Mathematics, Grade 7

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 7, students will:

B1. Number Sense

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

Specific expectations

By the end of Grade 7, students will:

B1.1 Rational Numbers

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

Teacher supports

Key concepts

- 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, in the number 876 345 107, the digit 8 represents 8 hundred millions, the digit 7 represents 7 ten millions, the digit 6 represents 6 millions, the digit 3 represents 3 hundred thousands, 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.

- Reading numbers involves interpreting them as a quantity when they are expressed in words, in standard notation, or in expanded notation using powers of ten. Large numbers may be expressed as a decimal number with the unit expressed in words. For example, 36.2 million is equivalent to 36 200 000 = 36.2×10^6.
- Expanded notation with powers of ten shows a number as an expression by using addition, multiplication, and exponents. The number "three hundred seven million, twenty thousand, and fifty", can be expressed as 307 020 050 and $3 \times 10^8 + 7 \times 10^6 + 2 \times 10^4 + 5 \times 10$.
- Numbers without units identified are assumed to be based on ones.
- Numbers can be written in terms of another number. For example:
    - 1 billion is 1000 millions.
    - 1 billion millimetres is equal to 1000 kilometres.
    - 1 billion seconds is about 32 years.
- Sometimes an approximation of a large number is used to describe a quantity. For example, the number 7 238 025 may be rounded to 7 million, or 7.2 million or 7.24 million, depending on the amount of precision needed.
- Numbers can be compared by their place value or they can be compared using proportional reasoning. For example, 1 billion is 1000 times greater than 1 million.

Note

- Every strand of mathematics relies on numbers.
- Some numbers have cultural significance.
- Real-life contexts can provide an understanding of the magnitude of large numbers. For example:
    - 1 billion seconds is about 32 years.
    - When they are closest to each other, Earth and Saturn are 1.2 billion kilometres apart.
    - Given that Earth's population is 7.5 billion (and counting), if you are "one in a million", there are 7500 people just like you.
- There are patterns in the place value system that help people read, write, say, and understand numbers, and that suggest important ways for numbers to be composed and decomposed.
    - The *place* (or position) of a digit determines its *value* (place value). The 5 in 511, for example, has a value of 500, not 5.
    - A zero in a column indicates that there are no groups of that size in the number. It serves as a placeholder, holding the other digits in their correct "place".

- The value of the columns increases and decreases by powers of ten. With each shift to the left, a digit's value increases by a power of 10 (i.e., its value is ten times as great). With each shift to the right, a digit's value decreases by a power of 10 (i.e., its value is one tenth as great).
- To find the value of a digit in a number, the value of a digit is multiplied by the value of its place.
- Each period – thousands, millions, billions, trillions – is 1000 times as great as the previous period. Periods increase in powers of 1000 (10^3).

Place Value Patterns

Trillions			Billions			Millions			Thousands					
100s	10s	1s	100s	10s	1s	100s	10s	1s	100s	10s	1s	100s	10s	1s
$n \times 10^{14}$	$n \times 10^{13}$	$n \times 10^{12}$	$n \times 10^{11}$	$n \times 10^{10}$	$n \times 10^{9}$	$n \times 10^{8}$	$n \times 10^{7}$	$n \times 10^{6}$	$n \times 10^{5}$	$n \times 10^{4}$	$n \times 10^{3}$	$n \times 10^{2}$	$n \times 10^{1}$	$n \times 10^{0}$

- When inputting numbers electronically, the "^" sign is used for exponents; for example, 10^6 would be entered as 10^6.

B1.2 Rational Numbers

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

Teacher supports

Key concepts

- Any whole number multiplied by itself produces a square number, or a perfect square, and can be represented as a power with an exponent of 2. For example, 9 is a square number because 3 × 3 = 9, or 3^2.
- The inverse of squaring a number is to take its square root. The square root of 9 ($\sqrt{9}$) is 3.
- A perfect square can be represented as a square with an area equal to the value of the perfect s2uare. The side length of a perfect square is the square root of its area. In general, the *area* (*A*) of a square is *side* (*s*) × *side* (s), $A = s^2$.

Note

- Perfect squares are often referred to as square numbers.
- Students should become familiar with the common perfect squares (1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144) and their associated square roots.
- Squares and square roots are inverse operations.

B1.3 Rational Numbers

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

Teacher supports

Key concepts

- Rational numbers are any numbers that can be expressed as $\frac{a}{b}$, where *a* and *b* are integers, and $b \neq 0$. Examples of rational numbers include: $\frac{-5}{4}$, $-\frac{3}{6}$, −7, 0, 205, 45.328, $6.\dot{4}$, −32.5.
- Fractions (positive and negative) are rational numbers. Any fraction can be expressed as a decimal number that either terminates or repeats.
- Whole numbers are rational numbers since any whole number can be expressed as a fraction (e.g., $5 = \frac{5}{1}$).
- Integers (whole numbers and their opposites) are rational numbers since any integer can be expressed as a fraction (e.g., $-4 = \frac{-4}{1}$, $+8 = \frac{8}{1}$).
- Rational numbers can be represented as points on a number line to show their relative distance from zero.
- The farther a rational number is to the right of zero on a horizontal number line, the greater the number.
- The farther a rational number is to the left of zero on a horizontal number line, the lesser the number.
- Fractions can be written in a horizontal format (e.g., 1/2 or ½) as well as stacked format (e.g., $\frac{1}{2}$).

Note

- There are an infinite number of rational numbers.
- Whole numbers, integers, positive fractions, and positive decimal numbers can be represented using concrete tools.
- Negative fractions and negative decimal numbers can be represented using a number line.
- Negative fractions have the same magnitude as their corresponding positive fraction. The positive and negative signs indicate their relative position to zero. One way of comparing negative fractions is to rewrite them as decimal numbers (e.g., $\frac{-4}{5} = -0.8$).
- Negative decimal numbers have the same magnitude as their corresponding positive decimal numbers. The positive and negative signs indicate their relative position to zero.

B1.4 Fractions, Decimals, and Percents

use equivalent fractions to simplify fractions, when appropriate, in various contexts

Teacher supports

Key concepts

- Equivalent positive fractions that represent parts of a whole are created by either partitioning or merging partitions.
- A fraction is *simplified* (in lowest terms) when the numerator (count) and the denominator (unit) have no common whole number factor other than 1 (e.g., $\frac{3}{5}$ is in lowest terms, $\frac{4}{6}$ is not in lowest terms because both the numerator and denominator have a common factor of 2).
- Multiplication and division facts are used to create equivalent fractions and reduce fractions to their lowest terms.
- All unit fractions are in lowest terms.

Note

- Positive and negative fractions can represent quotients. Fractions are equivalent when the results of the numerator divided by the denominator are the same.
- Creating equivalent fractions is used to add and subtract fractions that represent parts of a whole when their units (denominators) are different.
- When performing addition, subtraction, multiplication, and division involving fractions, the results are commonly expressed in lowest terms.
- Sometimes, when working with fractions, a fraction may become a complex fraction in which the numerator and/or the denominator are decimal numbers. To express these fractions in lowest terms, both the numerator and the denominator are multiplied by the appropriate power of ten.

B1.5 Fractions, Decimals, and Percents

generate fractions and decimal numbers between any two quantities

Teacher supports

Key concepts

- There are an infinite number of decimal numbers that fall between any two decimal numbers. The place values of the decimal numbers need to be compared to ensure that the number generated does indeed fall between the two numbers.
- The number that falls exactly between any two numbers can be determined by taking the average of the two numbers.
- To determine a fraction between any two fractions, equivalent fractions must be created so that the two fractions have the same denominator in order to do the comparison.

Note

- The number system is infinitely dense. Between any two rational numbers are other rational numbers.

B1.6 Fractions, Decimals, and Percents

round decimal numbers to the nearest tenth, hundredth, or whole number, as applicable, 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.
- A decimal number is rounded to the nearest thousandth, hundredth, tenth, or whole number based on which hundredth, tenth, or whole number it is closest to. If it is the same distance, it is usually rounded up. However, depending on context, it may be rounded down.
- Rounding involves making decisions about what level of precision is needed and is used in measurement, as well as in statistics. How close a rounded number is to the actual amount depends on the unit it is being rounded to: the larger the unit, the broader the estimate; the smaller the unit, the more precise.

Note

- Some decimal numbers do not terminate or repeat. For example, the decimal representation for *pi*. When working with circles, the decimal representation of *pi* is usually rounded to the nearest hundredth (3.14).

B1.7 Fractions, Decimals, and Percents

convert between fractions, decimal numbers, and percents, in various contexts

Teacher supports

Key concepts

- Converting between fractions, decimals, and percents often makes calculations and comparisons easier to understand and carry out.
- Relationships of quantities relative to a whole can be expressed as a fraction, a decimal number, and a percent. Percents can be greater than 100%.
- Some fractions can be converted to a percent by creating an equivalent fraction with a denominator of 100.
- When fractions are considered as a quotient, the numerator is divided by a denominator and the result is a decimal representation that can be converted to a percent.
- Some decimal numbers when converted to a percent result in a whole number percent (e.g., 0.6 = 60%, 0.42 = 42%).
- Some decimal numbers when converted to a percent result in a decimal number percent (e.g., 0.423 = 42.3%).
- The relationship of multiplying and dividing whole numbers and decimal numbers by 100 is used to convert between decimal numbers and percents.
- Percents can be understood as decimal hundredths.
- Any percent can be represented as a fraction with a denominator of 100. An equivalent fraction can be created expressed in lowest terms.

Note

- Unit fraction conversions can be scaled to determine non-unit conversions (e.g., one fifth = 0.2, so four fifths is 0.2 × 4 = 0.8). (See **SE B2.2**.)
- Common benchmark fractions, decimals, and percents include:

- $\frac{1}{2}$ = 0.5 = 0.50 = 50%
- $\frac{1}{4}$= 0.25 = 25%
- $\frac{1}{5}$ = 0.2 = 0.20 = 20%
- $\frac{1}{8}$ = 0.125 = 12.5%
- $\frac{1}{10}$ = 0.1 = 0.10 = 10%

B2. Operations

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

Specific expectations

By the end of Grade 7, students will:

B2.1 Properties and Relationships

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

Teacher supports

Key concepts

- Properties of operations are helpful for carrying out calculations.
  - The identity property: $a + 0 = a$, $a - 0 = a$, $a \times 1 = a$, $\frac{a}{1} = a$.
  - The commutative property: $a + b = b + a$, $a \times b = b \times a$.
  - The associative property: $(a + b) + c = a + (b + c)$, $(a \times b) \times c = a \times (b \times c)$.
  - The distributive property: $a \times b = (c + d) \times b = (c \times b) + (d \times b)$.
- The commutative, associative, and identity properties can be applied for any type of number.
- The order of operations needs to be followed when given a numerical expression that involves multiple operations. Any calculations in brackets are done first. Secondly, any

numbers expressed as a power (exponents) are evaluated. Thirdly, multiplication and division are done in the order they appear, from left to right. Lastly, addition and subtraction are done in the order they appear, from left to right.

- Multi-step problems may involve working with a combination of whole numbers, decimal numbers, and fractions.
- Multi-step problems may involve working with a combination of relationships, including ratios, rates, and percents.
- There may be more than one way to solve a multi-step problem.

Note

- This expectation supports most 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.
- Solving problems with more than one operation involve 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 operations(s) that match the actions to write the equation.
    - Solve by using the diagram (counting) or using the equation (calculating).
- In multi-operation problems, sometimes known as two-step problems, there is often 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 an important 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 it can be represented with addition or subtraction.
    - Does the situation involve equal groups (or rates), ratio comparisons (scaling), or arrays? Then it can be represented with multiplication or division.
- Representing a situation as an equation is often helpful in solving it.
- The same situation can be represented with different operations. Each operation has an "inverse" operation – an opposite that "undoes" it. The inverse operation can be used to rewrite an equation to make it easier to calculate, or to check whether a calculation is true.
    - The inverse of addition is subtraction, and the inverse of subtraction is addition. So, for example, $\frac{1}{2}$ + **?** = $\frac{3}{4}$ can be rewritten as $\frac{3}{4} - \frac{1}{2}$ = **?**.

- The inverse of multiplication is division, and the inverse of division is multiplication. So, for example, $\frac{1}{2} \times$ **?** $= \frac{3}{8}$ can be rewritten as $\frac{3}{8} \div \frac{1}{2} =$ **?**.

B2.2 Math Facts

understand and recall commonly used percents, fractions, and decimal equivalents

Teacher supports

Key concepts

- Certain equivalent representations of percents, fractions, and decimals are more commonly used to do mental calculations than others.
- Since 1% is 1 hundredth ($\frac{1}{100}$ or 0.01) of an amount, then any percent can be determined by scaling it up or down.
- Both 1% and 10% ($\frac{1}{10}$ or 0.1) of an amount can be calculated mentally by visualizing how the digits of a number change their place value.
- Five percent (5% = $\frac{5}{100}$ = 0.05) is commonly used to do mental calculations since it is half of ten percent.
- Any percent can be created as a composition of 1%, 5%, and 10%.
- Since 100% of an amount is the amount, then 200% is twice the amount.
- Any fraction can be used as an operator; however, there are certain fractions that are more common than others. For example:
  - One half of an amount ($\frac{1}{2}$ = 50% = 0.5).
  - One fourth of an amount, since it is half of a half ($\frac{1}{4}$= 0.25 = 25%).
  - Three fourths of an amount, since it is triple one-fourth ($\frac{3}{4}$= 0.75 = 75%).

Note

- For more about understanding the equivalence between percents, fractions, and decimals, see **SE B1.7**.
- Common benchmark fractions, decimals, and percents include:
  - $\frac{1}{2}$ = 0.50 = 50%
  - $\frac{1}{4}$ = 0.25 = 25%

- $\frac{1}{5}$ = 0.20 = 0.2 = 20%
- $\frac{1}{8}$ = 0.125 = 12.5%
- $\frac{1}{10}$ = 0.1 = 0.10 = 10%

- Unit fraction conversion can be scaled to determine non-unit conversions. For example:
  - 1 one fifth ($\frac{1}{5}$) = 0.2, so 4 one fifths ($\frac{4}{5}$) = 0.2 × 4 = 0.8.
  - 1 one fifth ($\frac{1}{5}$) = 20%, so 4 one fifths ($\frac{4}{5}$) = 20% × 4 = 80%.

B2.3 Mental Math

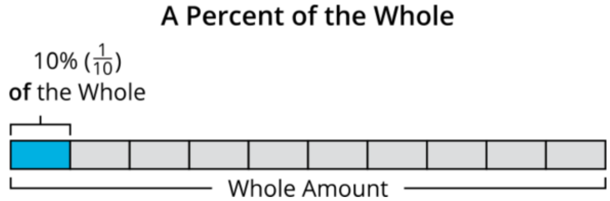
use mental math strategies to increase and decrease a whole number by 1%, 5%, 10%, 25%, 50%, and 100%, and explain the strategies used

Teacher supports

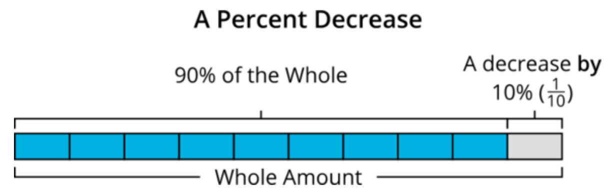
Key concepts

- Calculating whole number percents is a frequently used skill in daily life (e.g., when determining sales tax, discounts, or gratuities).
- Percents can be composed from other percents. A 15% discount combines a 10% discount and a 5% discount. A 13% tax adds 10% and another 3% (3 × 1%).
- Visuals are helpful for understanding (and communicating) whether a situation describes a percent increase or decrease or a percent of the whole. Unclear language can obscure the intended meaning.
- Finding a percent *of* a number is scaling an amount down or up. For example, finding 10% of a number is the same as scaling that number to $\frac{1}{10}$ of its size, as illustrated below. On a calculator, 10% of $50 = 0.10 × 50 = 5.

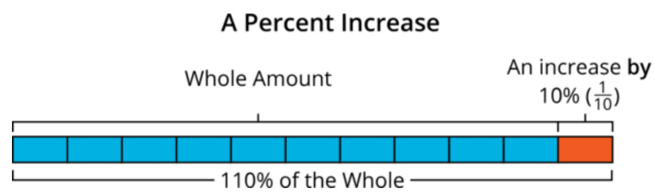
A Percent of the Whole



- Decreasing *by* a given percent means the percent is subtracted from the whole. So, a 10% decrease will be 90% ($\frac{9}{10}$) of the whole, as illustrated below. On a calculator, decreasing 50 by 10% = 50 − 10% or 50 − (0.10 × 50) = 45.



- Increasing *by* a given percent means the percent is added to the whole. So, a 10% increase is 110% ($1\frac{1}{10}$) of the whole, as illustrated below. On a calculator, increasing 50 by 10% = 50 + 10% or 50 + (0.10 × 50) = 55.



Note

- Mental math is not always quicker than paper and pencil strategies, but speed is not its 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 understanding of numbers and operations.
- Estimation is a useful mental strategy when either an exact answer is not needed or there is insufficient time to work out a calculation.

B2.4 Addition and Subtraction

use objects, diagrams, and equations to represent, describe, and solve situations involving addition and subtraction of integers

Teacher supports

Key concepts

- When adding and subtracting integers, it is important to pay close attention to all of the elements of the statement. For example:
  - (+4) + (−3) may be interpreted as combining positive four and negative three.
  - 4 + (−3) may be interpreted as adding negative three to positive four.
  - (−4) − (+3) may be interpreted as determining the difference between negative four and positive three by comparing them.

- $(-4) - 3$ may be interpreted as taking away positive three from negative four.
- $4 - 3$ may be interpreted as taking away positive three from positive four.
- $-4 - 3$ may be interpreted as taking away positive three from negative four.

- The order in which integers are written in an addition statement does not matter because the commutative property holds true (e.g., $-5 + 3 = 3 + (-5)$). It is important to note that the sign directly in front of the number belongs to the number.
- The order in which integers are written in a subtraction statement does matter because the commutative property does not hold true. For example, $(-5) - (+3) = -8$ and $(+3) - (-5) = +8$; they do not produce the same result.
- Addition and subtraction are inverse operations; therefore, a subtraction expression can be rewritten as an addition expression by adding its opposite (e.g., $(-5) - (+ 3) = (-5) + (-3)$ and $2 - (-4) = 2 + (+4)$).
- When two positive integers are added together, the result is positive. This can be visualized on a number line as:
  - two vectors moving in a positive direction (right or up);
  - a vector moving in a positive direction from a positive starting position.
- When two *negative* integers are added together, the result is negative. This can be visualized on a number line as:
  - two vectors moving in a negative direction (left or down);
  - a vector moving in a negative direction from a negative starting position.
- When a positive and a negative integer are added together, the result is negative if the absolute value of the negative integer is greater than the absolute value of the positive integer. This can be visualized on a number line as:
  - one vector moving in a positive direction and the other vector with a greater magnitude moving in a negative direction (the sign of the resultant vector is negative);
  - a vector moving in a negative direction from a positive starting position with the head of the vector to the left (or below) zero;
  - a vector moving in a positive direction from a negative starting position with the head of the vector to the left (or below) zero.
- When a positive and a negative integer are added together, the result is positive if the absolute value of the positive integer is greater than the absolute value of the negative integer. This can be visualized on a number line as:

- one vector moving in a negative direction and the other vector with a greater magnitude moving in a positive direction (the sign of the resultant vector is positive);
- a vector moving in a positive direction from a negative starting position with the head of the vector to the right (or above) zero;
- a vector moving in a negative direction from a positive starting position and the head of the vector to the right (or above) zero.

- If the two integers added together have the same sign, then their magnitudes are added together.
- If the two integers added together have different signs, then their magnitude is determined by taking the absolute difference between them.
- “Zero pairs” are the sum of a positive and a negative number that results in zero.
- Depending on the models and the integers that are involved in a subtraction, zero pairs may need to be introduced in order to act out the situation. For example, if the situation involves taking away a negative amount but only positive amounts are shown, then adding zero pairs will allow for the negative amount to be removed.
- If the situation involves comparing two integers, the two integers can be represented as positions on a number line to determine the distance between them (magnitude). The order in which the subtraction statement is written is important in determining the sign. The sign is determined by the direction of the movement from the point represented by the integer after the minus sign (subtrahend) to the point represented by the integer in front of the minus sign (minuend). For example:

  - For 10 − (+2) = +8, the distance between positive 10 and positive 2 is 8; the movement from positive 2 to 10 is in a positive direction.
  - For (+2) − (+10) = −8, the distance between positive 2 and positive 10 is 8; the movement from positive 10 to positive 2 is in a negative direction.
  - For (2) − (−10) = +12, the distance between positive 2 and negative 10 is 12; the movement from negative 10 to positive 2 is in a positive direction.

Note

- Familiar real-world contexts for negative and positive integers (e.g., temperature, elevators going up and down, parking garages, sea level, golf scores, plus/minus in hockey, gaining and losing money, walking forward and backwards) provide a starting point for understanding adding and subtracting with integers.
- Situations involving addition and subtraction can be modelled using tools such as a number line and integer tiles.
- When writing an equation, integers are often placed inside brackets and the equation written as (+3) − (−2) = (+5). If an integer sign is not included, the number is considered

positive, so it is also true that 3 − (−2) = 5. These conventions help reduce confusion between the number and the operation.

- Change can be represented by a positive or negative integer (e.g., rise of 4 expressed as +4, drop of 4 expressed as −4).
- A quantity relative to zero can be represented by a positive or negative integer (e.g., temperature is 3 degrees, temperature is −5 degrees).
- The integers in a situation may be interpreted as changes or as quantities. For example, if the temperature outside drops 5 degrees and then 3 degrees, this may be expressed as the addition of two drops [(−5) + (−3)] or as a subtraction of 3 degrees (−5 − 3). Both statements result in the same answer (−8), meaning the temperature decreased by 8 degrees.
- Modelling addition and subtraction expressions can help with the interpretation of the result relative to the context.

B2.5 Addition and Subtraction

add and subtract fractions, including by creating equivalent fractions, in various contexts

Teacher supports

Key concepts

- The addition and subtraction of fractions with the same denominator can be modelled on the same number line. Each one whole on the number line can be partitioned by the number of units indicated by the denominator. For example:
  - To model $\frac{3}{4} + \frac{2}{4} = \frac{5}{4}$, the number line is partitioned into fourths. Three fourths can be represented as a point and then a vector can be drawn from that point to the right for a distance of two fourths of a unit. The head of the vector is at the point five fourths.
  - To model, $\frac{7}{3} - \frac{2}{3} = \frac{5}{3}$, the number line is partitioned into thirds. Seven thirds and two thirds are represented as points. The distance between the two points is five thirds.

- Strategies to add and subtract fractions with unlike denominators depend on the types of fractions that are given. For example:
  - Mental math can be used to create wholes (ones). For example, for $\frac{1}{2} + \frac{3}{4} = 1\frac{1}{4}$, knowing that three fourths is composed of one half and one fourth, the two halves are combined to make one, and then one fourth is added on.

- Equivalent fractions may be created so that both fractions have a common denominator (e.g., $\frac{2}{3}+\frac{1}{2}$ can be scaled so that both have a denominator of 6, which results in the equivalent expression $\frac{4}{6}+\frac{3}{6}$). This can be modelled using a double number line.

Note

- Fractions are commonly added and subtracted in everyday life, particularly when using imperial units (inches, feet, pounds, cups, teaspoons). Imperial units are commonly used in construction and cooking.
- Only common units can be added or subtracted, whether adding or subtracting whole numbers, decimals, or 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.
- The numerator in a fraction represents the count of unit fractions. The denominator represents what is being counted (the unit). To add or subtract fractions is to change the total count of units. This is why only the numerator is added or subtracted.
- There are helpful ways to visualize the addition and subtraction of fractions. Drawings, fraction strips, clock models, and rulers in imperial units can be used to generate equivalent fractions and model how these common units can be combined or separated.
- The three types of addition and subtraction situations (see **SE B2.1**) also apply to fractions.

B2.6 Multiplication and Division

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

Teacher supports

Key concepts

- A number can be written in terms of its factors. For example, the factors of 6 are 1, 2, 3, and 6.
- One is a factor for all numbers. Some numbers only have 1 and themselves as factors, and they are called prime numbers (e.g., 3, 5).

- To determine the common factors among two or more numbers, factors are listed and then the common factors are identified, including the greatest one they have in common. For example:
    - The factors of 6 are {1, 2, 3, 6}.
    - The factors of 12 are {1, 2, 3, 4, 6, 12}.
    - The common factors of 6 and 12 are {1, 2, 3, 6}.
    - The greatest common factor of 6 and 12 is 6.
- The multiples of a number are the multiplication facts related to that number (e.g., the multiplication facts for 2 are 2, 4, 6, 8, 10, 12, …).
- To determine the lowest common multiple among two or more numbers, multiples are listed and then the common multiples are identified, including the lowest one they have in common. For example:
    - The multiples of 3 are {3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 32, 36 …} and they are all divisible by 3.
    - The multiples of 4 are {4, 8, 12, 16, 20, 24, 28, 32, 36 …} and they are all divisible by 4.
    - The common multiples of 3 and 4 are {12, 24, 36 …}.
    - The lowest common multiple of 3 and 4 is 12.
- The lowest common multiple of a set of numbers is the smallest whole number that divides evenly into all numbers in the set.

Note

- Knowing the greatest common factor among numbers can help with reducing the number of steps to simplify a fraction into its lowest terms. In this case the greatest common factor is being determined for the numerator and the denominator.
- Knowing the lowest common multiple among numbers can help with creating equivalent fractions in order to add or subtract fractions with a common denominator. In this case the lowest common multiple is being determined for all the denominators.

B2.7 Multiplication and Division

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

Teacher supports

Key concepts

- Exponentiation is a fifth number operation, like addition, subtraction, multiplication, and division. It is written as b^n and involves two numbers, where b is the base and n is the exponent or power.
- Exponential notation signifies the multiplication of factors that are all the same, often referred to as repeat multiplication, and known as a power.
- The power has two components: the base and the exponent. The base is the factor that is being repeated, and the exponent states the number of those factors and is written as a superscript. For example:
  - 5^2 has a base of 5, an exponent of 2, and represents 5 × 5.
  - 10^5 has a base of 10, an exponent of 5, and represents 10 × 10 × 10 × 10 × 10.
- To evaluate a power means to determine the result. Often the power would be rewritten as a product to determine its result. For example, $2^4 = 2 \times 2 \times 2 \times 2 = 16$.
- Powers are used to express very large and very small numbers. They are also used to describe very rapid growth (such as doubling) that increases over time.
- Any number can be written as a power with an exponent 1(e.g., $5 = 5^1$).

Note

- The term "power of 10" means the base is 10.
- When a number is expressed in expanded form, the place value is written as a power of ten, which means the base is 10. The exponent is dependent on the place value. For example, $500 = 5 \times 10^2$ and $5000 = 5 \times 10^3$.
- Exponential notation can also apply to variables, such as in a formula. For example, in the formula for the area of a circle, $A = \pi r^2$, the r^2 means $r \times r$.
- Using patterns can help with understanding the relationship between the exponents of the same base.

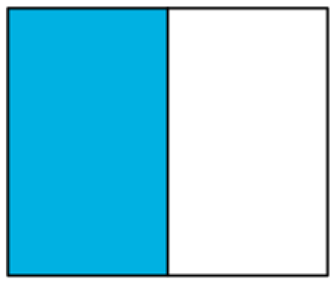
B2.8 Multiplication and Division

multiply and divide fractions by fractions, using tools in various contexts

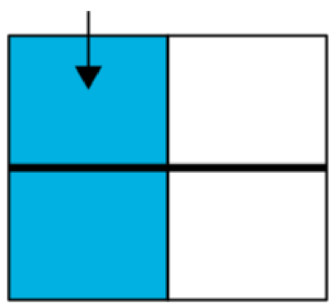
Teacher supports

Key concepts

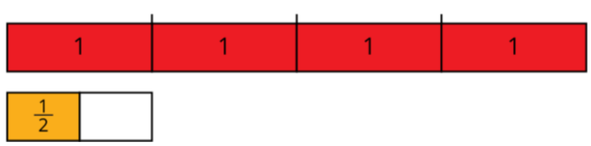
- The multiplication and division of two fractions can be interpreted based on the different ways fractions are used: as a quotient, as parts of a whole, as a comparison (ratio), and as an operator.
- The multiplication of two fractions as operators can be modelled as follows:
  - For $\frac{1}{2} \times 1$, the fraction one half as an operator can visually be shown as one half of a rectangle.



  - Therefore $\frac{1}{2} \times \frac{1}{2}$, is one half of the one half of a rectangle. The result is one fourth of a rectangle.

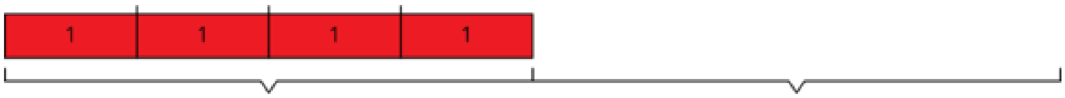


- Division of fractions can be interpreted in two ways:
  - $4 \div \frac{1}{2} = ?$ can be interpreted as “How many one halves are in four?”



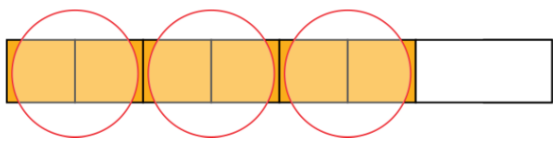
    - Two one halves make 1, so eight one halves make 4. Therefore, $4 \div \frac{1}{2} = 8$.

- $4 \div \frac{1}{2} = ?$ can also be interpreted as “If 4 is one half of a number, what is the number?”

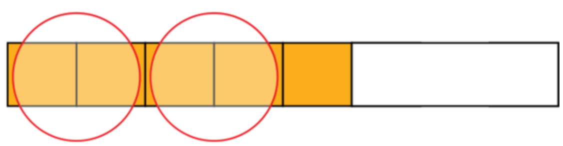


- Since 4 is one half of a number, the other one half is also 4. Therefore, $4 \div \frac{1}{2} = 8$

- Division of a fraction by its unit fraction (e.g., $\frac{5}{8} \div \frac{1}{8}$) can be interpreted as "How many counts of the unit are in the fraction (i.e., how many one eighths are in five eighths)?" The result is the number of counts (e.g., there are 5 counts of one eighth).
- Dividing a fraction by a fraction with the same denominator (e.g., $\frac{6}{8} \div \frac{2}{8}$) can be interpreted as “How many divisors are in the dividend?” In the fraction strip below, notice there are three counts of two eighths that are in six eighths. Similar to the division of a fraction by its unit fraction, the result is the count.



- Sometimes the division of a fraction by a fraction with the same denominator has a fractional result. For example: $\frac{5}{8} \div \frac{2}{8}$.



- Notice there are 2 two eighths in five eighths, and then $\frac{1}{2}$. of another two eighths.
- Therefore, $\frac{5}{8} \div \frac{2}{8} = 2\frac{1}{2}$.

Note

- When multiplying a fraction by a fraction using the area of a rectangle, first the rectangle is partitioned horizontally or vertically into the same number of sections as one of the denominators. Next, the region represented by that fraction is shaded to show that fraction of a rectangle. Next, the shaded section of the rectangle is partitioned in the other direction into the same number of sections as the denominator of the second fraction. Now it is possible to identify the portion of the shaded area that is represented by that fraction.

- Any whole number can be written as a fraction with one as its denominator. A whole number divided by a fraction can be used to support students in understanding the two ways division can be interpreted. If context is given, usually only one or the other way is needed. Dividing a whole number by a fraction also helps with making connections to thinking about division of a fraction as the multiplication of its reciprocal.
- In general, dividing fractions with the same denominator can be determined by dividing the numerators and dividing the denominators.
- Multiplying fractions follows a developmental progression that may be helpful in structuring tasks for this grade:
  - A fraction by a whole number (e.g., $5 \times \frac{3}{8}$; 5 groups of $\frac{3}{8}$).
  - A whole number by a fraction (e.g., $\frac{3}{4} \times 24$; multiplication as scaling).
  - A fraction by a fraction, no partitioning (e.g., $\frac{1}{3} \times \frac{3}{4}$; multiplication as scaling).
  - A fraction by a fraction, with partitioning (e.g., $\frac{2}{3} \times \frac{3}{4}$; $\frac{2}{3} \times \frac{4}{5}$).
- Dividing fractions also follows a developmental progression that may be helpful in structuring a task for this grade:
  - A whole number divided by a whole number (e.g., $8 \div 3$).
  - A fraction divided by a whole number (e.g., $\frac{3}{4} \div 2$).
  - A whole number divided by a unit fraction (e.g., $5 \div \frac{1}{3}$).
  - A whole number divided by a fraction (e.g., $5 \div \frac{2}{3}$).
  - A fraction divided by a unit fraction (e.g., $\frac{7}{8} \div \frac{1}{8}$).
  - A fraction divided by a fraction, with the same denominator and a result that is a whole number (e.g., $\frac{4}{5} \div \frac{2}{5}$).
  - A fraction divided by a fraction, with the same denominator and a result that is a fractional amount (e.g., $\frac{3}{4} \div \frac{1}{2}$; $\frac{1}{2} \div \frac{3}{4}$).

B2.9 Multiplication and Division

multiply and divide decimal numbers by decimal numbers, in various contexts

Teacher supports

Key concepts

- Any decimal number multiplied by one is that decimal number.
- One tenth × one tenth results in a hundredths product (0.1 × 0.1 = 0.01), similar to 10 × 10 = 100.
- One tenth × one hundredth results in a thousandths product (0.1 × 0.01 = 0.001), similar to 10 x 100 = 1000.
- One hundredth × one hundredth results in a ten thousandths product (0.01 × 0.01 = 0.0001), similar to 100 × 100 = 10 000.
- A strategy to multiply decimal numbers is to decompose them as a product of whole numbers with tenths, hundredths, or thousandths and then apply the associative property. For example:

    - 23.5 × 0.03

  = 235 × 0.1 × 3 × 0.01

  = 705 × 0.001

  = 0.705

- Sometimes a combination of words and numbers may be helpful, such as:

    - 23.5 × 0.03

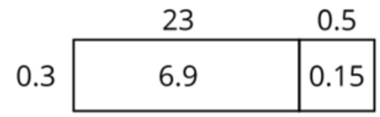
  = 235 tenths x 3 hundredths

  = 705 thousandths or 0.705

- The area model can be used to multiply decimal numbers. The decimal numbers can represent the dimensions of a rectangle. Each dimension can be decomposed into its place value, and then the area of each of the sections formed can be determined. For example:

    - 23.5 × 0.3 can be decomposed as 23 and 5 tenths, and 3 tenths. The partitions that result are 23 by 0.3 (6.9), and 5 tenths by 3 tenths (0.15). The total area is 6.9 + 0.15 = 7.05.

23.5 × 0.3



$$
\begin{array}{r}
6.90 \\
+\,0.15 \\
\hline
7.05
\end{array}
$$

- Standard multiplication algorithms for whole numbers can also be applied to decimal numbers. As with whole numbers, these algorithms add partial products to create a total. For example, with 23.5 × 0.3, the partial products are formed by multiplying each digit according to its place value by three tenths.

How It May Be Written	What Is Happening
23.5	
× 0.3	
0.15	➡ 0.3 × 0.5 = 0.15
0.90	➡ 0.3 × 3.0 = 0.9
+ 6.00	➡ 0.3 × 20.0 = 6.0
7.05	

- To divide decimal numbers, an equivalent division statement with a whole number divisor can be used since the results will be the same. For example: 70.5 ÷ 0.5 = 705 ÷ 5 when both the dividend and the divisor are scaled by 10, and 705 ÷ 5 = 141. In some cases, mental calculations can be used to determine the result and at other times the standard algorithm may be applied.
- Estimating a product or quotient prior to a calculation helps in assessing whether a calculation is reasonable.

Note

- Support students in making connections between the area model and the standard algorithms for multiplication.
- Depending on the context, the multiplication of a decimal number may be relative to a scale factor, a measurement, or a partial group.
- Division by decimal amounts disrupts the notion that division "makes numbers smaller". The question "How many tenths can be made from 3?" (i.e., 3 ÷ 0.1) will produce an answer that is larger than three – in fact, it will be ten times as large. As with fractions and measurement, the smaller the unit, the greater the count.

B2.10 Multiplication and Division

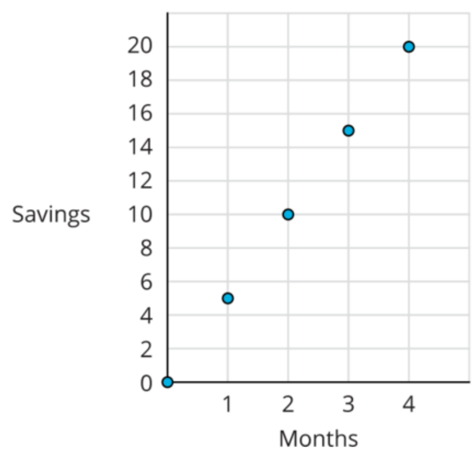
identify proportional and non-proportional situations and apply proportional reasoning to solve problems

Teacher supports

Key concepts

- A proportional relationship is when two variables change at the same rate. For example, depositing $5 into a savings account every month is a proportional situation because the relationship between months and money is constant: $5 per month. Note that the change is additive ($5 more per month), but the relationship is multiplicative ($5 per month):

Month	Deposit	Total Saved	Rate of Change	Rate per Month
1	$5	$5	+5	$5/month
2	$5	$10	+5	$5/month
3	$5	$15	+5	$5/month
4	$5	$20	+5	$5/month



- A non-proportional relationship is when two variables do not change at the same rate. For example, a deposit of $5 one month and $2 the next is not proportional because the growth is not constant. The line on a graph would be jagged, not straight.
- Tables and graphs are helpful for seeing proportional (or non-proportional) relationships.
- A proportion is a statement that equates two proportions (ratios, rates): $\frac{a}{b} = \frac{c}{d}$. There are four ways that the proportion can be written for it to hold true. For example, 3 km for every 5 hours and 6 km for every 10 hours can be expressed as:

- $\frac{3}{5} = \frac{6}{10}$ or
- $\frac{3}{6} = \frac{5}{10}$ or
- $\frac{5}{3} = \frac{10}{6}$ or
- $\frac{6}{3} = \frac{10}{5}$.

- Problems involving proportional relationships can be solved in a variety of ways, including using a table of values, a graph, a ratio table, a proportion, and scale factors.

Note

- Problems that involve proportions with whole numbers provide an opportunity to apply mental calculations that use multiplication and division facts. For example, to solve for *m*, in a proportion like $\frac{m}{9} = \frac{12}{56}$, one could determine the multiple of 9 that gives 56 and then use that to divide 12 by to find *m.*
- If two quantities change at the same rate, the quantities are proportional.

C. Algebra

Overall expectations

By the end of Grade 7, students will:

C1. Patterns and Relationships

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

Specific expectations

By the end of Grade 7, students will:

C1.1 Patterns

identify and compare a variety of repeating, growing, and shrinking patterns, including patterns found in real-life contexts, and compare linear growing patterns on the basis of their constant rates and initial values

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.
- If the ratio of the change in one variable to the change in another variable is equivalent between any two sets of data points, then there is a constant rate. An example of a real-life application of a constant rate is an hourly wage of $15.00 per hour.
- In a comparison of linear growing patterns, the pattern that has the greatest constant rate grows at a faster rate than the others and has a steeper incline as a line on a graph.
- The initial value (constant) of a linear growing pattern is the value of the term when the term number is zero. An example of a real-life application of an initial value is a membership fee.
- The relationship between the term number and the term value can be generalized. A linear growing pattern of the form $y = mx + b$ has a constant rate, *m,* and an initial value, *b*. The graph of a linear growing pattern that has an initial value of zero passes through the origin at (0, 0).
- In shrinking patterns, there is a decrease in the number of elements or the size of the elements from one term to the next.

Note

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

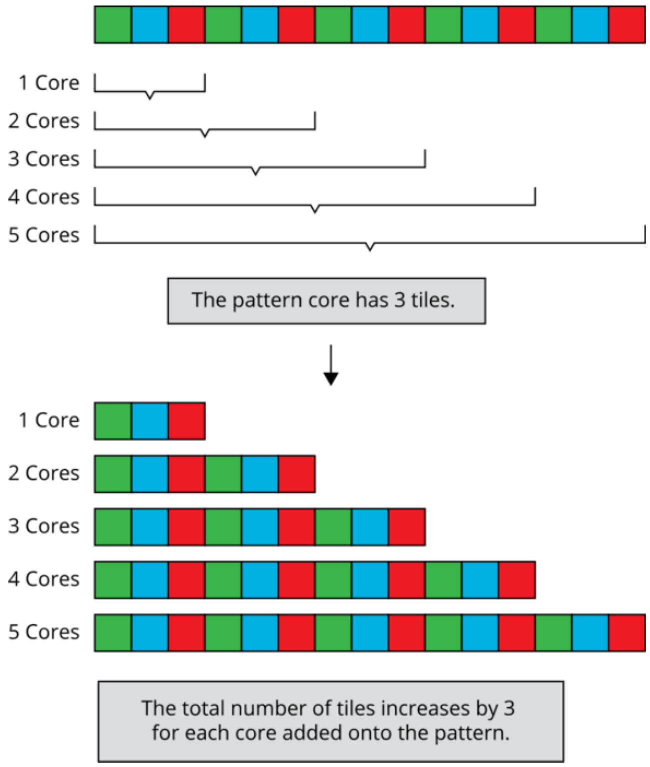
C1.2 Patterns

create and translate repeating, growing, and shrinking patterns involving whole numbers and decimal numbers using various representations, including algebraic expressions and equations for linear growing patterns

Teacher supports

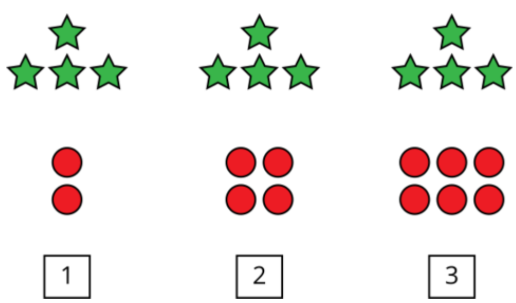
Key concepts

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



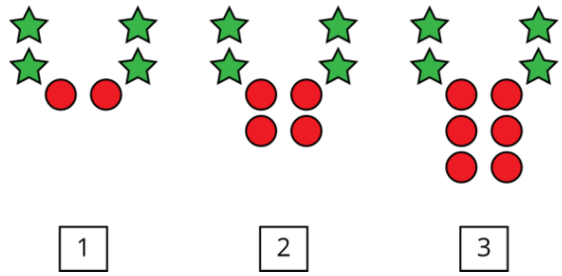
- Shrinking patterns are created by decreasing the number of elements or the size of the elements in each iteration.
- Examining the physical structure of a linear growing pattern can provide insight into the different algebraic equations that show the relationship between the term number and the term value. For example, in Diagram 1, each term value can be viewed as four more than double the term number, which can be expressed as
term value = 2*(term number) + 4 or $y = 2x + 4$.

Diagram 1



- Diagram 2 shows that for the same pattern, each term value can also be viewed as twice the term number plus two, which can be expressed as term value = term number + two + term number + two or $y = x + 2 + x + 2$. This expression for Diagram 2 can be simplified to $y = 2x + 4$, which is the same expression derived for Diagram 1.

Diagram 2



Note

- The creation of growing and shrinking patterns in this grade is not limited to linear patterns.

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 involving whole numbers and decimal numbers, and use algebraic representations of the pattern rules to solve for unknown values in linear growing 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 the 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 *n*th 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 interpolation.
- Determining a point beyond the graphical representation of a pattern is called extrapolation.

C1.4 Patterns

create and describe patterns to illustrate relationships among integers

Teacher supports

Key concepts

- Patterns can be used to demonstrate relationships within and among number properties, such as expressing numbers in exponential notation.

Note

- Using patterns is a useful strategy in developing understanding of mathematical concepts, such as knowing what sign to use when two integers are added or subtracted.

C2. Equations and Inequalities

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

Specific expectations

By the end of Grade 7, students will:

C2.1 Variables and Expressions

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

Teacher supports

Key concepts

- A monomial with a degree of 1 has a variable with an exponent of one. For example, the exponent of m for the monomial $2m$ is 1. When the exponent is not shown, it is understood to be one.
- Monomials with a degree of 1 with the same variables can be added together; for example, $2m$ and $3m$ can be combined as $5m$.
- Monomials with a degree of 1 with the same variables can be subtracted; for example, $10y - 8y = 2y$.
- Monomials can be subtracted in different ways. One way is to compare their representations and determine the missing addend (e.g., $3x + ? = 7x$). Another way is to remove them from the expression representation (e.g., 3 x-tiles are physically removed from the collection of 7 x-tiles).

Note

- Examples of monomials with a degree of 2 are x^2 and xy. The reason that xy has a degree of 2 is because both x and y have an exponent of 1. The degree of the monomial is determined by the sum of all the exponents of its variables.
- Adding and subtracting monomials using tools supports students in understanding which monomials can be simplified. Only monomials with the same variables (like terms) can be simplified.

C2.2 Variables and Expressions

evaluate algebraic expressions that involve whole numbers and decimal 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 4.5m becomes 4.5(m) and then 4.5(7.2) when m = 7.2. The operation between 4.5 and (7.2) is understood to be multiplication.
- Many coding applications involve algebraic expressions being evaluated. This may be carried out in several steps. For example, the instruction: “input ‘the radius of a circle’, radiusA” is instructing the computer to define the variable “radiusA” and store whatever the user inputs into the temporary location called radiusA. The instruction: “calculate 2*radiusA, diameterA” instructs the computer to take the value that is stored in radiusA and multiply it by two, and then store that result in the temporary location, which is another variable called “diameterA”.

C2.3 Equalities and Inequalities

solve equations that involve multiple terms, whole numbers, and decimal numbers 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 to solve equations including guess-and-check, the balance model, and the reverse flow chart.
- The strategy of using a reverse flow chart can be used to solve equations like $\frac{m}{4} - 2.1 = 10.4$. The first diagram shows the flow of operations performed on the variable m to produce the result 10.4. The second diagram shows the reverse flow chart, or flow of the reverse operations, in order to identify the value of the variable m.

$m \rightarrow \div 4 \rightarrow -2.1 \rightarrow 10.4$

$50 \leftarrow \times 4 \leftarrow +2.1 \leftarrow 10.4$

- 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, $A = lw$, if $l = 10.5$, and $w = 3.5$, then $A = (10.5)(3.5) = 36.75$. If $A = 36.75$ and $l = 10.5$, then $36.75 = 10.5w$, and this will require dividing both sides by 10.5 to solve for w.

Note

- Some equations may require monomials to be added together before they can be solved using the reverse flow chart method.
- The flow chart used in coding is different from the reverse flow chart that can be used to solve equations.

C2.4 Equalities and Inequalities

solve inequalities that involve multiple terms and whole numbers, and verify and graph the solutions

Teacher supports

Key concepts

- An inequality 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 by placing a dot at the greatest or least possible value. An open dot is used when an inequality involves “less than” or “greater than”; if the inequality includes the equal sign (=), then a closed dot is used.

Note

- Inequalities that involve multiple terms may need to be simplified before they can be solved.
- The solution for an inequality that has one variable, such as $2x + 3x < 10$, 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 7, students will:

C3.1 Coding Skills

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

Teacher supports

Key concepts

- Sub-programs are used to assemble a complex program by writing portions of the code that can be modularized. This helps to create efficient code.
- Sub-programs can be used to run specific sequences of code that are only needed or activated in response to specific inputs from the main program.
- Sub-programs can be reused for multiple programs or can be called upon more than once from one main program. For example, a sub-program to determine the area of a rectangle can be used in a program to optimize area, determine the surface area of a rectangle-based prism, and calculate the volume of a rectangle-based prism.

Note

- Coding can support students in developing 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. (See **SEs C2.2** and **C2.3**.)

- One way to introduce the idea of a sub-program is to use a defined count. A defined count is used to repeat an instruction either for a predefined number of times (e.g., 10 repeats) or until a condition has been met (e.g., Number <= 100).
- Students can curate their code from previous learning and use pieces of it as sub-programs for more complex programs.
- If students program a formula for the circle, they may need to use an approximation of pi (3.14 or $\frac{22}{7}$), depending on the programming language they are using.

C3.2 Coding Skills

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

Teacher supports

Key concepts

- Reading code is done to make predictions as to 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 is altered so that an expected outcome can be achieved.
- Code can be altered to be used for a new situation.
- Altering code to make it more efficient often involves refining algorithms so that there are no unnecessary steps and using control structures effectively.
- Loops can be used to create efficient code.
- Using sub-programs makes it easier to debug programs, since each sub-program can be tested individually.

Note

- When students are reading code, they are exercising problem-solving skills related to predicting and estimating.
- By reading code and describing the algorithms, students can begin to communicate their ideas around efficiencies and can begin to compare various “correct” solutions.
- By becoming familiar with pre-existing sub-programs, students can better communicate tools that they might use to solve future, more ambiguous real-life problems.

- 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.
- Efficient code can be altered more easily than inefficient code to adapt to new mathematical situations. For example, in a probability simulation, the number of trials can be increased by changing the number of repeats rather than writing additional lines of code for each of the new trials.

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 7, students will:

D1. Data Literacy

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

Specific expectations

By the end of Grade 7, students will:

D1.1 Data Collection and Organization

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

Teacher supports

Key concepts

- When comparing categories of a large population, it is easier to compare them by relative amounts (i.e., using percentages) rather than by their exact quantities. For example, in a survey administered to 45 896 respondents, 36 572 respondents selected “yes” and 592 selected “maybe”. It is easier to interpret the data if you know that 80% selected “yes” and 1% selected “maybe”.
- A variable for data sets of various populations with different sizes can be compared relatively.

Note

- Samples of varying sizes can also be compared relatively.

D1.2 Data Collection and Organization

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

Teacher supports

Key concepts

- The type and amount of data to be collected is based on the questions of interest. Some questions of interest may require answering multiple questions that involve any combination of qualitative data and quantitative data.
- 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.
- Relative frequency tables are helpful for recording and analysing data and necessary to prepare certain kinds of graphs. The frequencies in a relative frequency table must add to 100% if expressed as percentages and add to 1 if expressed as decimal numbers.
- In order to prepare a circle graph, the angle measures are determined by calculating the percentage of 360 degrees that each sector (category) requires.

D1.3 Data Visualization

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

Teacher supports

Key concepts

- Circle graphs are used to show how categories represent parts of a whole data set that can be either qualitative or quantitative data. Histograms are used to display intervals of continuous quantitative data.
- Broken-line graphs are used to show changes over time.
- Pictographs, line plots, bar graphs, multiple-bar graphs, and stacked-bar graphs may be used to display qualitative data, and discrete quantitative data.
- The source, titles, labels, and scales provide important information about data in a graph:
    - The source indicates where the data was collected.
    - The title introduces the data contained in the graph.

- Labels provide additional information, such as the categories that are represented in the sectors of a circle graph. Percentages are often used in circle graphs to describe the categories.
- Scales identify the possible values of a variable along an axis of a graph. Values are arranged in ascending order on a scale.

Note

- When there are too many sections in the circle graph, it gets too crowded and hard to read. A possible strategy is to group more than one category together.

D1.4 Data Visualization

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

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, graphs, with limited text including quotes.
- Information to be included in an infographic needs to be carefully considered so that it is clear, concise, connected, and makes an impact.
- 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 impact of adding or removing data from a data set on a measure of central tendency, and describe how these changes alter the shape and distribution of the data

Teacher supports

Key concepts

- Adding or removing a data value that is not the most frequent value in the set will not impact the mode.
- Adding data values that are extremely different from the existing data values can have a significant impact on the measures of central tendencies. As a result, the distribution and the shape of the data shown in the graphs can change.
- Removing data values that are clustered to one end or the other of an ordered data set can significantly impact the measures of central tendencies. As a result, the distribution and the shape of the data shown in the graphs can change.

Note

- Outliers are measures that are significantly different from the other measures. They may mean that something may have gone wrong in the data collection or they may represent a valid, unexpected piece of the population needing further clarification.

D1.6 Data Analysis

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

Teacher supports

Key concepts

- When interpreting a circle graph, the size of the slices (sectors) will help indicate which category is greatest or least. Sometimes the actual amount is needed, and this will require the percentage to be multiplied by the total number of data values.
- All of the slices (sectors) in a circle graph should add up to 100%.
- Looking at the angle of a sector can help in estimating the percentage that a sector takes up.
- Fractions can also describe the sectors of a circle graph, e.g., if a sector takes up half of the circle, it would represent half of total data.
- Sometimes graphs misrepresent data or show it inappropriately and this can influence the conclusions made about the data. 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.

D2. Probability

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

Specific expectations

By the end of Grade 7, students will:

D2.1 Probability

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

Teacher supports

Key concepts

- Two events are independent when the outcome of one event does not affect the outcome of the other event.
- Two events are dependent when the outcome of the first event affects the outcome of the second event.

Note

- The probabilities for independent and dependent events can be compared when based on the same event with slightly different conditions. For example, the probability of selecting two names from a bag with replacement versus the probability of selecting two names from a bag without replacement.

D2.2 Probability

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

Teacher supports

Key concepts

- The more trials completed in an experiment, the closer the experimental probability will be to the theoretical probability.
- The sum of the probability of all possible outcomes is 1 or 100%.
- The probability of an event can be used to predict the likelihood of that event happening again in the future.
- Tree diagrams are helpful to determine all the possible outcomes for two independent events and two dependent events.

Note

- “Odds in favour” is a comparison of the probability that an event will occur with the probability that the event will not occur (complementary events). For example, the probability that the sum of two dice is 2 is $\frac{1}{36}$ and the probability that the sum of two dice is not 2 is $\frac{35}{36}$ .The odds in favour of rolling a sum of 2 is $\frac{1}{36}:\frac{35}{36}$ or 1 : 35, since the fractions are both relative to the same whole

E. Spatial Sense

Overall expectations

By the end of Grade 7, students will:

E1. Geometric and Spatial Reasoning

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

Specific expectations

By the end of Grade 7, students will:

E1.1 Geometric Reasoning

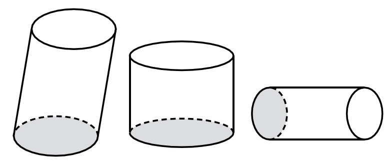
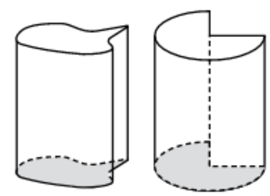
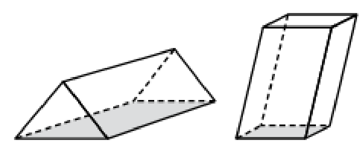
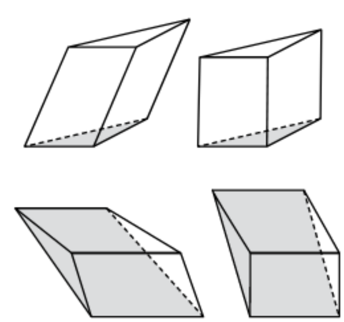
describe and classify cylinders, pyramids, and prisms according to their geometric properties, including plane and rotational symmetry

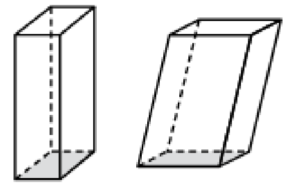
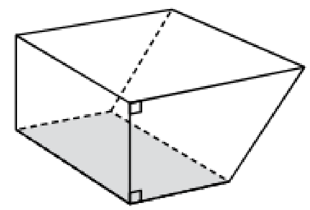
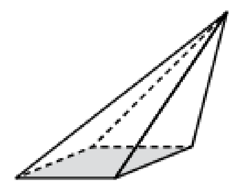
Teacher supports

Key concepts

- A geometric property is an attribute that helps define a class of objects.
- Cylinders, pyramids, and prisms represent three broad categories of three-dimensional objects.
- There are many attributes that are used to distinguish and define sub-categories or classes of objects, including:
    - the shape of the base or bases;
    - the number of bases;
    - the number of edges and vertices;
    - whether the object is symmetrical (e.g., whether it has rotational or plane symmetry);
    - whether the faces are perpendicular to the bases.
- Three-dimensional objects can have rotational symmetry (when an object can rotate around an axis and find a new spin position that matches its original position) and plane symmetry (when an object can be split along a plane to create two symmetrical parts). Generating property lists and using them to create geometric arguments builds spatial

sense. Minimum property lists identify the fewest properties needed to identify a class (e.g., if a prism has only one plane of symmetry, it must be an oblique prism). The following is a list of some properties for cylinders, prisms, and pyramids.

Cylinders	• Cylinders have two congruent faces that are parallel to each other. These are the bases of the cylinder. The bases of a cylinder may be circular, or its edges may be curved, straight, or some combination of curved or straight. • Any cross-section of a cylinder that is parallel to the base produces a face that is identical to its base. • Parallel lines (elements) join one base to the other. If the base of a cylinder is circular, it is a circular cylinder. If the base is a polygon, the cylinder is also a prism. • Cylinders may be right-angled or oblique, depending on whether the lines (elements) joining the bases are perpendicular to the bases or not. • All cylinders have translational symmetry (e.g., one base can be translated onto the other base), circular right cylinders also have plane and rotational symmetry. Whether a cylinder has rotational or reflective symmetry can distinguish subcategories of cylinders. • The height of a cylinder is the distance between its bases.	 Cylinders  Non-Circular Cylinders  Special Cylinders: Prisms
Prisms	• Prisms are special types of cylinders, with two congruent, polygonal faces that are parallel to each other. These are the bases of the prism. • Any cross-section of a prism that is parallel to the base produces a face that is identical to the base. • A prism is named for the shape of its base. So, for example, triangle-based prisms (or simply, triangular prisms) have two bases that are triangular, which are joined by parallelograms.	 Triangular Prisms

	• The lines (elements) joining the bases form faces that are parallelograms (inclusive of rectangles). • Prisms may be right-angled or oblique, depending on whether the lines (elements) joining the bases are perpendicular to the base or not. Rectangular faces produce right prisms; faces that are non-rectangular parallelograms produce oblique prisms. • All prisms have translational symmetry (i.e., one base can be translated onto the other base). Whether a prism has rotational or reflective symmetry can distinguish subcategories of prisms. • The height of a prism is the distance between its bases.	 Rectangular Prisms  Trapezoidal Prism
Pyramids	• Pyramids are a special type of cone with a polygon for a base. Triangles extend from each side of the base and join at the apex of the pyramid. • Any cross section of a pyramid, if it is parallel to its base, produces a scaled (similar) version of its base. • A pyramid is named for the shape of its base. So, for example, a hexagon-based pyramid (or a hexagonal pyramid) has a hexagon for its base and six triangular faces. • Pyramids may be right-angled or oblique, depending on whether the apex of the pyramid lies directly above the centre (i.e., the diagonal bisectors) of its base. • Pyramids may or may not have rotational or reflective symmetry, depending on the shape of their bases.	 Rectangular Pyramid

E1.2 Geometric Reasoning

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

Teacher supports

Key concepts

- Three-dimensional objects can be graphically projected in two dimensions. Two-dimensional representations show how things are made, how they can be navigated, or how they can be reproduced, and can be used to represent anything from very small objects to very large spaces. They are used by designers, builders, urban planners, instruction illustrators, and others.
- Top (plan) views, and front and side (elevation) views are "flat drawings" without perspective. They are used in technical drawings to ensure a faithful reproduction in three dimensions.
- Scales are used to convey the proportions of the original (i.e., angles and relative distances). If the scale is 1:100, then 1 cm always represents 100 cm at full size, regardless of the view. A legend communicates the scale.
- A perspective drawing shows three views (top, front, side) in one illustration.
  - Perspective views cannot show the back side, so some elements may be hidden.
  - They are also better at representing straight edges than curves.
  - To achieve the appearance of perspective, they may distort angles and lengths.
  - They are often easier to visualize than elevation drawings and are typically preferred for illustrations.
- Two types of perspective drawings are isometric projections and cabinet projections.

Note

- Isometric projections show an object from the "corner", with the width and depth going off at equal angles. In isometric projections, a scale is applied consistently to all dimensions (e.g., 1 cm = 2 cm, for the height, width, and depth).

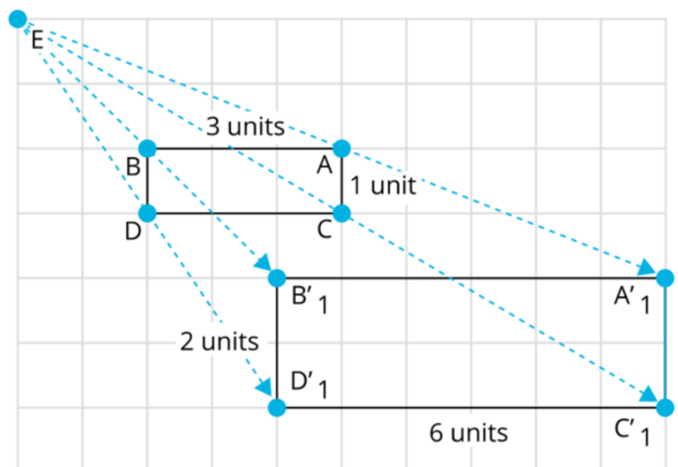
E1.3 Location and Movement

perform dilations and describe the similarity between the image and the original shape

Teacher supports

Key concepts

- A dilation (or dilatation) is a transformation that enlarges or reduces a figure by a certain scale factor. Unlike translations, reflections, and rotations, a dilation does not produce a congruent image.
- A dilated image is *similar* to the original. In everyday language, a *similar* image means it simply resembles something else. In mathematics, *similar* has a very precise meaning. Similar figures have the same shape (angles are congruent) and their corresponding sides are proportional. If the width of a dilated rectangle is now twice as long, so too is its length.



Note

- Dynamic geometry applications are recommended tools for understanding how transformations behave *in motion*. In a dynamic environment, repositioning the point of dilation has an immediate impact, as does changing the scale factor.
- Dilations have connections to the concept of one-point perspective in Grade 7 of the Visual Arts strand of the Arts curriculum (see *The Ontario Curriculum, Grades 1–8: The Arts, 2009*, p. 143).

E1.4 Location and Movement

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

Teacher supports

Key concepts

- Translations, reflections, and rotations all produce congruent images.
- Translations “slide” a shape by a given distance and direction (vector).
- Reflections “flip” a shape across a reflection line to create its opposite.
- Rotations “turn” a shape around a centre of rotation by a given angle.
- When shapes are transformed on a Cartesian plane, patterns emerge between the coordinates of the original and the corresponding coordinates of the image. These patterns are particularly evident when:
    - the translation vector (distance and direction) is compared to the coordinates of the original and the translated image;
    - a shape is reflected across the *x*-axis or the *y*-axis;
    - a shape is rotated by 90° or 180° around the point of origin (0, 0).

E2. Measurement

compare, estimate, and determine measurements in various contexts

Specific expectations

By the end of Grade 7, students will:

E2.1 The Metric System

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

Teacher supports

Key concepts

- There is a relationship between volume and capacity.
- Volume can describe many aspects of the same object, so it is important to clarify “which volume” is being measured. For example, the volume of a cup could refer to:
    - the volume of liquid the cup could hold (i.e., its capacity – see the note below);
    - the volume of material needed to make the cup; or

- the volume of space needed if packing the cup in a box.

- Volume is measured in cubic units, and the measure represents the number of cubes needed to completely fill an object. Similar to units of area, a cubic unit is an amount of volume, and can come in any shape. Units of volume can be decomposed, rearranged, partitioned, and redistributed to better fill a volume and minimize gaps and overlaps.
- The row-and-column structure of an array that is the basis for indirectly measuring area (see **Grade 4, E2.5**) also helps structure the count of cubic units and is used to indirectly measure volume (see **SE E2.7**).
- Common metric units of volume include cubic centimetres (cm^3) and cubic metres (m^3). Common metric units of capacity are milliliters (mL), litres (L), and kilolitres (kL).
- There are relationships between metric units of capacity and volume: 1 mL of liquid occupies 1 cm^3 of space, and a 1L container has an interior volume of 1000 cm^3.
- The relationship between volume and capacity means that the volume of an object can be found using displacement: the amount of water displaced by an object (or the amount that the water rises) when it is submerged is equal to its volume. For example, if an object is dropped into 1 L of water, and the water level rises to 1.5 L, the change is 500 mL, which is equal to a volume of 500 cm^3.

Note

- Volume and capacity are not the same thing. An object will always take up space (volume), but it may not have capacity. A solid, for example, has volume but no capacity. The capacity of an object will also depend on its design; it may not be the same as the volume. For example, a vase may have a solid chunk of glass for its base resulting in less capacity than volume.
- In real-life experiences, units of volume and capacity may be used interchangeably.

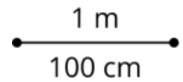
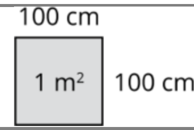
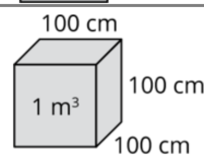
E2.2 The Metric System

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

Teacher supports

Key concepts

- Multiplicative relationships exist when converting from one metric unit to another. The relationships differ when converting units of length, units of area, and units of volume.

	In Metres	Visual Representation	In Centimetres
Length (one dimension)	1 metre		1 m = 100 cm
Area (two dimensions)	1 square metre = 1 m × 1 m		1 m^2 = 100 cm × 100 cm = 10 000 cm^2
Volume (three dimensions)	1 cubic metre = 1 m × 1 m × 1 m		1 m^3 = 100 cm × 100 cm × 100 cm = 1 000 000 cm^3

Note

- The goal is not to memorize these relationships as formulas, but to have the tools to visually represent and understand the relationships, and to use them to calculate unit conversions.
- The relationships between square centimetres and square metres, and between cubic centimetres and cubic metres, are ratios.
    - Since 1 metre = 100 cm, then 5 metres = 500 cm.
    - Since 1 m^2 = 10 000 cm^3, then 5 m^2 = 50 000 cm^2.
    - Since 1 m^3 = 1 000 000 cm^3, then 5 m^3 = 5 million cm^3.
- Since 1 millilitre has a volume of 1 cubic centimetre (see **SE E2.1**), by extension, there are 1 million millilitres in 1 cubic metre.
- In real-life experiences, units of volume and units of capacity may be used interchangeably, and conversions among these units may be necessary.

E2.3 Circles

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

Teacher supports

Key concepts

- For some shapes and some attributes, length measurements can be used to calculate other measurements. This is true for the circumference of a circle. Indirectly measuring the circumference of a circle is quicker and more accurate than measuring it directly (e.g., with a string).

- The distance from any point on a circle to its centre is always the same. This distance is a circle's *radius* (r).
- The *diameter* (d) of a circle is the longest distance from one side of a circle to another. The diameter will always pass through the centre of the circle, and so will be the same as two radiuses (r) (also called radii). This relationship can be expressed symbolically as ($d = 2r$) or ($r = d \div 2$).
- The perimeter of a circle – its distance around – is called its *circumference* (C). The circumference of a circle is a little more than 3 times the length of the diameter, or a little more than 6 times the length of the radius. This ratio is constant and is described using the Greek symbol π (spelled *pi* and pronounced like *pie*). This relationship can be expressed symbolically as ($C = \pi d$) or, equivalently, as ($C = \pi 2r$).
- Pi (π) is equal to $\frac{c}{d}$, which is a very important relationship, used in many math and physics formulas. It is approximately equal to 3.14159, but it is an *irrational number*, which means that it can never be exactly calculated: the decimals never end, and it cannot be represented precisely as a fraction.

Note

- The number of decimals used to express π depends on the level of precision needed. Commonly, π is approximated as 3.14 (or in fraction form as $\frac{22}{7}$). However, sometimes "a little more than 3" is a sufficient estimate; at other times, such as when astrophysicists calculate the circumference of the observable universe, π must be calculated to 39 digits. Some scientific applications round π to hundreds of digits, and mathematicians, using supercomputers, have calculated π to trillions of digits.

E2.4 Circles

construct circles when given the radius, diameter, or circumference

Teacher supports

Key concepts

- Compasses are often used to construct circles by hand. Another strategy is to attach a pencil to the end of a string. The radius must be known when using a compass or string to construct a circle.

- The relationships between the radius, diameter, and circumference may be used to determine the radius of a circle when its diameter or circumference are known.
- Circles of given measurements can also be constructed using technology. Dynamic geometry applications show how changes to radius, diameter or circumference affects the others.

Note

- The diameter (d) is twice the radius (r), (i.e., $d = 2r$), and the radius is half the diameter ($r = \frac{1}{2}d$).
- The circumference is a little more than 3 times (and a very little over 3.14 times) the length of the diameter ($C = \pi d$).
- If one of the three measurements are known – the circumference, the ratio, or the diameter – the other two can be measured indirectly by calculating.

E2.5 Circles

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

Teacher supports

Key concepts

- A relationship exists between the area of a circle (A) and its radius. This relationship can be expressed symbolically as ($A = \pi r^2$). The relationship between the radius and the diameter ($r = \frac{1}{2}d$) means that if either the radius or the diameter is known, the area can be measured indirectly, without the need to count square tiles. If the area is known, then the radius and the diameter can be determined using this relationship.

Note

- Visual proofs use the formulas for the area of a parallelogram or the area of a triangle to demonstrate the logic of the circle formula for area.

E2.6 Volume and Surface Area

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

Teacher supports

Key concepts

- Area is additive: partial areas can be added together to find a whole area. Finding the surface area of a cylinder is an application of the property of additivity.
- Nets help to visualize the two-dimensional shapes that make up a three-dimensional object such as a cylinder. Cylinders, for their bases, have two parallel, congruent faces (see **SE E1.1** for a full list of the properties of cylinders) that are joined by a rectangle (to produce a "*right*" cylinder) or a non-rectangular parallelogram (to produce an "*oblique*" cylinder).
- In real-life contexts, cylinders can have two closed bases (e.g., closed tin cans), one closed and one open base (e.g., cylindrical pencil holders), or two open bases (e.g., pipes; paper towel rolls).

Note

- Visualizing the net for a cylinder – imagining it in the "mind's eye" –involves identifying the shapes that form its faces and recognizing how the dimensions of the cylinder relate to the dimensions of the different faces.

E2.7 Volume and Surface Area

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

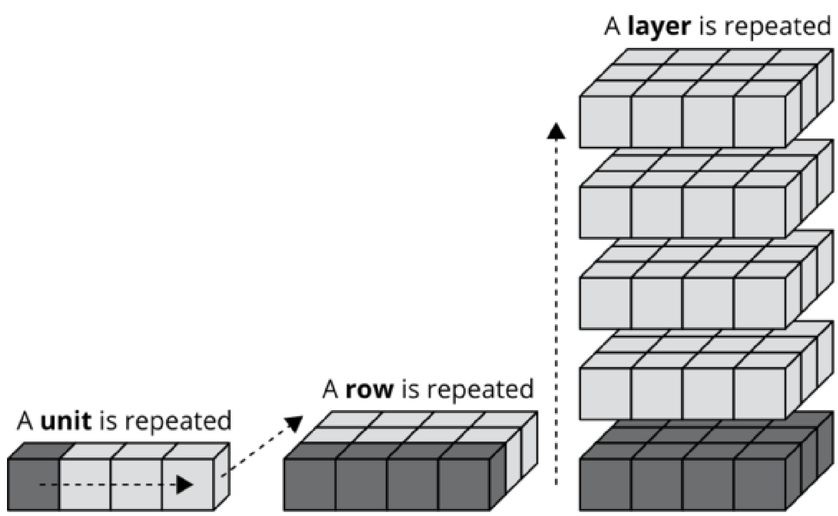
Teacher supports

Key concepts

- Volume is measured in cubic units, and the measure represents the number of cubes needed to completely fill an object. Similar to units of area, a cubic unit is an amount of volume, and can come in any shape. Units of volume can be decomposed, rearranged, partitioned, and redistributed to better fill a volume and minimize gaps and overlaps (see **SE E2.1**).

- Indirectly measuring the volume of shapes is often quicker, and more accurate than measuring volume directly (i.e., by laying out and stacking cubes).
- All prisms and cylinders have two congruent bases that are parallel to each other (see **SE E1.1)**. This means that, at any height in a prism or cylinder, a “slice” could be made, and – as long as the slice is parallel to the base – the cross-section that is created will have congruent faces. From top to bottom, the area of any slice, or layer, is consistent, and it is always equal to the area of the base. This geometric property of prisms and cylinders forms the basis for the formula for calculating their volume.
- Right prisms and right cylinders have bases that are perpendicular to their sides.
- The row-and-column structure of an array that helps to structure the count of square units for area (see **Grade 4, E 2.5**), also helps structure the count of cubic units and is used to indirectly measure volume.

    - A unit is repeated to produce the given length (a row).
    - A row is repeated to produce the given area of the base (a layer).
    - A layer is repeated to produce the given height (the volume).



- The *area of the base* determines how many cubes can be placed on the base, which forms a single unit – a layer of cubes. The height of the prism determines how many layers of cubes it takes to fill the volume. Therefore, the formula for finding the volume of a rectangular prism is: (area of the base) × (height).

Note

- The same is true for any prism or cylinder: the area of the base determines how many cubes can be placed on its base, and the height determines how many layers of cubes it takes to fill the volume. This means that the formula for finding the volume of *any* cylinder or prism is: (area of the base) × (height).

F. Financial Literacy

Overall expectations

By the end of Grade 7, students will:

F1. Money and Finances

demonstrate the knowledge and skills needed to make informed financial decisions

Specific expectations

By the end of Grade 7, students will:

F1.1 Money Concepts

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

Teacher supports

Key concepts

- International currencies have different values compared to Canadian currency.
- Current exchange rates can be used to convert Canadian currency into other currencies. Exchange rates can fluctuate daily.

F1.2 Financial Management

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

Teacher supports

Key concepts

- Managing finances, including creating financial goals, often requires accessing information from various sources in order to make decisions. It is important to recognize which sources of information are reliable and which are not reliable.

- Gaining experience in assessing the reliability of information sources helps strengthen financial management skills.

F1.3 Financial Management

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

Teacher supports

Key concepts

- Longer-term financial planning is a complex process with multiple steps requiring consolidation of prior knowledge and skills.
- Longer-term financial planning requires flexibility to respond to changing circumstances and the ability to make adjustments accordingly.
- Budgets include a recording of income and expenses over a period of time.

Note

- Simulated scenarios provide opportunities to learn financial literacy concepts in relevant and real-life contexts.
- Each person, family, or community may be facing a different financial situation, and some of these financial situations may be challenging or difficult. Fostering a safe, respectful, and inclusive environment in the classroom will ensure that all perspectives and opinions are valued and included when examining financial concepts.

F1.4 Financial Management

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

Teacher supports

Key concepts

- Many factors, including personal, family, cultural, and societal factors, can impact financial decision making. Awareness of these factors results in more informed decisions.
- Long-term financial well-being requires careful consideration of a variety of factors.

Note

- Social-emotional learning skills and financial management concepts and skills are developed concurrently.
- Each person, family, or community may be facing a different financial situation, and some of these financial situations may be challenging or difficult. Fostering a safe, respectful, and inclusive environment in the classroom will ensure that all perspectives and opinions are valued and included when examining financial concepts.

F1.5 Consumer and Civic Awareness

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

Teacher supports

Key concepts

- Interest rates can have an impact over time on amounts that are either invested or borrowed.
- Investing small amounts of money over the long term can potentially yield significant gains.

F1.6 Consumer and Civic Awareness

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

Teacher supports

Key concepts

- Financial institutions offer a range of accounts and products, including loans.
- Comparing interest rates and fees associated with different accounts and products can support more informed decisions appropriate to an individual’s circumstances.

Note

- Simulated scenarios provide opportunities for students to learn financial literacy concepts in relevant and real-life contexts.