**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
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**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
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|  **MATHEMATICS – Foundations of Mathematics and Pre-calculusBig 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?
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|  **MATHEMATICS – Foundations of Mathematics and Pre-calculusCurricular 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
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|  **MATHEMATICS – Foundations of Mathematics and Pre-calculusContent – 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 ($y=x^{2}+bx+c)$ 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
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