



## Correlation of the New Brunswick Mathematics Program of Study with Mathology Grade 9 (Number)

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

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



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



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

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



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



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



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



## Correlation of the New Brunswick 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
<b>General Outcome:</b> Collect, display and analyze data to solve problems.		
<b>Specific Learning Outcomes</b> SP.1. Describe the effect of: <ul style="list-style-type: none"> <li>• bias</li> <li>• use of language</li> <li>• ethics</li> <li>• cost</li> <li>• time and timing</li> <li>• privacy</li> <li>• cultural sensitivity on the collection of data.</li> </ul>	<b>Data Unit 1: Data Analysis</b> 1: Collecting Data 2: Factors Affecting Data Collection 5: Data and Probability in Decision Making	<b>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.</b> <b>Collecting Data and Organizing It into Categories</b> <ul style="list-style-type: none"> <li>- Explores methods for collecting data from a population (e.g., census) and a representative sample of a population.</li> <li>- Critiques methods for selecting representative samples from a population (e.g., bias, ethics, cost, privacy).</li> </ul> <b>Drawing Conclusions by Making Inferences and Justifying Decisions Based on Data Collected</b> <ul style="list-style-type: none"> <li>- Identifies and describes trends in data presented over time, and predicts future results.</li> </ul>
SP.2. Select and defend the choice of using either a population or a sample of a population to answer a question.	<b>Data Unit 1: Data Analysis</b> 1: Collecting Data	<b>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.</b> <b>Collecting Data and Organizing It into Categories</b> <ul style="list-style-type: none"> <li>- Explores methods for collecting data from a population (e.g., census) and a representative sample of a population.</li> </ul>

<p>SP.3. Construct, label, and interpret histograms to solve problems.</p>	<p><b>Data Unit 1: Data Analysis</b> 3: Single-Variable Data Displays</p>	<p><b>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.</b></p> <p><b>Creating Graphical Displays of Collected Data</b></p> <ul style="list-style-type: none"> <li>- Visually represents large-scale data (e.g., histograms, box plots).</li> </ul>
<p>SP.4. Develop and implement a project plan for the collection, display, and analysis of data by</p> <ul style="list-style-type: none"> <li>• formulating a question for investigation</li> <li>• choosing a data collection method that includes social considerations</li> <li>• selecting a population or a sample</li> <li>• collecting the data</li> <li>• displaying the collected data in an appropriate manner</li> <li>• drawing conclusions to answer the question</li> </ul>	<p><b>Data Unit 1: Data Analysis</b> 3: Single-Variable Data Displays</p>	<p><b>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.</b></p> <p><b>Creating Graphical Displays of Collected Data</b></p> <ul style="list-style-type: none"> <li>- Visually represents large-scale data (e.g., histograms, box plots).</li> </ul>



## Correlation of the New Brunswick 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
<b>General Outcome:</b> Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.		
<b>Specific Outcomes</b> SP.5. Demonstrate an understanding of the role of probability in society.	<b>Data Unit 1: Data Analysis</b> 5: Data and Probability in Decision Making	<b>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.</b> <b>Drawing Conclusions by Making Inferences and Justifying Decisions Based on Data Collected</b> <ul style="list-style-type: none"> <li>- Identifies and describes trends in data presented over time, and predicts future results.</li> </ul>

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