Area of Learning: Mathematics	**Foundations of Mathematics and Pre-calculus 10**
Big Ideas	Elaborations

• Algebra allows us to **generalize** relationships through abstract thinking.	• **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?

• The meanings of, and **connections** between, each operation extend to powers and polynomials.	• **connected:**
	• *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?

• Constant rate of change is an essential attribute of linear **relations** and has meaning in different representations and contexts.	• **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?
• Trigonometry involves using **proportional reasoning** to solve **indirect measurement** problems.	• **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?
• Representing and analyzing **situations** allows us to notice and wonder about relationships.	• **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?

Curricular Competencies	Elaborations	Content	Elaborations
Students are expected to do the following: Reasoning and modelling • Develop **thinking strategies** to solve puzzles and play games • Explore, **analyze**, and apply mathematical	• **thinking strategies:** ○ using reason to determine winning strategies ○ generalizing and extending • **analyze:** ○ examine the structure of and	*Students are expected to know the following:* • operations on **powers** with integral exponents • **prime factorization** • **functions and relations:** connecting data,	• **powers:** ○ positive and negative exponents ○ exponent laws ○ evaluation using order of operations ○ numerical and variable bases • **prime factorization:**

ideas using **reason**, **technology**, and **other tools** • **Estimate reasonably** and demonstrate **fluent, flexible, and strategic thinking** about number • **Model** with mathematics in **situational context**s • **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 Communicating and representing • **Explain and justify** mathematical ideas and **decisions** in **many ways** • **Represent** mathematical ideas in	connections between mathematical ideas (e.g., using an area model to factor a trinomial) • **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 to 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	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	○ 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

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	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		• **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 ($y = x^2 + bx + c$) and difference of squares • **trigonometric:** ○ sine, cosine, and tangent ratios ○ right-triangle problems: determining

	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 appropriate 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		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

	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: counting, measuring, locating, designing, playing, explaining (http://www.csus.edu/indiv/o/oreyd/ACP.htm_files/abishop.htm) ○ Aboriginal Education Resources (www.aboriginaleducation.ca) ○ *Teaching Mathematics in a First Nations Context*, FNESC (http://www.fnesc.ca/resources/math-first-peoples/)		