**Area of Learning: MATHEMATICS — Foundations of Mathematics Grade 11**

**BIG IDEAS**

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| **Similar** shapes and objects have proportional relationships that can be described, measured, and compared. |  | **Optimization** informs the decision-making process in situations involving extreme values. |  | **Logical reasoning** helps us discover and describe mathematical truths. |  | Statistical analysisallows us to notice, wonder about, and answer questions about **variation**. |

**Learning Standards**

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| **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:*   * forms of **mathematical reasoning** * **angle relationships** * **graphical analysis:**    + **linear inequalities**   + **quadratic functions**   + **systems of equations**   + **optimization** * **applications** of **statistics** * **scale models** * **financial literacy:** compound interest, investments and loans |

**Area of Learning: MATHEMATICS — Foundations of Mathematics Grade 11**

**Learning Standards (continued)**

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| **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 makeconnections with mathematical concepts |  |

| **MATHEMATICS – Foundations of Mathematics  Big Ideas – Elaborations Grade 11** |
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| * **Similar:**   *Sample questions to support inquiry with students:*   * + What characteristics make objects similar?   + How do the properties of 3D objects change in an enlargement or a reduction?   + How do the properties of 2D objects change in an enlargement or a reduction? * **Optimization:**    + a mathematical analysis used to determine the minimum or maximum output for a given situation   *Sample questions to support inquiry with students:*   * + Can we think of a story where a conflict can be resolved through optimization?   + How can mathematics help us make decisions regarding the best course of action?   + What factors influence the decision-making process when determining an optimal solution?   + How do graphs aid in understanding a situation that is being optimized? * **Logical reasoning:**    + the process of using a strategic, systematic series of steps based on valid mathematical procedures and given statements to form a conclusion   *Sample questions to support inquiry with students:*   * + How can logical reasoning help us deal with problems in our everyday lives?   + How does puzzle and game analysis help us in the world outside the math classroom? * **variation:**    + occurs in observation (e.g., reaction to medications, opinions on topics, income levels, graduation rates)   *Sample questions to support inquiry with students:*   * + How do we gather data in order to answer questions?   + How do we analyze data and make decisions?   + Can we think of a story that involves variation? How would we describe the variation?   + When analyzing data, what are some of the factors that need to be considered before making inferences? |

| **MATHEMATICS – Foundations of Mathematics  Curricular Competencies – Elaborations Grade 11** |
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| * **thinking strategies:**   + using reason to determine winning strategies   + generalizing and extending * **analyze:**   + examine the structure of and connections between mathematical ideas (e.g., quadratics and cubic functions, linear inequalities, optimization, financial decision making) * **reason:**   + inductive and deductivereasoning   + 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., angle size reasonableness,  scale calculations and unit choice, optimal solutions) * **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 * **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](http://www.fnesc.ca/wp/wp-content/uploads/2015/09/PUB-LFP-POSTER-Principles-of-Learning-First-Peoples-poster-11x17.pdf) (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](http://www.csus.edu/indiv/o/oreyd/ACP.htm_files/abishop.htm): counting, measuring, locating, designing, playing, explaining   + [Aboriginal Education Resources](http://www.aboriginaleducation.ca/)   + [*Teaching Mathematics in a First Nations Context*,](http://www.fnesc.ca/resources/math-first-peoples/) FNESC |

| **MATHEMATICS – Foundations of Mathematics  Content – Elaborations Grade 11** |
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| * **mathematical reasoning:**   + logic, conjecturing, inductive and deductive thinking, proofs, game/puzzle analysis, counter-examples * **angle relationships:**   + properties, proofs, parallel lines, triangles and other polygons, angle constructions * **graphical analysis:**   + using technology only * **linear inequalities:**   + graphing of the solution region   + slope and intercepts   + intersection points of lines * **quadratic functions:**   + characteristics of graphs, including end behaviour, maximum/minimum, vertex, symmetry, intercepts * **systems of equations:**    + including linear with linear, linear with quadratic, and quadratic with quadratic * **optimization:**   + using feasible region to optimize objective function   + maximizing profit while minimizing cost   + maximizing area or volume while minimizing perimeter * **applications:**   + posing a question about an observed variation, collecting and interpreting data, and answering the question * **statistics:**   + measures of central tendency, standard deviation, confidence intervals, z-scores, distributions * **scale models:**   + enlargements and reductions of 2D shapes and 3D objects   + comparing the properties of similar objects (length, area, volume)   + square-cube law * **financial literacy:**    + compound interest   + introduction to investments/loans with regular payments using technology   + buy/lease |