**Area of Learning: MATHEMATICS — Foundations of Mathematics and Pre-calculus Grade 10**

**BIG IDEAS**

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| 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**

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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:*   * 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 |

**Area of Learning: MATHEMATICS — Foundations of Mathematics and Pre-calculus Grade 10**

**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 and Pre-calculus Big Ideas – Elaborations Grade 10** |
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| * **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? |

| **MATHEMATICS – Foundations of Mathematics and Pre-calculus Curricular Competencies – Elaborations Grade 10** |
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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., using an area model to factor a trinomial) * **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., 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](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 and Pre-calculus Content – Elaborations Grade 10** |
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| * **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 * **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 ( 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 |