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
Students are expected to do the following: **Reasoning and modelling** • Develop **thinking strategies** to solve puzzles and play games • Explore, **analyze**, and apply mathematical ideas using **reason**, **technology**, and **other tools** • **Estimate reasonably** and demonstrate **fluent, flexible, and strategic thinking** about number • **Model** with mathematics in **situational contexts** • **Think creatively** and with **curiosity and wonder** when exploring problems **Understanding and solving** • Develop, demonstrate, and apply mathematical understanding through play, story, **inquiry**, and problem solving • **Visualize** to explore and illustrate mathematical concepts and relationships • Apply **flexible and strategic approaches** to **solve problems** • Solve problems with **persistence and a positive disposition** • Engage in problem-solving experiences **connected** with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures	*Students are expected to know the following:* • operations on **powers** with integral exponents • **prime factorization** • **functions and relations:** connecting data, graphs, and situations • **linear functions:** slope and equations of lines • **arithmetic sequences** • **systems** of linear equations • **multiplication** of polynomial expressions • polynomial **factoring** • primary **trigonometric** ratios • **financial literacy:** gross and net pay

 © Province of British Columbia

Learning Standards (continued)

Curricular Competencies	Content
Communicating and representing • **Explain and justify** mathematical ideas and **decisions** in **many ways** • **Represent** mathematical ideas in concrete, pictorial, and symbolic forms • Use mathematical vocabulary and language to contribute to **discussions** in the classroom • Take risks when offering ideas in classroom **discourse** **Connecting and reflecting** • **Reflect** on mathematical thinking • **Connect mathematical concepts** with each other, other areas, and personal interests • Use **mistakes** as **opportunities to advance learning** • **Incorporate** First Peoples worldviews, perspectives, **knowledge**, and **practices** to make connections with mathematical concepts	

© Province of British Columbia

- **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 (+, –, x, ÷, 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?

- **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?

- **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

- **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)

- **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

- **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*, FNESC

- **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