



Correlation of the Manitoba Mathematics Program of Study with Mathology Grade 9 (Number)

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Develop number sense.		
Specific Learning Outcomes 9.N.1. Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by: <ul style="list-style-type: none"> • representing repeated multiplication, using powers • using patterns to show that a power with an exponent of zero is equal to one • solving problems involving powers. 	Number Unit 3: Powers and Exponents 6: Exploring Whole Number Exponents	Big Idea: Quantities and numbers can be operated on to determine how many and how much. Investigating Number and Arithmetic Properties <ul style="list-style-type: none"> - Distinguishes between and investigates properties of prime and composite numbers (e.g., prime factorization). - Extends exponent notation to any repeated multiplication (e.g., $2 \times 2 \times 2 \times 2 = 2^4$) and evaluates expressions using exponents (e.g., $3^4 = 3 \times 3 \times 3 \times 3 = 81$).
9.N.2. Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents.	Number Unit 3: Powers and Exponents 10: Exploring Exponent Laws	Big Idea Quantities and numbers can be operated on to determine how many and how much. Investigating Number and Arithmetic Properties <ul style="list-style-type: none"> - Distinguishes between and investigates properties of prime and composite numbers (e.g., prime factorization). - Extends exponent notation to any repeated multiplication (e.g., $2 \times 2 \times 2 \times 2 = 2^4$) and evaluates expressions using exponents (e.g., $3^4 = 3 \times 3 \times 3 \times 3 = 81$).

<p>9.N.3. Demonstrate an understanding of rational numbers by:</p> <ul style="list-style-type: none"> • Comparing and ordering rational numbers • Solving problems that involve arithmetic operations on rational numbers. 	<p>Number Unit 4: Fluency with Rational Numbers 11: Comparing and Ordering Rational Numbers 12: Operations with Positive and Negative Fractions and Decimals</p>	<p>Big Idea: The set of real numbers is infinite. Extending Whole Number Understanding to the Set of Real Numbers</p> <ul style="list-style-type: none"> - Extends decimal and fraction understanding to positive and negative rational numbers. <p>Big Idea: Numbers are related in many ways. Comparing and Ordering Quantities (Multitude and Magnitude)</p> <ul style="list-style-type: none"> - Compares, orders, and locates positive and negative rational numbers. <p>Big Idea: Quantities and numbers can be operated on to determine how many and how much. Developing Fluency of Operations</p> <ul style="list-style-type: none"> - Uses reasoning, estimation, efficient strategies, and algorithms to operate on positive and negative rational numbers.
<p>9.N.4. Explain and apply the order of operations, including exponents, with and without technology.</p>	<p>Number Unit 4: Fluency with Rational Numbers 13: Order of Operations with Rational Numbers</p>	<p>Big Idea: Quantities and numbers can be operated on to determine how many and how much. Investigating Number and Arithmetic Properties</p> <ul style="list-style-type: none"> - Applies order of operations to equations involving exponents to evaluate expressions.
<p>9.N.5. Determine the square root of positive rational numbers that are perfect squares.</p>	<p>Number Unit 2: Squares and Square Roots 4: Calculating Square Roots of Perfect Squares</p>	<p>Big Idea: The set of real numbers is infinite. Extending Whole Number Understanding to the Set of Real Numbers</p> <ul style="list-style-type: none"> - Distinguishes between numbers that do and do not have whole number square roots. <p>Big Idea: Quantities and numbers can be operated on to determine how many and how much. Developing Conceptual Meaning of Operations</p> <ul style="list-style-type: none"> - Models and demonstrates an understanding of squares and square roots.
<p>9.N.6. Determine an approximate square root of positive rational numbers that are non-perfect squares.</p>	<p>Number Unit 2: Squares and Square Roots 5: Estimating Square Roots of Non-Perfect Squares</p>	<p>Big Idea: The set of real numbers is infinite. Extending Whole Number Understanding to the Set of Real Numbers</p> <ul style="list-style-type: none"> - Distinguishes between numbers that do and do not have whole number square roots <p>Big Idea: Numbers are related in many ways. Estimating Quantities and Numbers</p> <ul style="list-style-type: none"> - Estimates square roots of numbers that are imperfect squares (e.g., $\sqrt{28}$ is between 5 and 6, and closer to 5).



Correlation of the Manitoba Mathematics Program of Study with Mathology Grade 9 (Patterns and Relations: Patterns)

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Use patterns to describe the world and solve problems.		
Specific Learning Outcomes 9.PR.1. Generalize a pattern arising from a problem-solving context using linear equations, and verify by substitution.	Algebra Unit 2: Linear Relations 6: Investigating Linear Relations	Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions <ul style="list-style-type: none"> - Represents a mathematical context or problem with expressions and equations using variables to represent unknowns. Generalizing and Analyzing Patterns, Relations, and Functions <ul style="list-style-type: none"> - Predicts the value of a given element in a numeric or shape pattern using pattern rules.
9.PR.2. Graph linear relations, analyze the graph, and interpolate or extrapolate to solve problems.	Algebra Unit 2: Linear Relations 7: Graphing and Analyzing Linear Relations	Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions <ul style="list-style-type: none"> - Models problems and solves linear relations with rational coefficients, variables, and constants in different forms. Generalizing and Analyzing Patterns, Relations, and Functions <ul style="list-style-type: none"> - Approximates linear relation values between and beyond data through interpolation and extrapolation.



**Correlation of the Manitoba Mathematics Program of Study
with Mathology Grade 9 (Patterns and Relations: Variables and Equations)**

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Represent algebraic expressions in multiple ways.		
Specific Learning Outcomes 9.PR.3. Model and solve problems, using linear equations of the form: <ul style="list-style-type: none"> • $ax = b$ • $\frac{x}{a} = b, a \neq 0$ • $ax + b = c$ • $\frac{x}{a} + b = c, a \neq 0$ • $ax = b + cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{a}{x} = b, x \neq 0$ where a, b, c, d, e and f are rational numbers	Algebra Unit 5: Modelling and Solving Equations 14: Modelling and Solving Linear Equations 15: Solving More Complex Linear Equations 16: Solving Linear Equations in Different Forms	Big Idea: Patterns and relations can be represented with symbols, equations, and expressions. Understanding Equality and Inequality, Building on Generalized Properties of Numbers and Operations <ul style="list-style-type: none"> - Solves linear relations with rational coefficients, constants, and solutions (e.g., $2/3 m - 2 = -7/6$).
9.PR.4. Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context.	Algebra Unit 6: Inequalities 17: Introducing Inequalities 18: Solving Linear Inequalities and Graphing Solutions	Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions <ul style="list-style-type: none"> - Models and solves linear inequalities graphically and symbolically ($a + 5 < 9$).

<p>9.PR.5. Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2).</p>	<p>Algebra Unit 1: Algebraic Expressions 1: Representing and Evaluating Polynomials</p>	<p>Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions</p> <ul style="list-style-type: none"> - Represents a mathematical context or problem with expressions and equations using variables to represent unknowns. <p>Big Idea: Patterns and relations can be represented with symbols, equations, and expressions. Using Variables, Algebraic Expressions, and Equations to Represent Mathematical Relations</p> <ul style="list-style-type: none"> - Extends understanding of algebraic expressions to include writing and evaluating expressions with polynomials of degree two (e.g., $3x^2 - 7$).
<p>9.PR.6. Model, record, and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially, and symbolically (limited to polynomials of degree less than or equal to 2).</p>	<p>Algebra Unit 1: Algebraic Expressions 3: Adding and Subtracting Polynomial Expressions</p>	<p>Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions</p> <ul style="list-style-type: none"> - Represents a mathematical context or problem with expressions and equations using variables to represent unknowns. <p>Big Idea: Patterns and relations can be represented with symbols, equations, and expressions. Understanding Equality and Inequality, Building on Generalized Properties of Numbers and Operations</p> <ul style="list-style-type: none"> - Applies arithmetic properties to operate on polynomial expressions and solve problems (e.g., find area of rectangle with sides of $3x$ and $4 + x$). (Limited to degrees of 2.)
<p>9.PR.7. Model, record, and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially, and symbolically.</p>	<p>Algebra Unit 1: Algebraic Expressions 4: Multiplying and Dividing Polynomial Expressions</p>	<p>Big Idea: Regularity and repetition form patterns that can be generalized and predicted mathematically. Representing Patterns, Relations, and Functions</p> <ul style="list-style-type: none"> - Represents a mathematical context or problem with expressions and equations using variables to represent unknowns. <p>Big Idea: Patterns and relations can be represented with symbols, equations, and expressions. Understanding Equality and Inequality, Building on Generalized Properties of Numbers and Operations</p> <ul style="list-style-type: none"> - Applies arithmetic properties to operate on polynomial expressions and solve problems (e.g., find area of rectangle with sides of $3x$ and $4 + x$). (Limited to degrees of 2.)



Correlation of the Manitoba Mathematics Program of Study with Mathology Grade 9 (Shape and Space: Measurement)

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Use direct or indirect measurement to solve problems.		
Specific Learning Outcomes 9.SS.1. Solve problems and justify the solution strategy using circle properties, including <ul style="list-style-type: none"> • the perpendicular from the centre of a circle to a chord bisects the chord • the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc • the inscribed angles subtended by the same arc are congruent • a tangent to a circle is perpendicular to the radius at the point of tangency 	Geometry/ Measurement Unit 1: Geometry Around Us 2: Investigating Circle Properties and Constructions	Big Idea: Assigning a unit to a continuous attribute allows us to measure and make comparisons. Understanding Relationships Among Measured Units <ul style="list-style-type: none"> - Uses circle properties to generalize and solve problems (e.g., central angle, inscribed angle, tangent-radius, triangle applications, chord bisector). Big Idea: 2-D shapes and 3-D solids can be analyzed and classified in different ways by their attributes. Investigating Geometric Attributes and Properties of 2-D Shapes and 3-D Solids <ul style="list-style-type: none"> - Extends understanding of circle attributes to include arcs, sectors, chords, tangents, etc.



Correlation of the Manitoba Mathematics Program of Study with Mathology Grade 9 (Shape and Space: 3-D Objects and 2-D Shapes)

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.		
Specific Outcomes 9.SS.2. Determine the surface area of composite 3-D objects to solve problems.	Geometry/ Measurement Unit 3: Measurement of 3-D Objects 8: Investigating Surface Area of Composite 3-D Objects	Big Idea: Assigning a unit to a continuous attribute allows us to measure and make comparisons. Understanding Relationships Among Measured Units <ul style="list-style-type: none"> - Determines volume and surface area of composite 3-D objects. Big Idea: Many things in our world (e.g., objects, spaces, events) have attributes that can be measured and compared. Understanding Attributes That Can Be Measured, Compared, and Ordered <ul style="list-style-type: none"> - Understands surface area as an attribute of 3-D objects that can be measured and compared.
9.SS.3. Demonstrate an understanding of similarity of polygons.	Geometry/ Measurement Unit 2: Measurement of 2-D Shapes and Scale Drawings 4: Investigating Similar Triangles and Similar Polygons	Big Idea: 2-D shapes and 3-D solids can be analyzed and classified in different ways by their attributes. Investigating Geometric Attributes and Properties of 2-D Shapes and 3-D Solids <ul style="list-style-type: none"> - Uses interior angle properties of polygons to solve problems and determine similarity.



Correlation of the Manitoba Mathematics Program of Study with Mathology Grade 9 (Shape and Space: Transformations)

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Describe and analyze position and motion of objects and shapes.		
Specific Outcomes 9.SS.4. Draw and interpret scale diagrams of 2-D shapes.	Geometry/ Measurement Unit 2: Measurement of 2-D Shapes and Scale Drawings 5: Drawing and Interpreting Scale Drawings	Big Idea: 2-D shapes and 3-D solids can be analyzed and classified in different ways by their attributes. Investigating Geometric Attributes and Properties of 2-D Shapes and 3-D Solids <ul style="list-style-type: none"> - Uses interior angle properties of polygons to solve problems and determine similarity. Big Idea: 2-D shapes and 3-D solids can be transformed in many ways and analyzed for change. Exploring 2-D shapes and 3-D solids by applying and visualizing transformations <ul style="list-style-type: none"> - Investigates dilation as a form of transformation and creates scale drawings using scale factors.
9.SS.5. Demonstrate an understanding of line and rotation symmetry.	Geometry/ Measurement Unit 1: Geometry Around Us 1: Investigating Geometric Attributes including Line and Rotational Symmetry	Big Idea: 2-D shapes and 3-D solids can be transformed in many ways and analyzed for change. Exploring Symmetry to Analyze 2-D Shapes and 3-D Solids <ul style="list-style-type: none"> - Draws, creates, and identifies shapes that have rotational symmetry, and identifies the centre of rotation and angle of rotation.



**Correlation of the Manitoba Mathematics Program of Study
with Mathology Grade 9 (Statistics and Probability: Data Analysis)**

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Collect, display, and analyze data to solve problems.		
Specific Learning Outcomes 9.SP.1. Describe the effect of: <ul style="list-style-type: none"> • bias • use of language • ethics • cost • time and timing • privacy • cultural sensitivity on the collection of data. 	Data Unit 1: Data Analysis 1: Collecting Data 2: Factors Affecting Data Collection 5: Data and Probability in Decision Making	Big Idea: Formulating questions, collecting data, and consolidating data in visual and graphical displays help us understand, predict, and interpret situations that involve uncertainty, variability, and randomness. Collecting Data and Organizing It into Categories <ul style="list-style-type: none"> - Explores methods for collecting data from a population (e.g., census) and a representative sample of a population. - Critiques methods for selecting representative samples from a population (e.g., bias, ethics, cost, privacy). Drawing Conclusions by Making Inferences and Justifying Decisions Based on Data Collected <ul style="list-style-type: none"> - Identifies and describes trends in data presented over time, and predicts future results.
9.SP.2. Select and defend the choice of using either a population or a sample of a population to answer a question.	Data Unit 1: Data Analysis 1: Collecting Data	Big Idea: Formulating questions, collecting data, and consolidating data in visual and graphical displays help us understand, predict, and interpret situations that involve uncertainty, variability, and randomness. Collecting Data and Organizing It into Categories <ul style="list-style-type: none"> - Explores methods for collecting data from a population (e.g., census) and a representative sample of a population.

<p>9.SP.3. Develop and implement a project plan for the collection, display, and analysis of data by</p> <ul style="list-style-type: none"> • formulating a question for investigation • choosing a data collection method that includes social considerations • selecting a population or a sample • collecting the data • displaying the collected data in an appropriate manner • drawing conclusions to answer the question 	<p>Data Unit 1: Data Analysis 3: Single-Variable Data Displays</p>	<p>Big Idea: Formulating questions, collecting data, and consolidating data in visual and graphical displays help us understand, predict, and interpret situations that involve uncertainty, variability, and randomness.</p> <p>Creating Graphical Displays of Collected Data</p> <ul style="list-style-type: none"> - Visually represents large-scale data (e.g., histograms, box plots).
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**Correlation of the Manitoba Mathematics Program of Study
with Mathology Grade 9 (Statistics and Probability: Chance and Uncertainty)**

Curriculum Outcomes	Grade 9 Mathology.ca	Pearson Canada Grades 4–9 Mathematics Learning Progression
General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.		
Specific Outcomes 9.SP.4. Demonstrate an understanding of the role of probability in society.	Data Unit 1: Data Analysis 5: Data and Probability in Decision Making	Big Idea: Formulating questions, collecting data, and consolidating data in visual and graphical displays help us understand, predict, and interpret situations that involve uncertainty, variability, and randomness. Drawing Conclusions by Making Inferences and Justifying Decisions Based on Data Collected <ul style="list-style-type: none"> - Identifies and describes trends in data presented over time, and predicts future results.

The following lessons are not required, but recommended:

- Mathology 9 Algebra Unit 1: Algebraic Expressions, Lesson 2: Coding: Exploring Algebraic Expressions
- Mathology 9 Algebra Unit 1: Algebraic Expressions, Lesson 5: Mathematical Modelling: Top Ten
- Mathology 9 Data Management Unit 1: Data Analysis, Lesson 6: Mathematical Modelling: Oil Reserves
- Mathology 9 Financial Literacy Unit 1: Making Financial Decisions