers. For example:
  - 2×12 can be determined by knowing 12×2.
  - 7×12 can be determined by knowing 7×10 and adding two more 7s.
  - 8×12 can be determined by knowing $(8 \times 5) + (8 \times 5) + (8 \times 2)$, which is $40 + 40 + 16$, or 96.
- Division facts can be determined using multiplication facts (e.g., $24 \div 6$ can be determined using the multiplication facts for 6).
- When multiplying any number by zero, the result is zero. For example, 5 groups of zero is $0 + 0 + 0 + 0 + 0 = 0$. Also, zero groups of anything is nothing.
- Zero divided by any non-zero number is zero. For example, $\frac{0}{5} = n$ can be rewritten as $5 \times n = 0$. If 5 represents the number of groups and n represents the number of items in each group, then there must be zero items in each group.
- Any number divided by zero has no meaning and is said to be “undefined”. For example, there is no answer to the question, “How many groups of 0 are in 5?”

Note

- Automatic recall of math facts is an important foundation for doing calculations, both mentally and with paper and pencil. For example, knowing facts up to 12 is important for mentally converting inches to feet, units that are commonly used in everyday life.
- The commutative property of multiplication (e.g., $11 \times 12 = 12 \times 11$) reduces, by almost half, the number of facts to be learned and recalled.
- The distributive property means that a multiplication problem can be split (decomposed) into smaller parts, and the products of those smaller parts can be added together (composed) to get the total. It enables a known fact to be used to find an unknown fact. For example, in building on the facts for 1 to 10:

- Multiplication by 11 adds one more row to the corresponding 10 fact; there are also interesting patterns in the 11 facts up to × 9 that make them quick to memorize.
- Multiplication by 12 adds a double of what is being multiplied to the corresponding 10 fact; it can also be thought of as the double of the corresponding × 6 fact.

- The associative property means that the × 12 facts can be decomposed into factors and rearranged to make a mental calculation easier. For example, 5 × 12 can be thought of as 5 × 6 × 2 or double 30.
- Practice is important for moving from understanding to automaticity. Practising with one set of number facts at a time (e.g., the 11 facts) helps build understanding and a more strategic approach to learning the facts.

B2.3 Mental Math

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

Teacher supports

Key concepts

- The inverse relationship between multiplication and division helps when doing mental math with powers of ten.
- Multiplying a number by 0.1 is the same as dividing a number by 10. Therefore, a shifting of the digit(s) to the right by one place can be visualized. For example, 500 × 0.1 = 50; 50 × 0.1 = 5; and 5 × 0.1 = 0.5.
- Multiplying a number by 0.01 is the same as dividing a number by 100. Therefore, a shifting of the digit(s) to the right by two places can be visualized. For example, 500 × 0.01 = 5; 50 × 0.01 = 0.5; and 5 × 0.01 = 0.05.
- Mental math strategies for addition and subtraction of whole numbers can be used with decimal numbers. The strategies may vary depending on the numbers given. For example:
    - If given 0.12 + 0.15, the like units can be combined to get 0.27.
    - If given 44 − 31.49, 31.49 can be rounded to 31.5, and then 31.5 subtracted from 44 to get 12.5.

Note

- Mental math may or may not be quicker than paper-and-pencil strategies, but speed is not the goal. The value of mental math is in its portability and flexibility, since it does not require a calculator or paper and pencil. Practising mental math strategies also deepens an understanding of numbers.
- Mental math involves using flexible strategies that build on basic facts, number relationships, and counting.
- As numbers and calculations become too difficult to keep track of mentally, partial quantities are written down and totalled as a separate step.
- When adding and subtracting numbers, the like units are combined. For example, hundreds with hundreds, tens with tens, ones with ones, tenths with tenths, and hundredths with hundredths.
- Estimation can be used to check the reasonableness of calculations and should be continually encouraged when students are doing mathematics.

B2.4 Addition and Subtraction

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

Teacher supports

Key concepts

- Situations involving addition and subtraction may involve:
  - adding a quantity on to an existing amount or removing a quantity from an existing amount;
  - combining two or more quantities;
  - comparing quantities.
- Acting out a situation, by representing it with objects, a drawing or a diagram, can help identify the quantities given in a problem and what quantity needs to be determined.
- Set models can be used to add a quantity on to an existing amount or to remove a quantity from an existing amount.
- Linear models can be used to determine the difference by comparing two quantities.
- Part-whole models can be used to show the relationship between what is known and what is unknown and how addition and subtraction relate to the situation.

Note

- An important part of problem solving is the ability to choose the operation that matches the action in a situation. For additive situations – situations that involve addition or subtraction – there are three "problem types":

    - *Change* situations, where one quantity is changed by having an amount either *joined* to it or *separated* from it. Sometimes the result is unknown; sometimes the starting point is unknown; sometimes the change is unknown.
    - *Combine* situations, where two quantities are *combined*. Sometimes one part is unknown; sometimes the other part is unknown; sometimes the result is unknown.
    - *Compare* situations, where two quantities are being *compared*. Sometimes the larger amount is unknown; sometimes the smaller amount is unknown; sometimes the difference between the two amounts is unknown.

- A variety of strategies may be used to add or subtract, including algorithms.
- An algorithm describes a process or set of steps to carry out a procedure. A standard algorithm is one that is known and used by a community. Different cultures have different standard algorithms that they use to perform calculations.
- The most common standard algorithms for addition and subtraction in North America use a compact organizer to *decompose* and *compose* numbers based on place value. They begin with the smallest unit – whether it is the unit (ones) column, decimal tenths, or decimal hundredths – and use regrouping or trading strategies to carry out the computation. (See **Grade 4, SE B2.4**, for a notated subtraction example with decimals and **Grade 3, SE B2.4**, for a notated addition example with whole numbers; the same process applies to decimal hundredths.)
- When carrying out an addition or subtraction algorithm, only common units can be combined or separated. This is particularly noteworthy when using the North American standard algorithms with decimals because unlike with whole numbers, the smallest unit in a number is not always common (e.g., 90 − 24.7). The expression "line up the decimals" is really about making sure that common units are aligned. Using a zero as a placeholder is one strategy to align unit values. Unpacking the compactness and efficiency of the standard algorithm strengthens understanding of place value and the properties of addition and subtraction.

B2.5 Addition and Subtraction

add and subtract fractions with like denominators, in various contexts

Teacher supports

Key concepts

- As with whole numbers and decimal numbers, only common units can be combined or separated. This is also true for fractions. Adding fractions with like denominators is the same as adding anything with like units:
    - 3 apples and 2 apples are 5 apples.
    - 3 fourths and 2 fourths are 5 fourths.
- Fractions with the same denominator can be added by combining the counts of their unit. For example, 3 one fourths and 2 one fourths are 5 one fourths (i.e., $\frac{3}{4}+\frac{2}{4}=\frac{5}{4}$).
- Fractions with the same denominator can be subtracted by comparing the counts of their unit. For example, 7 one fourths is more than 2 one fourths by 5 one fourths (i.e., $\frac{7}{4}-\frac{2}{4}=\frac{5}{4}$).

Note

- The numerator in a fraction can describe the count of unit fractions (e.g., 4 one thirds is written in standard fractional form as $\frac{4}{3}$).
- The type of models and tools that are used to represent the addition or subtraction of fractions with like denominators can vary depending on the context. For example:
    - Hops on a number line may represent adding a fraction on to an existing amount or subtracting a fraction from an existing amount. The existing amounts are positions on a number line.
    - An area model may be used to combine fractional areas or remove fractional areas.

B2.6 Multiplication and Division

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

Teacher supports

Key concepts

- Numbers multiplied together are called factors, and their result is called a product.
- The multiplication of two two-digit numbers using the distributive property can be modelled as the area of a rectangle:

  - When the dimensions of a rectangle are decomposed, the area is also decomposed.
  - When the two-digit length is decomposed into tens and ones, and the two-digit width is decomposed into tens and ones, the area is subdivided into four areas – tens by tens, ones by tens, tens by ones, and ones by ones.
  - Known facts can be used to determine each of the smaller areas.
  - The smaller areas are added together resulting in the product.

- The area model is a visual model of the standard algorithm showing the sum of the partial products.
- The product can be determined using an area model or the standard algorithm.

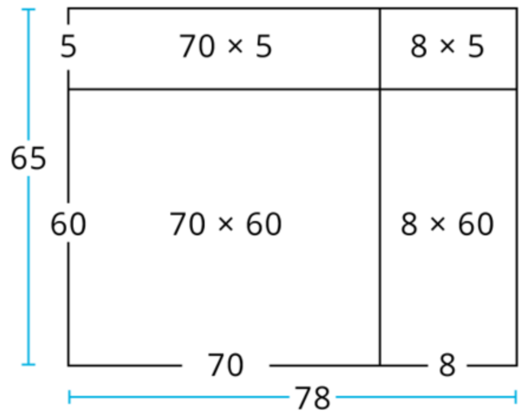
Note

- The context of multiplication problems may involve:

  - repeated equal groups;
  - scale factors – ratio comparisons, rates, and scaling;
  - area measures;
  - combinations of attributes given two or more sets (see **Data, D2.2**).

- The array can be a useful model for showing multiplication and division because it structures repeated groups of equal size into rows and columns. The array makes visual connections to skip counting, the distributive property, the inverse relationship between multiplication and division, and the measurement of area.
- The area model using a rectangle is sometimes referred to as an open array. Even though the area model can be used to represent the multiplication of any two numbers, support students in not confusing it with the actual context of the problem.
- Open arrays show how a multiplication statement can be thought of as the area of a rectangle ($b \times h$). An unknown product is decomposed into partial products (smaller rectangles) with "dimensions" that access known facts and friendly numbers. The partial products are then totalled (see **Grade 4, SE B2.4**, for more details). Standard algorithms for multiplication are based on the distributive property.
- The most common standard algorithm for multiplication in North America is a compact and efficient organizer that decomposes factors based on the distributive property. It creates partial products, which are then added together to give the total product. There are variations on how this algorithm is recorded, with some being more compact than others; however, the underlying process is the same. Priority should be given to understanding, especially when an algorithm is first introduced.

What It Looks Like



How It Is Written: Variation 1		How It Is Written: Variation 2		What It Means
78 × 65		78 × 65		
390	➡	40	➡	5 × 8 = 40
		350	➡	5 × 70 = 350
4680	➡	480	➡	60 × 8 = 480
		4200	➡	60 × 70 = 4200
5070		5070		

B2.7 Multiplication and Division

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

Teacher supports

Key concepts

- Multiplication and division are inverse operations (see **B2.1**).
  - The numbers multiplied together are called factors. The result of a multiplication is called the product.

- When a multiplication statement is rewritten as a division statement, the product is referred to as the dividend, one of the factors is the divisor, and the other factor is the quotient (result of division).

- Using the area model of a rectangle to solve a division question draws on multiplication as its inverse operation. A rectangle is gradually created by arranging all the square units (dividend) into rows and columns for a given dimension (divisor).
- Determining the quotient using an algorithm requires an understanding of place value, multiplication facts, and subtraction.
- Division does not always result in whole number amounts. For example, 320 ÷ 15 is 21 with a remainder of 5, which can also be expressed as $\frac{5}{15}$ or one third.
- The context of a problem can influence how the remainder is represented and interpreted. For example:
    - A rope is 320 cm long and is divided into 15 equal sections; how long is each section? (320 ÷ 15= ?). Each section is $21\frac{1}{3}$ centimetres. In this case, measuring $\frac{1}{3}$ of a centimetre of ribbon is possible, given that it is a linear dimension.
    - A van holds 18 students. There are 45 students. How many vans are needed to transport the students? Dividing 45 by 18 means that 2.5 vans are needed. This requires rounding up to 3 vans.

Note

- The context of a division problem may involve:
    - repeated equal groups;
    - scale factors – ratio comparisons, rates, and scaling (see **Grade 3, SE B2.9**);
    - area measures;
    - combinations of attributes.

- Multiplication and division are related and therefore the rectangle area model can be used to show how a division question can be solved using repeated addition or repeated subtraction. The area model using a rectangle is sometimes referred to as an open array. Even though the area model can be used to represent division, support students in not confusing it with the actual context of the problem.
- For each division situation, there are two division types:
    - equal-sharing division (sometimes called partitive division):
        - *What is known:* the *total* and *number* of groups;
        - *What is unknown*: the *size* of the groups;

        - *The action*: a total is shared equally among a given number of groups.

    - equal-grouping division (sometimes called measurement or quotative division):

        - *What is known*: the *total* and the *size* of groups.
        - *What is unknown*: the *number* of groups.
        - *The action*: from a total, equal groups of a given size are measured.

- Note that since area situations use *base* and *height* to describe the size and number of groups, and because these dimensions are interchangeable, the two types of division are indistinguishable.
- Often division does not result in whole number amounts. In the absence of a context, remainders can be treated as a leftover quantity, or they can be distributed equally as fractional parts across the groups. For example, the answer to 17 ÷ 5 can be written as 3 with 2 remaining, or as 3 and $\frac{2}{5}$, where the 2 left over are distributed among 5. So, the result is $3\frac{2}{5}$ or 3.4.
- In real-world situations, the context determines how a remainder should be dealt with:

    - Sometimes the remainder is ignored, leaving a smaller amount (e.g., how many boxes of 5 can be made from 17 items?).
    - Sometimes the remainder is rounded up, producing a greater amount (e.g., how many boxes are needed to pack 17 items into boxes of 5?).
    - Sometimes the remainder is rounded to the nearest whole number, producing an approximation (e.g., if 5 people share 17 items, approximately how many will each receive?).

- There are two common algorithms used for division in North America (with variations on each). In both algorithms the recording scheme is not immediately clear, and both will require direct instruction for students to understand and replicate the procedure. Visual models are very important for building conceptual understanding.

    - The most common division algorithm, sometimes referred to as “long division” or “bring-down division”, decomposes the total using place value. Unlike other algorithms, this algorithm starts at the left and moves to the right. Column by column, it “shares” each place-value amount and trades the remainder for smaller pieces, which it adds to the amount in the next column. The partial quotients are then added together for the full quotient. Note that there are variations in how long division is recorded for this algorithm.

Variation 1

$$
\begin{array}{r|l}
1 & \\
30 & 31\tfrac{3}{12} \\
\hline
12\overline{)375} & \\
-\,360 & \\
\hline
15 & \\
-\,12 & \\
\hline
3 &
\end{array}
$$

Variation 2

$$
\begin{array}{r}
31\tfrac{3}{12} \\
12\overline{)375} \\
-\,36\downarrow \\
\hline
15 \\
-\,12 \\
\hline
3
\end{array}
$$

- Another well-known algorithm, sometimes called the “repeated subtraction” or “grouping division” algorithm, uses estimation and “think multiplication” to produce partial products. The partial products can be groups of any size, and are determined by a combination of estimation strategies, known facts, and mental strategies. Unlike other algorithms, the amount to be shared is not decomposed into place-value partitions but is considered as a whole.

$$
\begin{array}{r|l}
31\tfrac{3}{12} & \\
12\overline{)375} & \\
-\,240 & \times\,20 \\
\hline
135 & \\
-\,120 & \times\,10 \\
\hline
15 & \\
-\,12 & \times\,1 \\
\hline
3 & 31
\end{array}
$$

B2.8 Multiplication and Division

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

Teacher supports

Key concepts

- Multiplication and division can describe situations involving repeated equal groups.
- The multiplication of a whole number with a unit fraction such as $4 \times \frac{1}{3}$ can be interpreted as 4 groups of one third of a whole and can be determined using repeated addition. For example, $4 \times \frac{1}{3}$ = 4 one thirds = $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{4}{3}$.

- Since multiplication and division are inverse operations, the division of a whole number by a unit fraction such as $4 \div \frac{1}{3}$ can be interpreted as “How many one thirds are in 4 wholes?” Since it takes 3 one thirds to make 1 whole, it will take four times as many to make 4 wholes, so $4 \div \frac{1}{3} = 12$.

Note

- Counting unit fractions, adding unit fractions with like denominators, and multiplying unit fractions all represent the same action of repeating (or iterating) an equal group, in this case a unit fraction. This count is also reflected in the numerator.
- The use of drawings, tools (fraction strips, number lines), and objects can help visualize the role of the unit fraction to solve multiplication and division problems.

B2.9 Multiplication and Division

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

Teacher supports

Key concepts

- A ratio describes the multiplicative relationship between two quantities.
- Ratios can compare one part to another part of the same whole, or a part to the whole. For example, if there are 12 beads in a bag that has 6 yellow beads and 6 blue beads, then:
  - the ratio of yellow beads to blue beads is 6 to 6 (6 : 6) or 1 to 1 because there is one yellow bead for every blue bead;
  - the ratio of yellow beads to the total number of beads is 6 to 12 (6 : 12) or 1 to 2, and this can be interpreted as one half of the beads in the bag are yellow, or that there are twice as many beads in the bag than the number that are yellow.
- Determining equivalent ratios involves scaling up or down. The ratio of blue marbles to red marbles (10 : 15) can be scaled down to 2 : 3 or scaled up to 20 : 30. In all cases, there are two thirds ($\frac{2}{3}$) as many blue marbles as red marbles.
- A rate describes the multiplicative relationship between two quantities expressed with different units. For example, 1 dime to 10 cents can be expressed as 1 dime per 10 cents or 2 dimes per 20 cents, or 3 dimes per 30 cents and so on.

Note

- Ratios compare two (or more) different quantities to each other using multiplication or division. This means the comparison is *relative* rather than *absolute*. For example, if there are 10 blue marbles and 15 red marbles:
  - an absolute comparison uses addition and subtraction to determine that there are 5 more red marbles than blue ones;
  - a relative comparison uses multiplication and division to determine that there are $\frac{2}{3}$ as many blue marbles as red marbles.
- Like ratios, rates make comparisons based on multiplication and division; however, rates compare two related but different measures or quantities. For example, if 12 cookies are eaten by 4 people, the rate is 12 cookies per 4 people. An equivalent rate is 6 cookies per 2 people. A unit rate is 3 cookies per person.
- A three-term ratio shows the relationship between three quantities. The multiplicative relationship can differ among the three terms. For example, there are 6 yellow beads, 9 red beads, and 2 white beads in a bag. This situation can be expressed as a ratio of yellow : red : white = 6 : 9 : 2. The multiplicative relationship between yellow to white is 6 : 2 or 3 : 1, meaning there are three times more yellow beads than white beads. The multiplicative relationship between yellow and red beads is 6 : 9 or 2 : 3, meaning there are two thirds as many yellow beads as there are red beads.
- A ratio table is very helpful for noticing patterns when a ratio or rate is scaled up or down. Ratio tables connect scaling to repeated addition, multiplication and division, and proportional reasoning.
- A ratio or rate relationship can also be described using fractions, decimals, and percents.

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:

C1.1 Patterns

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

Teacher supports

Key concepts

- Repeating patterns have a pattern core that is repeated over and over.
- In growing patterns, there is an increase in the number of elements or the size of the elements from one term to the next.
- In shrinking patterns, there is a decrease in the number of elements or the size of the elements from one term to the next.
- Many real-life objects and events can be viewed as having more than one type of pattern.

Note

- Growing and shrinking patterns are not limited to linear patterns.

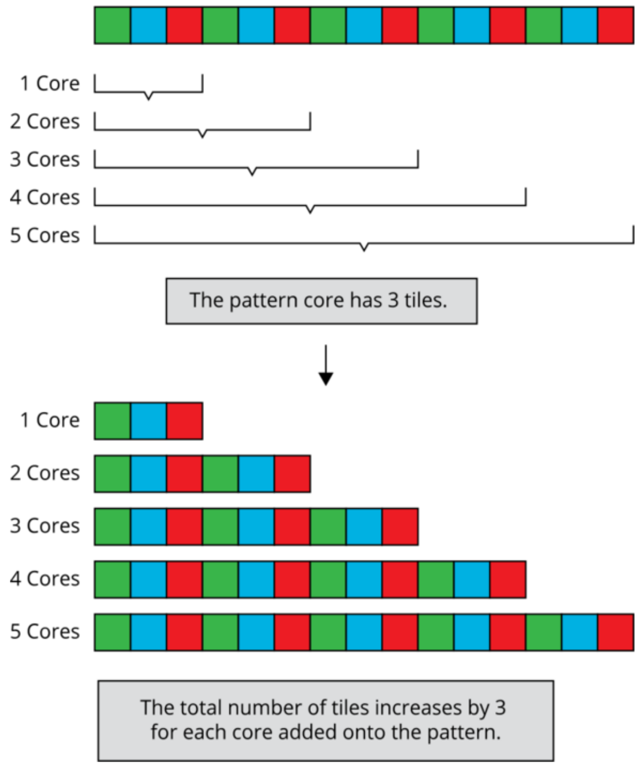
C1.2 Patterns

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

Teacher supports

Key concepts

- Growing patterns are created by increasing the number of elements or the size of the elements in each iteration (term).
- A growing pattern can be created by repeating a pattern’s core. Each iteration shows how the total number of elements grows with each addition of the pattern core.



- Shrinking patterns are created by decreasing the number of elements or the size of the elements in each iteration.
- In translating a pattern from a concrete representation to a table of values and a graph, each iteration of the pattern can be referred to as the term number, and the number of elements in each iteration can be referred to as the term value. The term value is dependent on the term number. The term number (x) is represented on the horizontal axis of the Cartesian plane, and the term value (y) is represented on the vertical axis. Each point (x, y) on the Cartesian plane is plotted to represent the pattern. In a table of values, the term number is shown in the left-hand column and the term value is shown in the right-hand column.
- A pattern’s structure is the same when a pattern is translated from one representation to another.

Note

- The creation of growing and shrinking patterns in this grade is not limited to linear patterns.
- For (x, y), the x-value is the independent variable and the y-value is the dependent variable.

C1.3 Patterns

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

Teacher supports

Key concepts

- Patterns can be extended because they are repetitive by nature.
- Pattern rules are generalizations about a pattern, and they can be described in words.
- Patterns can be extended in multiple directions, showing what comes next and what came before.
- To make a near prediction about a pattern is to state or show what a pattern will look like just beyond the given representation of that pattern. The prediction can be verified by extending that pattern.
- To make a far prediction about a pattern is to state or show what a pattern will look like well beyond the given representation of that pattern. Often calculations are needed to make an informed prediction that can be justified.
- Identifying the missing elements in a pattern represented using a table of values may require determining the term number (x) or the term value (y).
- Identifying the missing elements in a pattern represented on a graph may require determining a point (x, y) within the given representation or beyond it, in which case the pattern will need to be extended.
- The algebraic expression that represents a linear growing pattern is also referred to as the general term or the nth term. It can be used to solve for the term value or the term number.

Note

- Determining a point within the graphical representation of a pattern is called interpolating.
- Determining a point beyond the graphical representation of a pattern is called extrapolating.

C1.4 Patterns

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

Teacher supports

Key concepts

- Patterns can be used to understand relationships among numbers.
- There are many patterns within the decimal number system.

Note

- Many number strings are based on patterns and on the use of patterns to develop a mathematical concept.
- The use of the word "strings" in coding is different from its use in "number strings".

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:

C2.1 Variables and Expressions

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

Teacher supports

Key concepts

- Algebraic expressions are a combination of variables, operations, and numbers, such as 3*a* and *a* + *b.*
- Algebraic expressions are used to generalize relationships. For example, the perimeter of a square is four times its side length (*s*), which can be expressed as 4*s*.
- For expressions like 3*a*, it is understood that the operation between the number, 3, and the variable, *a*, is multiplication.
- When two expressions are set with an equal sign, it is called an equation.

Note

- The letter *x* is often used as a variable. It is important for students to know when it is being used as a variable.

- The letters used as a symbol are often representative of the words they represent. For example, the letters *l* and *w* are often used to represent the *length* and *width* of a rectangle, and also the formula for the area of a rectangle, $A = lw$.
- Many forms of technology require expressions like $3a$ to be entered as 3*a, where the asterisk is used to denote multiplication. The expression $a \div 2$ is entered as $a/2$.
- Words and abbreviated words are used in a variety of coding languages to represent variables and expressions. For example, in the instruction: "input 'the side length of a square', sideA", the computer is defining the variable sideA and stores whatever the user inputs into its temporary location.

C2.2 Variables and Expressions

evaluate algebraic expressions that involve whole numbers

Teacher supports

Key concepts

- To evaluate an algebraic expression, the variables are replaced with numerical values and calculations are performed based on the order of operations.

Note

- When students are working with formulas, they are evaluating expressions.
- Replacing the variables with numerical values often requires the use of brackets. For example, the expression $4s$ becomes $4(s)$ and then $4(5)$ when $s = 5$. The operation between 4 and (5) is understood to be multiplication.
- Many coding applications involve algebraic expressions being evaluated, and this may be carried out in several steps. For example, the instruction: "input 'the side of a square', sideA" is instructing the computer to define the variable sideA and store whatever the user inputs into the temporary location called sideA. The instruction: "calculate 4*sideA, perimeterA" instructs the computer to take the value that is stored in "sideA" and multiply it by 4, and then store that result in the temporary location, which is another variable, called perimeterA.

C2.3 Equalities and Inequalities

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

Teacher supports

Key concepts

- Equations are mathematical statements such that the expressions on both sides of the equal sign are equivalent.
- In equations, variables are used to represent unknown quantities.
- There are many strategies for solving equations, including guess-and-check, the balance model, and the reverse flow chart.
- Formulas are equations in which any of the variables can be solved for. When solving for a variable in a formula, values for the variables are substituted in, and then further calculations may be needed depending on which variable is being solved for. For example, for $A = lw$, if $l = 10$ and $w = 3$, then $A = (10)(3) = 30$. If $A = 50$ and $l = 10$, then $50 = 10w$, and solving this will require either using known multiplication facts or dividing both sides by 10 to solve for w.

Note

- The strategy of using a reverse flow chart can be used to solve equations like $\frac{m}{4} - 2 = 10$; for example:

$m \rightarrow \div 4 \rightarrow - 2 \rightarrow 10$

$48 \leftarrow \times 4 \leftarrow + 2 \leftarrow 10$

- The flow chart used in coding is different from the reverse flow chart that can be used to solve equations.
- Many coding applications involve formulas and solving equations.

C2.4 Equalities and Inequalities

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

Teacher supports

Key concepts

- Inequalities can be solved like an equation, and then values need to be tested to identify those that hold true for the inequality.

- A number line shows the range of values that hold true for an inequality. An open dot on a number line is used when an inequality involves "less than" or "greater than", and a closed dot is used when it also includes "equal to".

Note

- The solution for an inequality that has one variable, such as $x + 3 < 4$, can be graphed on a number line.
- The solution for an inequality that has two variables, such as $x + y < 4$, can be graphed on a Cartesian plane, showing the set of points that hold true.

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:

C3.1 Coding Skills

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

Teacher supports

Key concepts

- Conditional statements are a representation of binary logic (yes or no, true or false, 1 or 0).
- A conditional statement evaluates a Boolean condition, something that can be either true or false.
- Conditional statements are usually implemented as "if…then" statements or "if…then…else" statements. If a conditional statement is true, then there is an interruption in the current flow of the program being executed and a new direction is taken or the program will end.

- Conditional statements, like loops, can be nested to allow for a range of possible outcomes or to implement decision trees.

Note

- Coding can support the development of a deeper understanding of mathematical concepts.
- Coding can be used to learn how to automate simple processes and enhance mathematical thinking. For example, students can code expressions to recall previously stored information (defined variables), then input values (e.g., from a sensor, count, or user input) and redefine the value of the variable. For examples of these, refer to the notes in **SEs C2.1**, **C2.2**, and **C2.3**.
- The construction of the code should become increasingly complex and align with other developmentally appropriate learning.

C3.2 Coding Skills

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

Teacher supports

Key concepts

- Reading code is done to make a prediction about what the expected outcome will be. Based on that prediction, one can determine if the code needs to be altered prior to its execution.
- Reading code helps with troubleshooting why a program is not able to execute.
- Code must sometimes be altered so that the expected outcome can be achieved.
- Code can be altered to be used for a new situation.

Note

- When students are reading code, they are exercising problem-solving skills related to predicting and estimating.
- When code is altered with the aim of reaching an expected outcome, students get instant feedback when it is executed. Students exercise problem-solving strategies to further alter the program if they did not get the expected outcome. If the outcome is as expected, but it gives the wrong answer mathematically, students will need to alter their thinking.

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

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.

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:

D1.1 Data Collection and Organization

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

Teacher supports

Key concepts

- Sampling is gathering information by using a subset of a population. It is more efficient and practical than trying to get data from every item in a population. It is more cost effective too.
- Simple random sampling is a method used to obtain a subset such that each subject in the population has an equal chance of being selected (e.g., randomly selecting 10% of the population using a random generator).
- Stratified random sampling involves partitioning the population into strata and then taking a random sample from each. For example, a school population could be divided into two strata: one with students who take a bus to school and the other with those who don't take a bus. Then a survey could be given to 10% of the population randomly selected from each of these strata.
- Systematic random sampling is used when the subjects from a population are selected through a systematic approach that has been randomly determined. For example, a sample could be determined from an alphabetized list of names, using a starting name and count (e.g., every fourth name) that are randomly selected.
- Data from a sample is used to make judgements and predictions about a population.

Note

- A census is an attempt to collect data from an entire population.

D1.2 Data Collection and Organization

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

Teacher supports

Key concepts

- The type and amount of data to be collected is based on the question of interest. Data can either be qualitative (e.g., colour, type of pet) or quantitative (e.g., number of pets, height).
- Depending on the question of interest, the data may need to be collected from a primary or a secondary source.
- Depending on the question of interest, a random sample of the population may need to be taken. Types of sampling methods include simple random sampling, stratified random sampling, and systematic random sampling.
- A relative frequency table is an extension of a frequency table and shows each category expressed as a proportion of the total frequencies, represented using fractions, decimals, or percentages. The sum of the relative frequencies is 1 or 100%.

Note

- Every subject in the sample must be collected in the same manner in order for the data to be representative of the population.

D1.3 Data Visualization

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

Teacher supports

Key concepts

- Relative frequencies can be used to compare data sets that are of different sizes.
- Stacked-bar graphs can be created in more than one way to show different comparisons, including with horizontal and vertical bars.
- Stacked-bar graphs display the data values proportionally. Stacked-bar graphs can be used to display percent, or relative frequency. Each bar in the graph represents a whole, and each of the segments in a bar represents a different category. Different colours are used within each bar to easily distinguish between categories.
- The source, titles, labels, and scales provide important information about data in a graph or table:

- The source indicates where the data was collected.
- The title introduces the data contained in the graph.
- Labels on the axes of a graph describe what is being measured (the variable). A key on a stacked-bar graph indicates what each portion of the bar represents.
- Scales are indicated on the axis showing frequencies in bar graphs and in the key of pictographs.
- The scale for relative frequencies is indicated using fractions, decimals, or percents.

Note

- The type of scale chosen is dependent on whether frequencies or relative frequencies will be displayed on the graphs.
- Depending on the scale that is chosen, it may be necessary to estimate the length of the bars or the portions of the bars on a stacked-bar graph.

D1.4 Data Visualization

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

Teacher supports

Key concepts

- Infographics are used in real life to share data and information on a topic, in a concise and appealing way.
- Infographics contain different representations, such as tables, plots, and graphs, with minimal text.
- Information to be included in an infographic needs to be carefully considered so that it is clear, concise, and connected.
- Infographics tell a story about the data with a specific audience in mind. When creating infographics, students need to create a narrative about the data for that audience.

Note

- Creating infographics has applications in other subject areas, such as communicating key findings and messages in STEM projects.

D1.5 Data Analysis

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

Teacher supports

Key concepts

- The mean, median and mode can be determined for quantitative data. Only the mode can be determined for qualitative data.
- A variable can either have one mode, multiple modes, or no modes.
- The use of the mean, median, or mode to make an informed decision is relative to the context.

Note

- The mean, median, and mode are the three measures of central tendency.

D1.6 Data Analysis

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

Teacher supports

Key concepts

- Different representations are used for different purposes to convey different types of information.
- Stacked-bar graphs present information in a way that allows the reader to compare multiple data sets proportionally.

- Sometimes graphs misrepresent data or show it inappropriately, which could influence the conclusions that we make. Therefore, it is important to always interpret presented data with a critical eye.
- Data presented in tables, plots, and graphs can be used to ask and answer questions, draw conclusions, and make convincing arguments and informed decisions.
- Sometimes presented data challenges current thinking and leads to new and different conclusions and decisions.
- Questions of interest are intended to be answered through the analysis of the representations. Sometimes the analysis raises more questions that require further collection, representation, and analysis of data.

Note

- There are three levels of graph comprehension that students should learn about and practise:
    - Level 1: information is read directly from the graph and no interpretation is required.
    - Level 2: information is read and used to compare (e.g., greatest, least) or perform operations (e.g., addition, subtraction).
    - Level 3: information is read and used to make inferences about the data using background knowledge of the topic.
- Working with misleading graphs supports students to analyse their own graphs for accuracy.

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:

D2.1 Probability

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

Teacher supports

Key concepts

- The probability of events is measured in numeric values ranging from 0 to 1.
- Fractions can be used to express the probability of events across the 0 to 1 continuum.

Note

- Have students make connections between the words to describe the likelihood of events (from Grade 4) and possible fractions that can be used to represent those benchmarks on the probability line.

D2.2 Probability

determine and compare the theoretical and experimental probabilities of an event happening

Teacher supports

Key concepts

- The more trials done in an experiment, the closer the experimental probability will be to the theoretical probability.
- The sum of the probabilities of all possible outcomes is 1.
- The probability of an event can be used to predict the likelihood of that event happening again in the future.

Notes

- “Odds in favour” is a comparison of the probability that an event will occur to the probability that the event will not occur (complementary events). For example, the odds in favour of rolling a 6 is $\frac{1}{6} : \frac{5}{6}$, which can be simplified to 1 : 5 since the fractions are both relative to the same whole.

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:

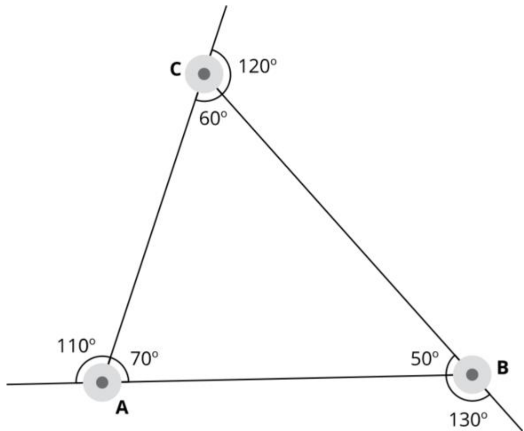
E1.1 Geometric Reasoning

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

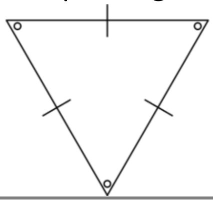
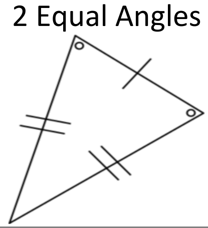
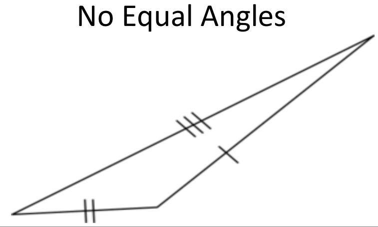
Teacher supports

Key concepts

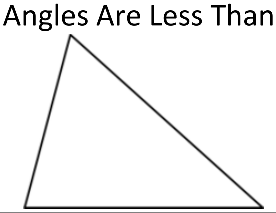
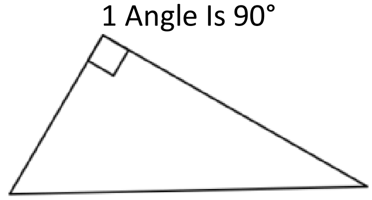
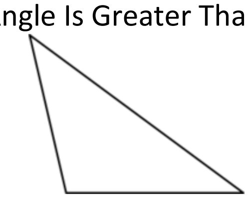
- Triangles have been an important shape for mathematicians throughout history, and they continue to be significant in engineering, astronomy, navigation, and surveying.
- Geometric properties are specific attributes that define a “class” of shapes or objects. The following are geometric properties of triangles:
  - All triangles have three sides and three angles.
  - The combined length of any two sides of a triangle is always greater than the length of the third side.
  - The interior angles of a triangle always add up (sum) to 180° (e.g., 70° + 60° + 50° = 180°).
  - The exterior angles of a triangle always add up (sum) to 360° (e.g., 110° + 120° + 130° = 360°).
  - The interior angle and its corresponding exterior angle always add up (sum) to 180° (e.g., 130° + 50° = 180°).



- Triangles can be classified by the number of equal side lengths or number of equal angles:

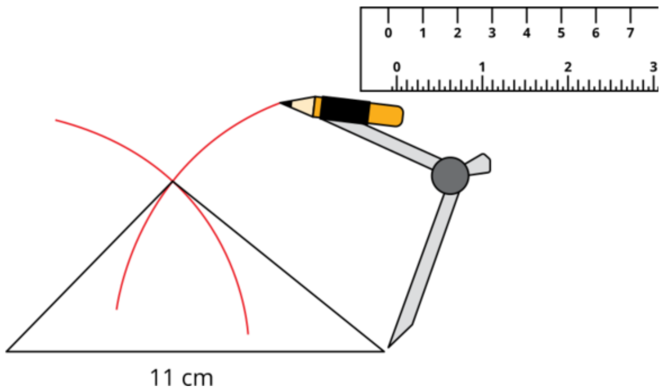
Classifying Triangles by Number of Equal Sides or Number of Equal Angles		
Equilateral Triangle: 3 Equal Sides 3 Equal Angles 	**Isosceles Triangle:** 2 Equal Sides 2 Equal Angles 	**Scalene Triangle:** No Equal Sides No Equal Angles 

- Triangles can be classified by the type of angle measures:

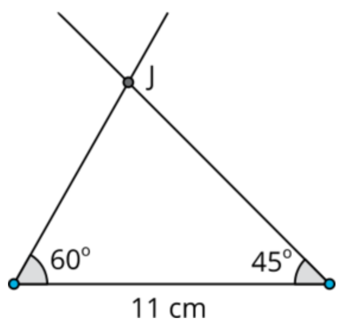
Classifying Triangles by Type of Angle Measures		
Acute Triangle: All Angles Are Less Than 90° 	Right Triangle: 1 Angle Is 90° 	Obtuse Triangle: 1 Angle Is Greater Than 90° 

- There are different techniques for constructing triangles depending on what is known and unknown:
    - When all side lengths of a triangle are known but the angles are unknown, a ruler and compass can be used to construct the triangle. To do so, one could draw the length of one of the sides, then set the compass for the length of another side. The compass can then be put at one of the ends of the line and an arc drawn. Now the compass should be set to the length of the third side and set on the other end of

the line to draw another arc. Where the two arcs intersect is the third vertex of the triangle (see the diagram below). The sides can be completed by drawing a line from the ends of the original line to the point of intersection.



- When one side length and all the angles of a triangle are known, a protractor and a ruler can be used to construct the triangle. The unknown vertex is the point where the arms of the angles intersect:



Note

- Triangles can also be constructed using dynamic geometry applications in many ways, including by transforming points and by constructing circles.

E1.2 Geometric Reasoning

identify and construct congruent triangles, rectangles, and parallelograms

Teacher supports

Key concepts

- Congruent two-dimensional shapes can be transposed exactly onto each other. Congruent shapes have congruent angles and congruent lengths.
- If all the side lengths of two triangles are congruent, all the angles will also be congruent.
- If all the angles of two triangles are congruent, it is not necessarily true that the side lengths are congruent.
- Parallelograms, including rectangles and squares, require a combination of congruent angles and congruent side lengths to be congruent.
- Constructing congruent shapes involves measuring and using protractors and rulers. For more information on using protractors, see **SE E2.4**. For more information on using rulers, see **Grade 2, SE E2.3**.

E1.3 Geometric Reasoning

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

Teacher supports

Key concepts

- Three-dimensional objects can be represented in two dimensions.
- Given accurate top, front, and side views of an object, with enough information included, the object can be reproduced in three dimensions. Conventions exist (e.g., shading squares to show different heights; using lines as way to show changes in elevations) to clarify any potential ambiguities.
- Architects and builders use plan (top view) and elevation (side view) drawings to guide their construction. STEM (science, technology, engineering, and mathematics) professionals use three-dimensional modelling apps to model a project before building a prototype. Visualizing objects from different perspectives is an important skill used in many occupations, including all forms of engineering.

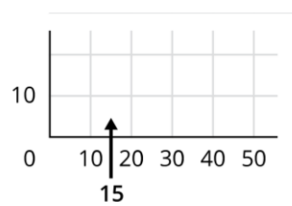
E1.4 Location and Movement

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

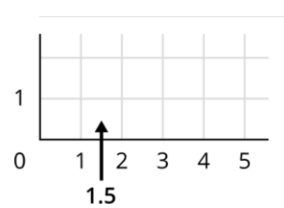
Teacher supports

Key concepts

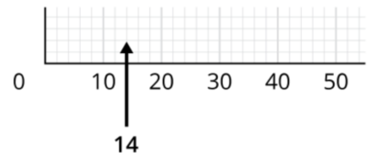
- The X-Y Cartesian plane uses two perpendicular number lines to describe locations on a grid. The *x*-axis is a horizontal number line, the *y*-axis is a vertical number line, and these two number lines intersect perpendicularly at the origin, (0, 0).
- Pairs of numbers (coordinates) describe the precise location of any point on the plane. The coordinates are enclosed by parentheses as an ordered pair (*x*, *y*). The first number in the pair describes the horizontal distance from the origin, and the second number describes the vertical distance from the origin.
- The point (1, 5) is located 1 unit to the right of the origin (along the *x*-axis) and 5 units above the *x*-axis. As a translation from the origin, the point (1, 5) is right 1 unit and up 5 units.
- The *x*- and *y*-axes on the Cartesian plane, like any other number line or graduated measurement tool, are continuous scales that can be infinitely subdivided into smaller increments. The numbering of the axes may occur at any interval.
    - Sometimes a gridline is marked in multiples of a number and the subdivisions must be deduced (e.g., for an axis marked in multiples of 10, a coordinate of 15 is half the distance between 10 and 20):



    - Sometimes the axes are labelled in whole number increments, and the location of a decimal coordinate must be deduced (e.g., for an axis labelled 1, 2, 3, 4, ..., a coordinate of 1.5 is plotted five tenths or one half of the distance between 1 and 2):



    - Sometimes not every gridline is labelled, and the value of the unlabelled grid line must be deduced (e.g., when every fifth line is labelled 10, 20, 30, 40, …):



- The number lines on the Cartesian plane extend infinitely in all directions and include both positive and negative numbers, which are centred by the origin, (0, 0). In the first quadrant of the Cartesian plane, the *x*- and *y*-coordinates are both positive.

E1.5 Location and Movement

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

Teacher supports

Key concepts

- Transformations on a shape, result in changes to its position or its size. As a shape transforms, its vertices (points on a grid) move. The transformation describes the results of the movement. This explains how transformations involve location and movement.
- A translation involves distance and direction. Every point on the original shape “slides” the same distance and direction to create a translated image. This is called the translation vector. For example, on a grid, a vector could describe each point moving “5 units to the right and 2 units up”. It is a mathematical convention that the horizontal distance (*x*) is given first, followed by the vertical distance (*y*).
- A reflection involves a line of reflection that acts like a mirror. Every point on the original shape is “flipped” across the line of reflection to create a reflected image. Every point on the original image is the same distance from the line of reflection as the corresponding point on the reflected image. Reflections are symmetrical.
- A rotation involves a *centre* of rotation and an *angle* of rotation. Every point on the original shape turns around the centre of rotation by the same specified angle. Any point on the original is the same distance to the centre of rotation as the corresponding point on the rotated image.

Note

- At this grade level, students can express the translation vector using arrows; for example, (5→, 2↑).

- Dynamic geometry applications are recommended for visualizing and understanding how transformations, and especially rotations, behave.

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 5, students will:

E2.1 The Metric System

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

Teacher supports

Key concepts

- The choice of an appropriate unit depends on which attribute is being measured and the reason for measuring it.
  - The attribute to be measured determines whether to choose a unit of length, area, mass, or capacity.
  - The reason and context for measuring determines how accurate a measurement needs to be. Large units are used for broad, approximate measurements; small units are used for precise measurements and detailed work.
- When choosing the appropriate size of unit, it is helpful to know that the same set of metric prefixes applies to all attributes (except time) and describes the relationship between the units. For any given unit, the next largest unit is 10 times its size, and the next smallest unit is one tenth its size.

Note

- Although not all metric prefixes are used commonly in English Canada, understanding the system reinforces the connection to place value:

Metric Prefix	kilo-unit	hecto-unit	deca-unit	**unit**	deci-unit	centi-unit	milli-unit
Unit Value	1000 units	100 units	10 units	**1 unit**	$\frac{1}{10}$ unit	$\frac{1}{100}$ unit	$\frac{1}{1000}$ unit
Place Value	thousand	hundred	ten	**one**	one tenth	one hundredth	one thousandth

- Canada, as well as all but three countries in the world, has adopted the metric system as its official measurement system. It is also universally used by the scientific community because its standard prefixes make measurements and conversions easy to perform and understand. However, Canadians also commonly refer to the imperial system in daily life (gallons, quarts, tablespoons, teaspoons, pounds), and the *Weights and Measures Act* was officially amended in 1985 to allow Canadians to use a combination of metric and imperial units. The most appropriate unit is dependent on the context. Sometimes it is a metric unit (this is the emphasis in this expectation), sometimes it is an imperial unit, and sometimes it is personal non-standard unit or benchmark.
- Although the size of a unit may change, the process for measuring an attribute remains the same. This is true whether using inches, centimetres, or handspans.

E2.2 The Metric System

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

Teacher supports

Key concepts

- Conversions within the metric system rely on understanding the relative size of the metric units (see **SE E2.1**) and the multiplicative relationships in the place-value system (see **Number, SE B1.1**).
- Because both place value and the metric system are based on a system of tens, metric conversions can be visualized as a shifting of digits to the left or right of the decimal point a certain number of places. The amount of shift depends on the relative size of the units being converted. For example, since 1 km is 1000 times as long as 1 m, 28.5 km becomes 28 500 m when the digits shift three places to the left.
- There is an inverse relationship between the size of a unit and the count of units: the smaller the unit, the greater the count. Remembering this principle is important for estimating whether a conversion will result in more or fewer units.

Note

- Although this expectation focuses on converting from larger to smaller units, it is important that students understand that conversions can also move from smaller to larger units using decimals. Exposure to decimal measurements is appropriate for Grade 5 students.

E2.3 Angles

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

Teacher supports

Key concepts

- The lines (rays) that form an angle (i.e., the "arms" of an angle) meet at a vertex. The size of the angle is not affected by the length of its arms.
- Angles are often difficult to transport and compare *directly* (i.e., by overlaying and matching one against another); therefore, angles are often compared *indirectly* by using a third angle to make the comparison:
    - If the third angle can be adjusted and transported, it can be made to match the first angle and then be moved to the second angle to make the comparison directly. This involves the property of transitivity (if A equals C, and C is greater than B, then A is also greater than B).
    - If the third angle is a smaller but fixed angle, it can operate as a unit that is iterated to produce a count. Copies of the third angle are fitted into the other two angles to produce a measurement. The unit count is compared to determine which angle is greater and how much greater.
- In the same way that units of length are used to measure length, and units of mass are used to measure mass, units of angle are used to measure angles. Any object with an angle can represent a unit of angle and be used to measure another angle.

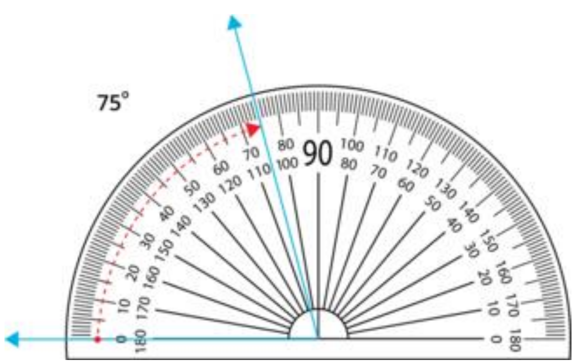
E2.4 Angles

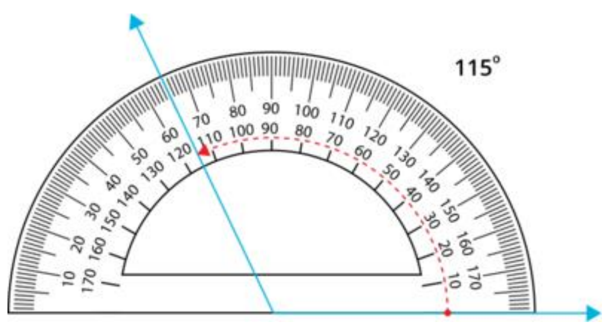
explain how protractors work, use them to measure and construct angles up to 180°, and use benchmark angles to estimate the size of other angles

Teacher supports

Key concepts

- Protractors, like rulers or any other measuring tool, replace the need to lay out and count individual physical units. The protractor repeats a unit so there are no gaps or overlaps and includes a scale to keep track of the unit count.
- A degree is a very small angle and is a standard unit for measuring angles. When 180 degrees are placed together, they form a straight line as demonstrated on a 180° protractor.
- Since a degree is such a small unit, standard protractors often use a scale (typically in increments of 10) with markings to show the individual degrees. If every degree was labelled, the protractor would need to be much larger.
- Protractors usually include a double scale to make it easier to count the degrees in angles that rays open clockwise and those that open counterclockwise. The outer scale goes from 0° to 180°and reads from left to right, whereas the inner scale goes from 0° to 180° and reads from right to left.
- To use a protractor to make an accurate measurement (i.e., a count of degrees):
    - align the vertex of the lines (rays) with the vertex of the protractor (i.e., the midpoint of the protractor where all the degree angles meet);
    - align the arm of the line (ray) with the zero line on the protractor, similar to measuring from zero with a ruler;
    - choose the scale that begins the count at zero and read the measurement where the arm of the line (ray) crosses the number scale, i.e., if the rays open to the right, use the inner scale and if the rays open to the left, use the outer scale.





- Being able to identify benchmark angles, such as 45°, 90°, 135°, and 180°, is helpful for estimating other angles.

E2.5 Area

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

Teacher supports

Key concepts

- For some shapes and some attributes, length measurements can be used to calculate other measurements. This is true for the area of rectangles, parallelograms, and triangles. Indirectly measuring the area of these shapes is more accurate than measuring them directly (i.e., by laying out and counting square units and partial units).
- The spatial relationships between rectangles, parallelograms, and triangles can be used to determine area formulas. The array is an important model for visualizing these relationships.
- The area (A) of any rectangle can be indirectly measured by multiplying the length of its base (b) by the length of its height (h) and can be represented symbolically as $A = b \times h.$ It also, can be determined by multiplying the rectangles length (l) by its width (w) or $A = l \times w$ (see **Grade 4, SE E2.6**). This formula can be used to generate formulas for the area of other shapes.
- Any parallelogram can be rearranged (composed) into a rectangle with the same area. For all parallelograms it is true that:
    - the *areas* of the parallelogram and its rearrangement as a rectangle are equal;
    - the *base lengths* of the parallelogram and its rearrangement as a rectangle are equal;
    - the *heights* of the parallelogram and its rearrangement as a rectangle are equal;
    - this means that, the area of any parallelogram can be indirectly measured, like a rectangle, by multiplying the length of its base by the length of its height;
    - this relationship can be represented symbolically using the formula, $A = b \times h,$ where A represents *Area, b* represents *base* and h represents *height*.
- Any triangle can be doubled to create a parallelogram (i.e., by rotating a triangle around the midpoint of a side). Any parallelogram can be divided into two congruent triangles. Half of a parallelogram is a triangle.
- For all triangles it is true that:
    - the *base lengths* of the triangle and the parallelogram formed by rotating a copy of the triangle are equal;
    - the *heights* of the triangle and the parallelogram are equal;

- the *area* of the parallelogram is double that of the triangle, and the area of the triangle is half that of the parallelogram;
- therefore, since $A = b \times h$ for a parallelogram, the area (A) of a triangle can be measured indirectly by multiplying the length of its base (b) by the length of its height (h) and dividing by 2;
- this relationship can be represented using the formula $A = (b \times h) \div 2$. Because multiplying by one half is the same as dividing by 2, it can also be represented as $A = \frac{1}{2}(b \times h)$.

Note

- Any side of a rectangle, parallelogram, or triangle can be its base, and each base has a corresponding height.

E2.6 Area

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

Teacher supports

Key concepts

- Different shapes can have the same area. Therefore, shapes that have the same area do not necessarily have the same perimeter.
- An area can be maximized for a given perimeter, and a perimeter can be minimized for a given area. Choosing the most appropriate shape depends upon the situation and possible constraints (e.g., minimizing the amount of fencing needed; maximizing the area for a goat to graze).
- Perimeter measures the distance around a shape, and area measures the amount of space occupied within the shape. They are two different attributes.
- The perimeter, P, of a rectangle is the sum of its lengths (l) and widths (w), which can be expressed as $P = l + l + w + w$, or $P = 2l + 2w$.

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:

F1.1 Money Concepts

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

Teacher supports

Key concepts

- Money can be transferred in a wide variety of ways.
- Some methods of transferring money might work for some individuals, families, communities, organizations, or businesses, but not for others, depending on a variety of factors (e.g., purpose, context, geography, personal circumstances and preferences, available financial institutions, time constraints, security considerations, available funds).

F1.2 Money Concepts

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

Teacher supports

Key concepts

- Estimating and calculating the cost and change required in cash transactions requires the application of addition, subtraction, multiplication, division, mental math strategies, and math facts.
- Sales tax[25] has an impact on the total cost of a purchase.

Note

- In Grade 5, students should be representing money amounts using standard currency notation, including for calculations.
- Real-life contexts provide opportunities to practise strategies for accurately calculating money amounts that include cents (decimals to hundredths).
- Practice with estimating and calculating money amounts and determining change strengthens students’ understanding of addition, subtraction, and place value.
- Working with money reinforces students' understanding of the concept of percent and of decimals to hundredths and helps to connect their understanding of the concept of place value to its use in real-life contexts.

F1.3 Financial Management

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

Teacher supports

Key concepts

- Budgets are financial planning tools that can be used in real-life contexts.
- Creating a sample basic budget requires the consideration of factors involved (e.g., earnings, expenses, the goals of the budget) and how to use a budget to inform financial decisions.

[25] In general, Indigenous peoples in Canada are required to pay taxes on the same basis as other people in Canada, except where limited exemptions apply. Eligible Status First Nations may claim an exemption from paying the 8% Ontario component of the Harmonized Sales Tax (HST) on qualifying goods and services purchased off-reserve. Qualifying goods and services are described in the Ontario First Nations Harmonized Sales Tax (HST) rebate. Under Section 87 of the Indian Act, the personal property of eligible Status First Nations or a band situated on a reserve is tax exempt.

- Keeping a record of earnings and expenditures is a key components of a budget.

F1.4 Financial Management

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

Teacher supports

Key concepts

- The concepts of credit and debt are introduced to identify how using credit and carrying debt might impact financial well-being.

Note

- Financial decisions involve choices and are based on varying circumstances (e.g., there are many situations where someone may decide to take a loan to acquire an asset, or use a payment plan to purchase an item to meet an immediate need).

F1.5 Consumer and Civic Awareness

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

Teacher supports

Key concepts

- Unit rates can be used to make direct comparisons in order to identify the “better buy”. This is a skill that supports consumer awareness, allowing consumers to determine the best value when making a purchase.

Note

- Unit rate is an important concept that can be applied to solve mathematical problems across strands.

F1.6 Consumer and Civic Awareness

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

Teacher supports

Key concepts

- Different levels of government and other elected bodies (i.e., federal, provincial, territorial, and municipal governments; band councils) collect a variety of taxes from individuals and businesses in order to pay for facilities, services, and programs (e.g., roads and highways, hospitals, education, national defence, police and fire services, parks and playgrounds, garbage collection, and many other programs and services).

Note

- Contributing to and distributing financial resources through taxes impacts the standard of living in communities.