BIG IDEAS

Probabilistic thinking informs decision making in situations involving chance and uncertainty.	**Modelling** data requires an understanding of a variety of functions.	Mathematical analysis informs financial **decisions**.	Through **explorations** of spatial relationships, we can develop a geometrical appreciation of the world around us.

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 conceptual understanding of mathematical ideas 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:* • geometric explorations: – **constructions** – **conics** – **fractals** • graphical **representations** of polynomial, logarithmic, exponential, and sinusoidal functions • **regression analysis** • **combinatorics** • **odds, probability**, and expected value • **financial planning**

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	

Big Ideas – Elaborations

- **Probabilistic thinking:**
  Sample questions to support inquiry with students:
  - How do we make decisions involving probabilities?
  - How reliable is a test that is 98% accurate?
  - What is the difference between reliability and accuracy?
  - What information is needed when considering the likelihood of an event?
- **Modelling:**
  Sample questions to support inquiry with students:
  - How do we know what type of regression best models a given set of data?
  - What factors would affect the reliability of a regression analysis?
  - What are the limitations associated with regression models?
- **decisions:**
  Sample questions to support inquiry with students:
  - How do we make decisions regarding our financial options?
  - What are the repercussions of our financial decisions (e.g., in the short term versus the long term)?
  - What factors influence our willingness to take financial risks?
- **explorations:**
  Sample questions to support inquiry with students:
  - What can we construct using a straightedge and compass?
  - What properties change and stay the same when we vary a square, parallelogram, triangle, and so on?
  - How are circles, ellipses, parabolas, and hyperbolas related?
  - Where are conics found in the world around us?
  - How does nature exhibit fractal properties?
  - What patterns do we see in fractals?

- **thinking strategies:**
  - using reason to determine winning strategies
  - generalizing and extending
- **analyze:**
  - examine the structure of and connections between mathematical ideas (e.g., conic sections, functions, financial planning)
- **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., regression analysis and combinatorics calculations)
- **fluent, flexible and strategic thinking:**
  - includes using known facts and benchmarks; partitioning; applying whole number strategies to graphing; regression choice; probability
- **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

Curricular Competencies – Elaborations

- **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
- **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

Content – Elaborations

- **constructions:**
  - perpendicular bisector, tangents, polygons, tessellations, geometric art
- **conics:**
  - locus definition and constructions, conic sections, applications
- **fractals:**
  - understanding fractals as an iteration of a simple instruction
  - constructing and analyzing models of fractals, such as Cantor's dust, Serpinski's triangle, Koch's snowflake
  - connecting fractals with nature
- **representations:**
  - using technology only
  - using characteristics of a graph to identify these functions
- **regression analysis:**
  - polynomial, exponential, sinusoidal, logarithmic
  - applying the appropriate regression model
- **combinatorics:**
  - permutations, combinations, pathways, Pascal's Triangle
- **odds, probability:**
  - mutually exclusive, non–mutually exclusive, conditional probability, binomial probability
  - Venn diagrams
- **financial planning:**
  - developing a personal financial portfolio
  - mortgages
  - risk
  - changing interest rates and/or payments
  - credit cards
  - exploring banking options and financial markets