

## BIG IDEAS

Algebra allows us to **generalize** relationships through abstract thinking.

The meanings of, and **connections** between, each operation extend to powers and polynomials.

Constant rate of change is an essential attribute of linear **relations** and has meaning in different representations and contexts.

Trigonometry involves using **proportional reasoning** to solve **indirect measurement** problems.

Representing and analyzing **situations** allows us to notice and wonder about relationships.

## Learning Standards

| Curricular Competencies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p><i>Students are expected to do the following:</i></p> <p><b>Reasoning and modelling</b></p> <ul style="list-style-type: none"> <li>• Develop <b>thinking strategies</b> to solve puzzles and play games</li> <li>• Explore, <b>analyze</b>, and apply mathematical ideas using <b>reason</b>, <b>technology</b>, and <b>other tools</b></li> <li>• <b>Estimate reasonably</b> and demonstrate <b>fluent, flexible, and strategic thinking</b> about number</li> <li>• <b>Model</b> with mathematics in <b>situational contexts</b></li> <li>• <b>Think creatively</b> and with <b>curiosity and wonder</b> when exploring problems</li> </ul> <p><b>Understanding and solving</b></p> <ul style="list-style-type: none"> <li>• Develop, demonstrate, and apply mathematical understanding through play, story, <b>inquiry</b>, and problem solving</li> <li>• <b>Visualize</b> to explore and illustrate mathematical concepts and relationships</li> <li>• Apply <b>flexible and strategic approaches</b> to <b>solve problems</b></li> <li>• Solve problems with <b>persistence and a positive disposition</b></li> <li>• Engage in problem-solving experiences <b>connected</b> with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures</li> </ul> | <p><i>Students are expected to know the following:</i></p> <ul style="list-style-type: none"> <li>• operations on <b>powers</b> with integral exponents</li> <li>• <b>prime factorization</b></li> <li>• <b>functions and relations:</b> connecting data, graphs, and situations</li> <li>• <b>linear functions:</b> slope and equations of lines</li> <li>• <b>arithmetic sequences</b></li> <li>• <b>systems</b> of linear equations</li> <li>• <b>multiplication</b> of polynomial expressions</li> <li>• polynomial <b>factoring</b></li> <li>• primary <b>trigonometric</b> ratios</li> <li>• <b>financial literacy:</b> gross and net pay</li> </ul> |

### Learning Standards (continued)

| Curricular Competencies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Content |
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| <p><b>Communicating and representing</b></p> <ul style="list-style-type: none"> <li>• <b>Explain and justify</b> mathematical ideas and <b>decisions</b> in <b>many ways</b></li> <li>• <b>Represent</b> mathematical ideas in concrete, pictorial, and symbolic forms</li> <li>• Use mathematical vocabulary and language to contribute to <b>discussions</b> in the classroom</li> <li>• Take risks when offering ideas in classroom <b>discourse</b></li> </ul> <p><b>Connecting and reflecting</b></p> <ul style="list-style-type: none"> <li>• <b>Reflect</b> on mathematical thinking</li> <li>• <b>Connect mathematical concepts</b> with each other, other areas, and personal interests</li> <li>• Use <b>mistakes</b> as <b>opportunities to advance learning</b></li> <li>• <b>Incorporate</b> First Peoples worldviews, perspectives, <b>knowledge</b>, and <b>practices</b> to make connections with mathematical concepts</li> </ul> |         |

Big Ideas – Elaborations

• **generalize:**

*Sample questions to support inquiry with students:*

- After solving a problem, can we extend it? Can we generalize it?
- How can we take a contextualized problem and turn it into a mathematical problem that can be solved?
- How can we tell if a mathematical solution is reasonable?
- Where can errors occur when solving a contextualized problem?
- What do we notice when we square binomials?
- How do we decide on a strategy for solving a system of equations?

• **connections:**

*Sample questions to support inquiry with students:*

- How are the different operations (+, −, ×, ÷, exponents) connected?
- What are the similarities and differences between multiplication of numbers, powers, and polynomials?
- How is prime factorization helpful?
- How does prime factorization of numbers extend to algebraic terms?
- How can we verify that we have factored a trinomial correctly?
- How can visualization support algebraic thinking?
- How can patterns in numbers lead to algebraic generalizations?

• **relations:**

*Sample questions to support inquiry with students:*

- How can we tell if a relation is linear?
- How can we use rate of change to make predictions?
- What connections can we make between arithmetic sequences and linear functions?
- How do we decide which form of linear equation to use?

• **proportional reasoning:**

- comparisons of relative size or scale instead of numerical difference

• **indirect measurement:**

- using measurable values to calculate immeasurable values (e.g., calculating the height of a tree using distance from the tree and the angle to the top of the tree)

*Sample questions to support inquiry with students:*

- When might we need to measure a length or angle indirectly?
- Why is trigonometry defined in reference to right triangles rather than other types of triangles?
- How can rate of change be connected to trigonometry?
- What is the origin of the names for the trigonometric ratios?

## Big Ideas – Elaborations

- **situations:**

- situational contexts (e.g., relating volume to height when filling containers of different shapes, relating distance to time for a bike ride)
- non-situational contexts (e.g., the graph of a piecewise function)

*Sample questions to support inquiry with students:*

- How does the representation of a relation support a strategy when solving a problem?
- Do all data have trends and relationships?
- Why are trends important?

## Curricular Competencies – Elaborations

- **thinking strategies:**

- using reason to determine winning strategies
- generalizing and extending

- **analyze:**

- examine the structure of and connections between mathematical ideas (e.g., using an area model to factor a trinomial)

- **reason:**

- inductive and deductive reasoning
- predictions, generalizations, conclusions drawn from experiences (e.g., with puzzles, games, and coding)

- **technology:**

- graphing technology, dynamic geometry, calculators, virtual manipulatives, concept-based apps
- can be used for a wide variety of purposes, including:
  - exploring and demonstrating mathematical relationships
  - organizing and displaying data
  - generating and testing inductive conjectures
  - mathematical modelling

Curricular Competencies – Elaborations

- **other tools:**
  - manipulatives such as algebra tiles and other concrete materials
- **Estimate reasonably:**
  - be able to defend the reasonableness of an estimated value or a solution to a problem or equation (e.g., estimating the solution for a system of equations from a graph)
- **fluent, flexible and strategic thinking:**
  - includes:
    - using known facts and benchmarks, partitioning, applying whole number strategies to rational numbers and algebraic expressions
    - choosing from different ways to think of a number or operation (e.g., Which will be the most strategic or efficient?)
- **Model:**
  - use mathematical concepts and tools to solve problems and make decisions (e.g., in real-life and/or abstract scenarios)
  - take a complex, essentially non-mathematical scenario and figure out what mathematical concepts and tools are needed to make sense of it
- **situational contexts:**
  - including real-life scenarios and open-ended challenges that connect mathematics with everyday life
- **Think creatively:**
  - by being open to trying different strategies
  - refers to creative and innovative mathematical thinking rather than to representing math in a creative way, such as through art or music
- **curiosity and wonder:**
  - asking questions to further understanding or to open other avenues of investigation
- **inquiry:**
  - includes structured, guided, and open inquiry
  - noticing and wondering
  - determining what is needed to make sense of and solve problems
- **Visualize:**
  - create and use mental images to support understanding
  - Visualization can be supported using dynamic materials (e.g., graphical relationships and simulations), concrete materials, drawings, and diagrams.
- **flexible and strategic approaches:**
  - deciding which mathematical tools to use to solve a problem
  - choosing an effective strategy to solve a problem (e.g., guess and check, model, solve a simpler problem, use a chart, use diagrams, role-play)

Curricular Competencies – Elaborations

- **solve problems:**
  - interpret a situation to identify a problem
  - apply mathematics to solve the problem
  - analyze and evaluate the solution in terms of the initial context
  - repeat this cycle until a solution makes sense
- **persistence and a positive disposition:**
  - not giving up when facing a challenge
  - problem solving with vigour and determination
- **connected:**
  - through daily activities, local and traditional practices, popular media and news events, cross-curricular integration
  - by posing and solving problems or asking questions about place, stories, and cultural practices
- **Explain and justify:**
  - use mathematical arguments to convince
  - includes anticipating consequences
- **decisions:**
  - Have students explore which of two scenarios they would choose and then defend their choice.
- **many ways:**
  - including oral, written, visual, use of technology
  - communicating effectively according to what is being communicated and to whom
- **Represent:**
  - using models, tables, graphs, words, numbers, symbols
  - connecting meanings among various representations
  - using concrete materials and dynamic interactive technology
- **discussions:**
  - partner talks, small-group discussions, teacher-student conferences
- **discourse:**
  - is valuable for deepening understanding of concepts
  - can help clarify students' thinking, even if they are not sure about an idea or have misconceptions
- **Reflect:**
  - share the mathematical thinking of self and others, including evaluating strategies and solutions, extending, posing new problems and questions

## Curricular Competencies – Elaborations

- **Connect mathematical concepts:**
  - to develop a sense of how mathematics helps us understand ourselves and the world around us (e.g., daily activities, local and traditional practices, popular media and news events, social justice, cross-curricular integration)
- **mistakes:**
  - range from calculation errors to misconceptions
- **opportunities to advance learning:**
  - by:
    - analyzing errors to discover misunderstandings
    - making adjustments in further attempts
    - identifying not only mistakes but also parts of a solution that are correct
- **Incorporate:**
  - by:
    - collaborating with Elders and knowledge keepers among local First Peoples
    - exploring the [First Peoples Principles of Learning](#) (e.g., Learning is holistic, reflexive, reflective, experiential, and relational [focused on connectedness, on reciprocal relationships, and a sense of place]; Learning involves patience and time)
    - making explicit connections with learning mathematics
    - exploring cultural practices and knowledge of local First Peoples and identifying mathematical connections
- **knowledge:**
  - local knowledge and cultural practices that are appropriate to share and that are non-appropriated
- **practices:**
  - [Bishop's cultural practices](#): counting, measuring, locating, designing, playing, explaining
  - [Aboriginal Education Resources](#)
  - [Teaching Mathematics in a First Nations Context](#), FNEC

Content – Elaborations

- **powers:**
  - positive and negative exponents
  - exponent laws
  - evaluation using order of operations
  - numerical and variable bases
- **prime factorization:**
  - expressing prime factorization of a number using powers
  - identifying the factors of a number
  - includes greatest common factor (GCF) and least common multiple (LCM)
  - strategies include using factor trees and factor pairs
- **functions and relations:**
  - communicating domain and range in both situational and non-situational contexts
  - connecting graphs and context
  - understanding the meaning of a function
  - identifying whether a relation is a function
  - using function notation
- **linear functions:**
  - slope: positive, negative, zero, and undefined
  - types of equations of lines (point-slope, slope intercept, and general)
  - equations of parallel and perpendicular lines
  - equations of horizontal and vertical lines
  - connections between representations: graphs, tables, equations
- **arithmetic sequences:**
  - applying formal language (common difference, first term, general term) to increasing and decreasing linear patterns
  - connecting to linear relations
  - extension: exploring arithmetic series
- **systems:**
  - solving graphically
  - solving algebraically by inspection, substitution, elimination
  - connecting ordered pair with meaning of an algebraic solution
  - solving problems in situational contexts

Content – Elaborations

- **multiplication:**
  - applying the distributive property between two polynomials, including trinomials
  - connecting the product of binomials with an area model
- **factoring:**
  - greatest common factor of a polynomial
  - simpler cases involving trinomials ( $y = x^2 + bx + c$ ) and difference of squares
- **trigonometric:**
  - sine, cosine, and tangent ratios
  - right-triangle problems: determining missing sides and/or angles using trigonometric ratios and the Pythagorean theorem
  - contexts involving direct and indirect measurement
- **financial literacy:**
  - types of income
  - income tax and other deductions