Manitoba Rural Learning Consortium
Grade 9/10 Mathematics
Essential Learning Document

Acknowledgements

This document has been developed by Senior Years teachers from across rural Manitoba. The mRLC Grade 9/10 Mathematics Essential Learning Cohort was made up of the following members:

Mike Luptak	Borderland School Division
Shane Shumsky	Hanover School Division
Heather Blue	Lakeshore School Division
Erika Jonasson	Lakeshore School Division
Shannon Blondeau	Pine Creek School Division
Heather Howarth	Pine Creek School Division
Andrea Lenton	Pine Creek School Division
Anne Reimer	mRLC Facilitator

Introduction

What is mathematical literacy?

- Mathematical literacy is an evolving combination of recognizing, describing, and working with numerical and non-numerical patterns, having an intuitive number sense, interpreting and reflecting on the physical environment and making predictions.
- Mathematically literate individuals demonstrate fluency with mental mathematics and estimation, develop and apply new mathematical knowledge through problem solving and mathematical reasoning.
- Mathematically literate individuals can effectively communicate in order to learn and express their understanding, connect mathematical ideas to other concepts in mathematics, to everyday experiences, and to other disciplines.
- Students need to select and use technologies as tools for learning and solving problems as well as develop visualization skills to assist in processing information and making connections.

Enduring Understandings

In the new provincial report card, there are no categories in the senior years mathematics courses for which student progress must be tracked and reported. So unlike the documents developed by the mRLC for grades 1-8 where there is a distinct correlation to report card categories, we have chosen instead to highlight the enduring understandings of mathematics, mapping them across the strands of the curriculum and connecting them to essential learning and specific learning outcomes from the Manitoba Mathematics Curriculum. Our reasoning was this: If our aim is to develop mathematically literate persons, we must shift our focus from the content of math to using the content as a tool to develop the processes and critical thinking skills that define mathematical literacy. Our assessment practices must shift from being point-in-time snapshots to tracking a student's progress over time by providing multiple opportunities for them to demonstrate their learning.

By organizing the templates and sample gradebook according to enduring understandings, it becomes clear that a student has many opportunities to grow and develop in their understanding, their skills, and their thinking, regardless of which strand or unit they are learning. For example, we expect a student to be able to construct a graph from data. But rather than relegating graphing to a single lesson in a single unit, we connect that graphing lesson to the enduring understanding of multiple representations. Graphing is a way of representing. So in the number strand, a student learns how to construct it, in the patterns and relations strand the student learns more about how to interpret it and to connect it to other forms, in the shape and space strand the student learns to relate that graph to concepts of scale, and in the statistics and probability strand the student can critically examine that graph for bias or in light of a social issue. How much richer is that student's understanding, and how much more reliably can the teacher now assess that understanding than by tracing that student's growth through multiple representations? Comments on the report card can highlight the strengths, challenges and next steps relative to that enduring understanding.

Five enduring understandings contributing to mathematical literacy have been identified for this document.

1. *The student will understand that the **language and process of mathematics** includes precise terminology and accepted rules which create consistency when working with numbers and expressions.* This represents most closely the content knowledge and skills specific to the curriculum.
2. *The student will understand that a **strong number sense** enables us to compare values and expressions and determine the reasonableness of a solution.* This is about being able to position a value relative to others, and using that to make sense of an answer.
3. *The student will understand that **multiple representations** offer choice to interpret, analyze, and validate mathematical data.* This is about recognizing how different forms can represent the same thing and how to move among the forms.
4. *The student will understand that mathematical knowledge and thinking requires **building connections** within mathematics and with the world around us.* This is about recognizing how mathematical knowledge builds on itself and how it is used in contexts that the students may be able to relate to.
5. *The student will understand that **solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.* This is not about simply manufacturing a context to create a "word problem". Instead it is about the process of gathering and organizing, planning and applying, analyzing and concluding. Above all, it is about critical thinking.

The Templates

It is important to note that the attached templates are intended to serve as an example of how teachers might identify essential learning and cluster specific learning outcomes. Therefore, the templates may be viewed as a guide and support document to help teachers in implementing the Mathematics curriculum and the new provincial report card.

The document should be used alongside the Manitoba Curriculum Framework of Outcomes for Mathematics, as well as the grade-specific support documents. In addition, teachers are encouraged to consider the following issues:

- On each template, essential vocabulary has been included in the Vocabulary category. This vocabulary has been identified through an examination of the specific learning outcomes for each strand. These are terms that teachers and students will be using as they explore the mathematical concepts related to each strand.
- Although the templates have been organized by specific strands of the Mathematics curriculum, the overall program is intended to be presented as a spiral curriculum. Using this approach, enduring understandings are interwoven and explored throughout the school year.

Grade 9 Mathematics
Strand: Number

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Powers are written in defined ways. Exponent laws provide an efficient way to perform operations on powers. Order of operations must be followed when evaluating an expression.	Why does the base have to be the same when using the exponent laws? How can we use our knowledge of repeated multiplication and division to verify the exponent laws?	A power consists of a base and an exponent. Exponent laws exist for multiplication and division, power to an exponent, exponent of zero. Exponents must be evaluated in proper order.	9N.1 9N.2 9N.4	Power Base Exponent
	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Rational numbers can be compared and ordered. Square roots and perfect squares are inverse operations.	What are the parts of a fraction and what do they represent? What are the advantages of representing a number as a decimal? a fraction? a percent? What is the definition of a square root?	Converting between fractions and decimals assists comparing, ordering, or checking for equivalence. Perfect squares are benchmarks for estimating the square root of non-perfect squares.	9N.3 9N.5 9N.6	Square root Perfect square Non-perfect square

	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	There are many ways to represent a number.	How are exponent laws a short-cut for repeated multiplication of the same value?	Repeated multiplication is represented through a power. Rational numbers can be expressed as fractions or decimals.	9N.1 9N.3	Rational number
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Rational numbers have direct connection to many areas of everyday life.	Why do we use fractions? What jobs or tasks in life require a mastery of fractions?	Measurement (e.g. cooking, construction, mechanical, etc.)	9N.3	
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Extending the pattern of repeated multiplication is a way of understanding powers. Benchmarks can be used as a strategy for estimation.	How can we show that a non-zero base raised to the power of zero is equal to 1? How can we compare non-perfect square roots without the use of a calculator?	A power with an exponent of 0 is equal to 1. Perfect squares are benchmarks for estimating the square root of non-perfect squares.	9N.1 9N.3 9N.5 9N.6	Benchmark

Grade 9 Mathematics

Strand: Patterns & Relations

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Data is organized and represented in specific ways. Equations are used to describe a system in balance; inequalities are used to describe a system in imbalance. Operations on polynomials are an extension of operations on numbers.	Why are graphs and tables used to represent data? Why is the dependent variable placed along the vertical axis? Why do students need to be able to solve equations and inequalities? What are like terms? How do the rules/laws that we use with numbers compare to the ones we use with Polynomial expressions?	Tables and graphs are structured according to their independent and dependent variables. The use of inverse operations in solving equations must maintain balance. The use of inverse operations in solving inequalities must maintain a true imbalance. Polynomial expressions are manipulated in the same way as numerical expressions.	9PR.2 9PR.3 9PR.4 9PR.5 9PR.6 9PR.7	Independent variable Dependent variable Interpolate Extrapolate Linear relation Linear equation Linear inequality Monomial, binomial, trinomial, polynomial Term, degree, coefficient, constant

	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Inequalities are used to describe a system in imbalance.	How are equations and inequalities solved in the same way? What is the main difference in solving an equation versus an inequality?	Equalities and inequalities must result in a true statement.	9PR.4	
	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	Relations can be expressed in different forms, which may be needed to make sense of different contexts. Linear equations and inequalities can be modeled in different ways. Polynomial expressions can be represented in different forms.	How many different ways can a linear relationship be represented? How do we represent an inequality on a number line? How can we represent a Polynomial expression using concrete objects?	Represent data in words, tables, graphs and equations. Balance shows equality, imbalance shows inequality. Linear inequalities can be expressed on a number line and symbolically. Represent polynomial expressions concretely, pictorially, and symbolically.	9PR.2 9PR.3 9PR.4 9PR.6 9PR.7	
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Linear relations have many direct connections to the world around us. Operations on polynomials are an extension of operations on numbers.	What are some examples of linear relations in the real world?	Tables, graphs, and equations (inequalities) depict connections between variables. Known techniques of numerical operations are applied within the new context of polynomial expressions.	9PR.1 9PR.2 9PR.3 9PR.4 9PR.6 9PR.7	

	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Solving a problem must be approached in a purposeful, organized and justifiable manner.	How can we use or skills in equation solving and polynomial expressions to solve a contextual problem? Why can't we use guess and check to solve these types of problems? How can we check to determine if the solution is a reasonable answer?	Look for a relationship between variables. Choose an appropriate way to represent the relationship and/or solve for missing data. Assess the reasonableness of the conclusion within the context of the problem.	9PR.1 9PR.2 9PR.3 9PR.4	

Grade 9 Mathematics
Strand: Shape and Space

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Properties of circles are described in defined ways. Symmetry can be described in terms of the movement of a polygon	What are the parts of the circle and how are they connected? What properties of a circle can be used in other applications? What is line and rotational symmetry? How is symmetry significant outside the classroom?	Properties of circles Line and rotational symmetry	9SS.1 9SS.5	Diameter, radius, circumference Chord, arc, tangent Central angle Inscribed angle Subtend Point of tangency Perpendicular bisector
	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Understanding scale allows us to draw parallels between drawings or models and the objects they represent. Proportionality is the mathematical relationship between two quantities.	What is a scale factor? How can we use proportions to solve other contextual problems?	The corresponding sides of any similar polygons will change in proportion to one another. A scale diagram maintains proportionality.	9SS.3 9SS.4	

	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	A scale diagram or model may be used to represent an object. Similarity exists through proportionality	How are proportions used in scale diagrams? What are the properties of mathematical similarity?	A scale diagram is an enlargement or reduction that maintains proportionality. Polygons are similar if a consistent scale factor exists between them.	9SS.3 9SS.4	Scale factor
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Scale drawings have direct connection to many areas of everyday life.	What occupations or tasks require the use of Scale drawings?			
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Draw from different sources and organize information into a plan to solve a problem. Alternate strategies may be applied to the same problem.	How do we use accepted properties and definitions to prove additional conclusions? How can we use our knowledge of geometry and circle properties to solve real life problems? How can we determine which strategies and properties will be relevant in solving a contextual problem?	Different sources can be synthesized into a plan for a solution. • Circle problems draw from the Pythagorean Theorem, angle geometry, and circle properties • composite object problems draw from the understanding of line symmetry and 2-D shapes. Each strategy must be justifiable. This lends itself well to communication opportunities among students.	9SS.1 9SS.2	

Grade 9 Mathematics

Strand: Statistics and Probability

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Applying the rules of statistics may not result in consistency since the collection and interpretation of data is affected by the methods chosen. Probability allows us to make predictions, but the predictions may not work out as expected.	How do we conduct a proper survey in order to ensure the results represent a valid and unbiased response? What are the applications of probability in the real world?	Method of collection Selection of sample Representation of data Conclusions drawn Compare how theoretical and experimental probability can differ.	9SP.1 9SP.2 9SP.4	Bias Population Sample population Census Experimental probability Theoretical probability
	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Thorough critical analysis is necessary whenever examining statistical information in society.	How can we use our knowledge of statistics and probability to help us interpret statistical information in society?			
	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	Choices must be made in how to represent data.	How can data representation (i.e. graphs) be used to misrepresent the actual results?	The form in which data is collected and represented can influence the way in which it is interpreted.	9SP.3	

	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Information about the world around us is often presented in statistical context or in terms of probability.	What are some common errors in thinking to avoid when using probability?	Information must be viewed in context and critically evaluated. Statements of probability contain assumptions and limitations that need to be considered. Social awareness	9SP.1 9SP.2 9SP.4	
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Thorough critical analysis is necessary whenever examining statistical information in society.	What do we need to analyze in order to determine if statistical information is valid?	Method of collection Selection of sample Representation of data Conclusions drawn	9SP.2 9SP.3	

Grade 10 Mathematics – Intro to Applied and Pre-Calculus

Strand: Number

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	The underlying structure of a number or expression reveals important information about its makeup. Every number or expression can be broken down completely to its prime factors. Exponent laws provide an efficient way to perform operations on powers.	What are the prime factors of a number? How can we use prime factors in order to determine the greatest common factor and least common multiple? What does a negative exponent represent? How can we evaluate a rational exponent?	Prime factorization helps determine greatest common factor and least common multiple. A factor tree is used to determine prime factors. Exponent laws exist for integral and rational exponents.	10IA.1 10IA.3 10IA.5	Factor Prime factor Greatest common factor Least common multiple Irrational numbers
	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Irrational numbers can be compared and ordered. Cube roots and perfect cubes are inverse operations.	How can we compare the values of irrational numbers?	Converting irrational numbers to a consistent form assists comparing, ordering, checking for equivalence and approximating their location on a number line.	10IA.2	Radical Radicand Index of a radical

	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	Numbers and mathematical expressions can be broken down into their component parts. There are many ways to represent a number. Factoring and operations on polynomial expressions can modeled in different ways.	What does factoring represent? How can we represent a negative or rational exponent ? Why is it helpful to represent an expression in factored form?	Factors form the component parts of numbers and expressions. Radicals and powers with integral and rational exponents can be written in different forms. Represent factoring and operations concretely, pictorially, and symbolically.	10IA.1 10IA.3 10IA.4 10IA.5	
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.					
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Extending a pattern is a way of understanding new mathematical concepts. Identifying and explaining errors helps to clarify mathematical thinking.	How can we use extending patterns in order to draw conclusions about new concepts? How can identifying and explaining our errors improve our understanding of a concept?	Extend patterns to integral and rational exponents. Extend patterns of multiplying numbers to multiplying polynomial expressions. e.g. Examine the steps of a simplification to determine where and why an error may have occurred.	10IA.1 10IA.3 10IA.4	

Grade 10 Mathematics – Intro to Applied and Pre-Calculus

Strand: Patterns and Relations

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Each form in which a relation or function is expressed conveys characteristics and specific information about the relationship between variables.	What does an ordered pair represent in a linear function?	e.g. An ordered pair will give information about the variables, slope will give information about the rate of change.	10I.R.2 10I.R.3 10I.R.5 10I.R.8	Relation Function Slope Parallel lines Perpendicular lines Ordered pair Domain Range Intercept Slope intercept form General form Point slope form Linear Relation
			How can we determine the equation of a line from its graph?	The equation of a line can be determined from various sources of information such as point and slope, slope and intercept, etc.		
		Slope describes the rate of change between two variables.	How is the slope represented in the different expressions of a linear relationship?	Slope is a key component in linear relations and functions, it is evident in every expressed form.		
		Specific notation differentiates functions from relations.	How can we differentiate between a relation and a function?	Functions must be written using proper function notation, showing that for every x there is a unique value of y.		
		Conditions of two or more equations are simultaneously satisfied at the point of intersection.	How can we solve a set of two linear equations that involve two variables?	Solve systems by substitution, elimination, or graphing.		

	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Slope describes the rate of change between two variables.	What does the slope of a linear function represent?	The value of a slope relates to the steepness of a graphed line. Slope allows comparison between multiple linear relations or functions (parallel and perpendicular lines)	10I.R.3 10I.R.5	
	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	Representing a relation in different ways makes it possible to highlight a specific aspect of the relationship.	How can we differentiate between a relation and a function in various forms?	Relations and functions may be stated in words, ordered pairs, tables, graphs and different forms of an equation.	10I.R.1 10I.R.4 10I.R.6 10I.R.8	
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Graphs and equations have connecting characteristics. A relation or function that models a contextual situation connects each component to something in that context.	How can we use a linear equation to predict its graph and vice versa? What characteristics do we use in describing the graph of a function or relation?	The axes, slope and intercepts of a graph correspond to the variables, coefficients, and constant values in linear equations in their three forms. Slope, intercept, domain, and range each represent different aspects within the context and describe any limitations.	10I.R.6 10I.R.8	
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	Solving a problem must be approached in a purposeful, organized and justifiable manner.	How can we use our knowledge of linear functions to help solve real world contextual problems? How does the context of a real life situation affect the possible solutions?	Look at the information given to determine the form of equation used. Choose an appropriate way to represent the relationship and/or solve for missing data. Assess the reasonableness of the conclusion within the context of the domain and range.	10I.R.7 10I.R.9 10I.R.10	

Grade 10 Mathematics – Intro to Applied and Pre-Calculus

Strand: Shape and Space

Suggested Report Card Categories	Enduring Understandings The student will understand that…	Essential Learning	Essential Questions	Concepts	Learning Outcomes	Essential Vocabulary
	…the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.	Measurement systems have a base unit that can be built up to larger units or broken down into smaller units.	What is a measuring system?	Metres and feet can be built up to larger units such as kilometres and yards, respectively, or broken into smaller units such as millimetres or inches, respectively.	10IM.1 10IM.2 10IM.3 10IM.4	Referent Metre (kilometre, millimetre, etc.) Foot (yard, inch, etc.) Sine Cosine Tangent Cone Cylinder Prism Pyramid Sphere
		Conversions require proportions.	How do we use proportions in converting between systems?	Use proportional reasoning to convert between measurement systems.		
		Specific formulas are used to describe the surface area and volume.	What are some real world contexts in which determining surface area and volume would be important?	Use formulas to determine surface area and volume for: right-angle cones, cylinders, prisms, pyramids, and for spheres.		
		Trigonometric ratios describe relationships within a right-angle triangle.	Why is knowledge of right-angled triangles and trigonometry important?	Develop the sine, cosine, and tangent ratios.		
	…a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.	Compare base units to establish reference points for estimation.	How can we use base units to help us estimate a measurement?	e.g. Knowing that a metre is bigger than a yard helps to assess the reasonableness of a result when converting between metres and yards.	10IM.1 10IM.2	

	…multiple representations offer choice to interpret, analyze, and validate mathematical data.	The same quantities can be measured in different units, dependent on the context and tools available.	What is the advantage of the SI system over the Imperial system? How are referents helpful in measurement?	Imperial and SI systems of measurement Estimation strategies involve using items at hand as referents	10IM.1	
	… mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.	Canada uses both the SI and imperial systems of measurement, so fluency is required in both. Measurement can be exact using tools, or can be an estimate using commonly available referents.	Why do we continue to use both systems in Canada? How are estimates helpful in measurement?	Imperial and SI systems of measurement Appropriate tools should be used measuring (e.g. calipers for diameter of a cylinder, rather than a straight ruler) Estimation strategies involve using items at hand as referents (e.g. using the number of strides to estimate how many metres)	10IM.1 10IM.2	
	…**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.	A measuring tool or strategy must match the context and intent of the measurement. Draw from different sources and organize information into a plan to solve a problem.	How does the context of the measurement affect the precision and units of measurement? How can we use a formula to solve for a variable that has not been isolated?	Justify the use of a particular measuring tool or referent, considering the nature of the object to be measured and the degree of accuracy or precision required. e.g. Identify the appropriate formula needed for 3-D objects to solve for an unknown. e.g. Use trigonometric ratios to set up triangles for indirect measurements.	10IM.1 10IM.3 10IM.4	

Sample Grade Book
Grade 10 Intro to Applied & Pre-Calculus Math
Strand: Number

This is a sample of how a gradebook could be organized by class.

	Enduring Understandings in NUMBER																								
	Language and Processes					Number Sense					Multiple Representations					Connections					Problem Solving				
	• The underlying structure of a number or expression reveals important information about its makeup. • Every number or expression can be broken down completely to its prime factors. • Exponent laws provide an efficient way to perform operations on powers.					• Irrational numbers can be compared and ordered. • Cube roots and perfect cubes are inverse operations.					• Numbers and mathematical expressions can be broken down into their component parts. • There are many ways to represent a number. • Factoring and operations on polynomial expressions can modeled in different ways.										• Extending a pattern is a way of understanding new mathematical concepts. • Identifying and explaining errors helps to clarify mathematical thinking.				
	Evidence of Learning					Evidence of Learning					Evidence of Learning					Evidence of Learning					Evidence of Learning				
Students	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5

Sample Grade Book
Grade 10 Intro to Applied & Pre-Calculus Math
Strand: Number

4 Very good understanding
3 Good understanding
2 Basic understanding
1 Limited understanding
ND Not yet demonstrated

This is a sample of how a gradebook could be organized by individual student.

Student Name _____		Number					Patterns & Relations					Shape & Space					Statistics & Probability				
		Evidence of Learning					Evidence of Learning					Evidence of Learning					Evidence of Learning				
		Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5	Assess 1	Assess 2	Assess 3	Assess 4	Assess 5
Language and Processes	...the **language and process of mathematics** has precise terminology and accepted rules which create consistency when working with numbers and expressions.																				
Number Sense	... a strong **number sense** enables us to compare values and expressions and determine the reasonableness of a solution.																				
Multiple Representations	...**multiple representations** offer choice to interpret, analyze, and validate mathematical data.																				
Connections	... mathematical knowledge and thinking requires building **connections** within mathematics and with the world around us.																				
Problem Solving	...**solving a problem** requires identifying relevant information, making decisions about strategies, and critically evaluating results.																				

Grades 9/10 Mathematics Definitions –
Suggested Provincial Report Card Categories

Knowledge and Understanding

This report card category focuses on student progress related to learning experiences in which students demonstrate knowledge and understanding of grade-specific mathematical concepts and skills in each strand (Number, Patterns and Relations, Shape and Space, Statistics and Probability).

Mental Math and Estimation

This report card category focuses on student progress related to learning experiences in which students use math knowledge and number facts to calculate mentally or estimate. This includes:

- Determining an answer using multiple mental math strategies
- applying mental math strategies that are efficient, accurate and flexible
- making a reasonable estimate of value or quantity using benchmarks and referents
- using estimation to make mathematical judgements in daily life

Problem Solving

This report card category focuses on student progress related to learning experiences in which students apply knowledge, skill, or understanding to solve math problems. This includes:

- applying various strategies to model solutions to problems
- applying mathematical knowledge to solve problems
- using prior knowledge to connect math ideas to other concepts
- using appropriate technology to solve problems
- using visualization or models to demonstrate understanding
- communicating problem-solving solutions mathematically
- justifying mathematical thinking
- thinking logically to make sense of mathematics (reasoning)
- using logic and divergent thinking to present mathematical arguments
- applying algebraic reasoning when solving problems

References:
The Manitoba Report Card Support Document. Manitoba Education. 2012.

Essential Learning Terminology

Enduring understanding
"Enduring understandings are statements summarizing important ideas and core processes that are central to a discipline and have lasting value beyond the classroom. They synthesize what students should understand….as a result of studying a particular content area. Moreover, they articulate what students should "revisit" over the course of their lifetimes in relationship to the content area."

Key performance skills
Key performance skills draw on a variety of skills. Performance skills develop within the individual and grow in sophistication over time. Some examples of key performance skills include problem solving, critical thinking and inquiry, design process etc.

Values/attitudes/dispositions
Students need to develop the values and attitudes that assist them in understanding each discipline with some depth, then knowing how to communicate their understanding while seeing the relationship between each discipline.

Essential questions
Questions that are not answerable with finality in a brief sentence…their aim is to stimulate thought, provoke inquiry and spark more questions. *Wiggins/McTighe 2005*

Concepts
The broad concept provides a frame through which students filter information *(Erickson*). When a concept is truly understood it can be explained and is transferrable, or applied to problem-solving. *Wiggins/McTighe 2005*

Essential vocabulary
Vocabulary is introduced when needed to clarify experiences and ideas rather than in a list of new terms that start the unit. Essential vocabulary consists of figurative language, nuances in word meaning, roots, affixes, context clues, dictionary, thesaurus, pronunciation, parts of speech. *Wiggins/McTighe 2005*