BIG IDEAS

Design involves investigating, planning, creating, and evaluating.	Constructing **3D objects** often requires a 2D plan.	**Transferring mathematical skills** between problems requires conceptual understanding and flexible thinking.	**Proportional reasoning** is used to make sense of multiplicative relationships.	Choosing a tool based on required precision and accuracy is important when **measuring**.

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:* • **measuring:** using tools with graduated scales; conversions using metric and imperial • similar **triangles:** including right-angle trigonometry • 2D and 3D shapes: including area, surface area, volume, and nets • **3D objects** and their views (isometric drawing, orthographic projection) • **mathematics in the workplace** • **financial literacy:** business investments and loans

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 computer science concepts	

Big Ideas – Elaborations

- **Design:**
  Sample questions to support inquiry with students:
  - How is a product designed?
  - How can the design process be applied to meet a need or solve a problem?
- **3D objects:**
  Sample questions to support inquiry with students:
  - What are some limitations that result when 3D objects are represented in 2D?
  - Which type of 2D representation would be the most appropriate for a 3D object?
  - How does visualization help when solving problems?
  - How does visualization help break down a larger problem?
- **Transferring mathematical skills:**
  Sample questions to support inquiry with students:
  - How does awareness and knowledge of mathematics in the workplace make learning more meaningful?
  - What is the mathematics required for a particular trade of interest?
- **Proportional reasoning:**
  - reasoning about comparisons of relative size or scale instead of numerical difference
  - ways of showing proportional comparison when analyzing problems in situational contexts
    - scale diagrams
    - rates of change

  Sample questions to support inquiry with students:
  - How are proportions used to solve problems?
  - What is the importance of proportional reasoning when making sense of the relationship between two things?
- **measuring:**
  Sample questions to support inquiry with students:
  - What skills are required for measuring with accuracy?
  - What is the importance of choosing appropriate tools and units when measuring?
  - What are the implications of inaccurate measurements?

- **thinking strategies:**
  - using reason to determine winning strategies
  - generalizing and extending
- **analyze:**
  - examine the structure of and connections between mathematical ideas (e.g., proportional reasoning, metric/imperial conversions)
- **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 rulers and other measuring tools
- **Estimate reasonably:**
  - be able to defend the reasonableness of an estimated value or a solution to a problem or equation (e.g., reasonableness of measurements)
- **fluent, flexible, and strategic thinking:**
  - including:
    - using known facts and benchmarks, partitioning, applying whole number strategies to expressions involving proportional reasoning, financial analysis, and logic
    - 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
- **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

- **measuring:**
  - unit analysis
  - precision and accuracy
  - breaking of units into smaller divisions to get more precise measurements
  - extension: project or presentation to share measurement concepts and skills used in a field/career of interest
- **triangles:**
  - situational examples such as stairs and roofs
  - application of Pythagorean theorem
  - situations involving multiple right-angle triangles
- **3D objects:**
  - creating and reading various types of technical drawings
  - extension: project or presentation to share geometry concepts and skills used in a field/career of interest
- **mathematics in the workplace:**
  - compare and contrast mathematics used in different workplace contexts
  - interview someone working in a field of interest
  - extension: project that includes an element of design and mathematical thinking
- **financial literacy:**
  - business investments, loans (lease versus buy), graphical representations of financial growth, projections, expenses
  - extension: project or presentation to share mathematical concepts and skills used in a field/career of interest