Principles of Mathematics 9

The tables below list the correspondence between the overall expectations of the Ontario Principles of Mathematics 9 (MPM1D) curriculum and the CEMC Grade 9/10/11 courseware.

Each section of each table is labelled with a dark heading containing a MPM1D overall expectation. The left-hand entries in a section are corresponding CEMC Grade 9/10/11 courseware strands and units. The right-hand side entries are all relevant courseware lessons within this courseware strand and unit.

The CEMC Grade 9/10/11 courseware has been designed with curricula from across Canada in mind. It is not an exact match to the current curriculum in any specific jurisdiction. In order to help teachers and students determine any discrepancies relevant to them, the table below also includes all of the courseware lesson goals for any cited courseware lesson. Additionally, some italicized notes point out topics that are not covered by the courseware or covered in an earlier or later part of the CEMC courseware suite.

Number Sense and Algebra: Operating with Exponents	
Number Sense and Algebraic Expressions Unit 1: Exponents	Lesson 1: An Introduction to Exponents • Examine the relationship between the exponential representation of length, area, and volume. • Express simplified exponential form in expanded form. • Represent algebraic expressions in simplified exponential form.
	Lesson 2: Multiplying and Dividing Monomials • Explore the exponent rule for multiplying monomials. • Explore the exponent rule for dividing monomials.
	Lesson 3: Power of a Power Exponent Rule • Explore the power of a power rule for both numeric and algebraic expressions.
	Lesson 7: Exponent Laws All Together • Simplify algebraic expressions. • Evaluate algebraic expressions. *(Parts of this lesson may be beyond the scope of this course.)*
Number Sense and Algebra: Manipulating Expressions and Solving Equations	
Number Sense and Algebraic Expressions Unit 2: Manipulating Algebraic Expressions	Lesson 1: An Introduction to Polynomials • Introduce the concept of a variable. • Examine polynomials and classify an expression as monomial, binomial or trinomial based on the number of terms. • State the degree of a polynomial.
	Lesson 2: Adding and Subtracting Polynomials • Look at an expression and identify like terms. • Add and subtract polynomials by collecting like terms.
	Lesson 3: Multiplying a Polynomial by a Monomial • Multiply a polynomial by a monomial using the Distributive Property.
	Lesson 5: Simplifying Polynomials • Simplify polynomials by adding, subtracting and multiplying. • Define the term equivalence. • Determine if two algebraic expressions are equivalent. *(Parts of this lesson may be beyond the scope of this course.)*
Linear Relations and Analytic Geometry	Lesson 1: Solving One- and Two-Step Equations • Solve one and two step linear equations. • Show a formal check for a solution.

Unit 1: Linear Equations	Lesson 2: Solving Multi-Step Linear Equations • Solve multi-step linear equations. • Examine the process of cross multiplication and when it can be used.
	Lesson 3: Applications of Solving Linear Equations • Solve application problems with the linear equation given. • Translate a written description to an algebraic equation. • Solve application problems without the linear equation given.
	Lesson 4: Solving Problems With Rate, Ratio, Proportion, and Percent • Review the terms rate, ratio, proportion and percent. • Solve problems involving rate, ratio, proportion and percent using cross multiplication. • Solve applications problems involving rate, ratio, proportion and percent.
	Lesson 5: Rearranging Equations and Formulas • Rearrange linear relations to solve in terms of one variable. • Rearrange formulas to solve in terms of one variable.
Linear Relations: Using Data Management to Investigate Relationships	
Linear Relations and Analytic Geometry Unit 8: Data Management and Statistics	Lesson 1: Scatter Plots and Lines or Curves of Best Fit • Construct scatter plots and interpret the meaning of points on scatter plots. • Identify trends in data and describe the correlation. • Draw curves or lines of best fit and determine the equation of a line of best fit. • Interpolate and extrapolate information using the line of best fit.
	Lesson 2: Investigating Relationships Between Two Variables • Pose problems, identify variables associated with problems, and formulate hypotheses about possible relationships between variables. • Design and carry out investigations to collect and organize data to determine if a relationship exists between two variables.
Linear Relations: Understanding Characteristics of Linear Relations	
Linear Relations and Analytic Geometry Unit 2: Characteristics of Linear Relations	Lesson 1: Introduction to Linear Relations — Part 1 • Use patterns to identify growth rates and starting values in linear relations. • Develop equations to represent linear patterns or scenarios. • Create a table of values and corresponding scatter plots for linear relations and look at characteristics within each representation. Revisit how to identify an independent and dependent variable. • Compare linear and non-linear growth.
	Lesson 2: Introduction to Linear Relations — Part 2 • Define the terms initial value and rate of change. • Given a linear relation, identify or calculate the initial value and rate of change from scenario descriptions, table of values and graphs, then use the values to develop a corresponding equation. • Calculate the first differences from a table of values and use this concept to determine if a relation is linear or non-linear.
	Lesson 3: Linear Relations — Direct and Partial Variation • Define the terms direct variation and partial variation. • Classify various representations of a linear relation as being a direct or partial variation.
Linear Relations and Analytic Geometry Unit 8: Data Management and Statistics	Lesson 1: Scatter Plots and Lines or Curves of Best Fit • Construct scatter plots and interpret the meaning of points on scatter plots. • Identify trends in data and describe the correlation. • Draw curves or lines of best fit and determine the equation of a line of best fit. • Interpolate and extrapolate information using the line of best fit.

Linear Relations: Connecting Various Representations of Linear Relations	
Linear Relations and Analytic Geometry Unit 3: Connecting Various Representations of Linear Relations	Lesson 1: Finding Missing Values in a Linear Relation • Solve for the unknown values in a table of values representing a linear relation. • Determine information from a graph. • Solve for unknown quantities given a description of a linear relation.
	Lesson 2: Connecting Various Forms of a Linear Relation • Identify equivalent representations of a linear relation. • Connect the table, graph and equation of a linear relation using the slope and y-intercept.
	Lesson 3: Changing the Properties of a Linear Relation • Determine how changing the slope and/or y-intercept of a linear relation effects the graph and equation of the relation.
Analytic Geometry: Investigating the Relationship Between the Equation of a Relation and the Shape of Its Graph	
Linear Relations and Analytic Geometry Unit 4: Properties of Slope	Lesson 2: Working With y = mx + b • Determine algebraically the equation of a line in the form y = mx + b.
	Lesson 4: Horizontal and Vertical Lines • Investigate the properties of slope for both horizontal and vertical lines. • Using properties of slope, solve problems involving horizontal and vertical lines.
Linear Relations and Analytic Geometry Unit 5: Equations of Linear Relations and Problem Solving	Lesson 1: Alternate Forms of an Equation of a Line • Identify various forms of an equation of a line. • Rearrange a given equation of a line from one form to another. • Solve problems involving the various forms of an equation of a line.
	Lesson 2: Comparing Linear and Non-Linear Relations • Identify characteristics of a linear relation that distinguish it from a non-linear relation. • Use table of values, graphs or equations to classify a relation as linear or non-linear.
Analytic Geometry: Investigating the Properties of Slope	
Linear Relations and Analytic Geometry Unit 2: Characteristics of Linear Relations	Lesson 1: Introduction to Linear Relations — Part 1 • Use patterns to identify growth rates and starting values in linear relations. • Develop equations to represent linear patterns or scenarios. • Create a table of values and corresponding scatter plots for linear relations and look at characteristics within each representation. Revisit how to identify an independent and dependent variable. • Compare linear and non-linear growth.
	Lesson 2: Introduction to Linear Relations — Part 2 • Define the terms initial value and rate of change. • Given a linear relation, identify or calculate the initial value and rate of change from scenario descriptions, table of values and graphs, then use the values to develop a corresponding equation. • Calculate the first differences from a table of values and use this concept to determine if a relation is linear or non-linear.
Linear Relations and Analytic Geometry Unit 4: Properties of Slope	Lesson 1: The Slope Formula • Develop the slope formula for a linear relation. • Use the slope formula to answer questions about a given linear relation.
	Lesson 2: Working With y = mx + b • Determine algebraically the equation of a line in the form y = mx + b.

	Lesson 3: Parallel and Perpendicular Lines • Investigate the properties of slope for both parallel and perpendicular lines. • Using the properties of slope, solve problems involving parallel and perpendicular lines.
	Lesson 4: Horizontal and Vertical Lines • Investigate the properties of slope for both horizontal and vertical lines. • Using properties of slope, solve problems involving horizontal and vertical lines.
Linear Relations and Analytic Geometry Unit 5: Equations of Linear Relations and Problem Solving	Lesson 3: Applications of Linear Relations • Solve problems involving linear relations represented in different forms. • Determine a point of intersection graphically, and explain the meaning within a given context. • Identify and explain restrictions on variables within a given context.
Analytic Geometry: Using the Properties of Linear Relations to Solve Problems	
Linear Relations and Analytic Geometry Unit 2: Characteristics of Linear Relations	Lesson 4: Slope and the y-Intercept • Define the terms slope and y-intercept. • Identify or calculate the y-intercept and slope of a linear relation given a graph, table of values or equation. • Explore families of lines.
	Lesson 5: Graphing Linear Relations • Graph linear relations by hand using a table of values. • Graph linear relations by hand using the x and y intercepts. • Graph linear relations by hand using the slope and y-intercept.
Linear Relations and Analytic Geometry Unit 4: Properties of Slope	Lesson 2: Working With y = mx + b • Determine algebraically the equation of a line in the form y = mx + b.
Linear Relations and Analytic Geometry Unit 5: Equations of Linear Relations and Problem Solving	Lesson 3: Applications of Linear Relations • Solve problems involving linear relations represented in different forms. • Determine a point of intersection graphically, and explain the meaning within a given context. Identify and explain restrictions on variables within a given context.
	Lesson 4: Interpreting Stories and Graphs • Given a detailed description of an event, create a corresponding story graph. • Given a story graph, create a detailed description of the event. • Use slope calculations to determine the average speed.
Measurement and Geometry: Investigating the Optimal Values of Measurements	
CEMC 9/10/11: Measurement, Geometry, and Trigonometry Unit 1: Pythagorean Theorem, Measurement, and Optimization	Lesson 6: Maximizing Area of Rectangles With Fixed Perimeter • Recognize that rectangles with the same perimeter may have different areas. • Represent the relationship between the dimensions of a rectangle with a fixed perimeter and its area using tables of values and graphs. • Calculate the maximum area of rectangles with a fixed perimeter.
	Lesson 7: Determining the Optimal Perimeter of Rectangles • Recognize that rectangles with the same area may have different perimeters. • Represent the relationship between the dimensions of a rectangle with a fixed area and its perimeter using tables of values and graphs. • Use systematic trial and formulas to determine the optimal perimeter of rectangles with a fixed area.

	Lesson 8: Optimizing Surface Area of Cylinders and Square-Based Prisms • Identify the effects of varying the dimensions on the surface area of a square-based prism or cylinder with a given volume. • For a square-based prism or cylinder with a fixed volume, represent the relationship between the dimensions and surface area using tables of values, graphs, and formulas. • Calculate the minimum surface area of square-based prisms and cylinders with a fixed area.
	Lesson 9: Maximizing the Volume of Cylinders and Square-Based Prisms • Given the surface area of a cylinder or square based prism, recognize the optimal shape to maximize the volume. • For a prism or cylinder with a fixed surface area, represent the relationship between the dimensions and the volume using tables of values, graphs and formulas. • Calculate the maximum volume of prisms and cylinders with a given surface area.
Measurement and Geometry: Solving Problems Involving Perimeter, Area, Surface Area, and Volume	
CEMC 9/10/11: Measurement, Geometry, and Trigonometry Unit 1: Measurement, Optimization, and the Pythagorean Theorem	Lesson 1: The Pythagorean Theorem • Recognize the connection between the geometric and algebraic representation of the Pythagorean Theorem. • Solve for the missing length of a right triangle. • Develop and apply the converse of the Pythagorean Theorem.
	Lesson 2: Perimeter and Area of Composite Shapes • Decompose shapes into simpler shapes with known area formulas. • Determine the perimeter and area of composite shapes. • Solve word problems involving perimeters, areas and unit conversions.
	Lesson 3: Surface Area of Pyramids and Cones • Visualize the surface area of a pyramid or a cone. • Calculate the surface area of pyramids or cones. • Solve problems involving the surface area of pyramids or cones.
	Lesson 4: Volume of Pyramids and Cones • Connect the volume of pyramids and cones to their corresponding prisms and cylinders. • Calculate the volume of pyramids and cones. • Solve application problems involving pyramids, cones and unit conversions.
	Lesson 5: Volume and Surface Area of Spheres • Calculate the volume and surface area of spheres. • Solve word problems involving applications of spheres.
Measurement and Geometry: Investigating and Applying Geometric Relationships	
CEMC 9/10/11: Measurement, Geometry, and Trigonometry Unit 2: Geometric Relationships	Lesson 1: Review of Basic Angle Properties • Recognize the properties of opposite, supplementary and complementary angles. • Recognize the properties of angles produced by parallel lines and a transversal (i.e, alternate, corresponding and co-interior angles). • Solve for unknown angles in a diagram using these angle properties.
	Lesson 2: Angle Properties of Triangles • Determine the sum of the interior angles of a triangle. • Determine the sum of the exterior angles of a triangle. • Explore other relationships between interior and exterior angles, particularly in different types of triangles. • Use angle relationships in triangles to solve for missing angles; classify triangles; and identify whether conjectures are true or false.

	Lesson 3: Angle Properties of Quadrilaterals and Other Polygons • Determine the sum of the interior angles and the sum of the exterior angles of a quadrilateral. • Identify angle properties in specific types of quadrilaterals (such as parallelograms, squares, etc.). • Determine the relationship between the number of sides of a polygon and the sum of the interior angles and the sum of the exterior angles. • Apply angle relationships in the context of regular polygons. • Use angle relationships in quadrilaterals and other polygons to solve for missing angles and verify whether conjectures are true or false.
	Lesson 4: Midpoints and Diagonals of Triangles, Quadrilaterals, and Other Polygons • Investigate and describe the line segments formed by joining the midpoints of the sides of a triangle. • Investigate and describe the polygon formed by joining the midpoints of the sides of a quadrilateral. • Investigate and describe the properties of the diagonals of specific types of quadrilaterals. • Investigate and describe the number of diagonals that can be drawn in a polygon, depending on the number of sides. • Use these properties to solve problems and to verify whether conjectures are true or false.