**Area of Learning: MATHEMATICS — Foundations of Mathematics Grade 12**

**BIG IDEAS**

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| **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**

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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 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**
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**Area of Learning: MATHEMATICS — Foundations of Mathematics Grade 12**

**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
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|  **MATHEMATICS – Foundations of Mathematics Big Ideas – Elaborations Grade 12** |
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| * **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?
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|  **MATHEMATICS – Foundations of Mathematics Curricular Competencies – Elaborations Grade 12** |
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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., conic sections, functions, financial planning)
* **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., 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
* **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
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|  **MATHEMATICS – Foundations of Mathematics Content – Elaborations Grade 12** |
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| * **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
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