Pattern Blocks in the Ontario Curriculum, 2005

http://www.edu.gov.on.ca/eng/curriculum/elementary/math18curr.pdf

Grade	Strand	Page	Reference
1	*Geometry and Spatial Sense*	37	Geometric Relationships By the end of Grade 1, students will: ● compose patterns, pictures, and designs, using common two-dimensional shapes (Sample problem: Create a picture of a flower using **pattern blocks**.); ● identify and describe shapes within other shapes (e.g., shapes within a geometric design); ● cover outline puzzles with two-dimensional shapes (e.g., **pattern blocks**, tangrams) (Sample problem: Fill in the outline of a boat with tangram pieces.).
Grade	**Strand**	**Page**	**Reference**
2	*Measurement*	45	Attributes, Units, and Measurement Sense By the end of Grade 2, students will: ● choose benchmarks – in this case, personal referents – for a centimetre and a metre (e.g.,“My little finger is about as wide as one centimetre. A really big step is about one metre.”) to help them perform measurement tasks; ● estimate and measure length, height, and distance, using standard units (i.e., centimetre, metre) and non-standard units; ● record and represent measurements of length, height, and distance in a variety of ways (e.g., written, pictorial, concrete) (Sample problem: Investigate how the steepness of a ramp affects the distance an object travels. Use cash-register tape for recording distances.);

			• select and justify the choice of a standard unit (i.e., centimetre or metre) or a nonstandard unit to measure length (e.g., “I needed a fast way to check that the two teams would race the same distance, so I used paces.”); • estimate, measure, and record the distance around objects, using non-standard units (Sample problem: Measure around several different doll beds using string, to see which bed is the longest around.); • estimate, measure, and record area, through investigation using a variety of non-standard units (e.g., determine the number of yellow **pattern blocks** it takes to cover an outlined shape) (Sample problem: Cover your desk with index cards in more than one way. See if the number of index cards needed stays the same each time.); • estimate, measure, and record the capacity and/or mass of an object, using a variety of non-standard units (e.g.,“I used the pan balance and found that the stapler has the same mass as my pencil case.”);
2	Measurement	45	Measurement Relationships By the end of Grade 2, students will: • describe, through investigation, the relationship between the size of a unit of area and the number of units needed to cover a surface (Sample problem: Compare the numbers of hexagon **pattern blocks** and triangle **pattern blocks** needed to cover the same book.); • compare and order a collection of objects by mass and/or capacity, using non-standard units (e.g.,“The coffee can holds more sand than the soup can, but the same amount as the small pail.”);

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3	*Measurement*	57	Measurement Relationships By the end of Grade 3, students will: ● compare and order various shapes by area, using congruent shapes (e.g., from a set of **pattern blocks** or Power Polygons) and grid paper for measuring (Sample problem: Does the order of the shapes change when you change the size of the **pattern blocks** you measure with?); ● describe, through investigation using grid paper, the relationship between the size of a unit of area and the number of units needed to cover a surface (Sample problem: What is the difference between the numbers of squares needed to cover the front of a book, using centimetre grid paper and using two-centimetre grid paper?);
3	*Geometry and Spatial Sense*	59	Geometric Properties By the end of Grade 3, students will: ● use a reference tool (e.g., paper corner, **pattern block**, carpenter's square) to identify right angles and to describe angles as greater than, equal to, or less than a right angle (Sample problem:Which **pattern blocks** have angles bigger than a right angle?); ● identify and compare various polygons (i.e., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) and sort them by their geometric properties (i.e., number of sides; side lengths; number of interior angles; number of right angles); ● compare various angles, using concrete materials and pictorial representations, and describe angles as bigger than, smaller than, or about the same as other angles (e.g., "Two of the angles on the red **pattern block** are bigger than all the angles on the green **pattern block**."); ● compare and sort prisms and pyramids by geometric properties (i.e., number and shape of faces, number of edges, number of vertices), using concrete materials; ● construct rectangular prisms (e.g., using given paper nets; using Polydrons), and describe geometric properties (i.e., number and shape of faces, number of edges, number of vertices) of the prisms

3	Geometry and Spatial Sense	59	Geometric Relationships By the end of Grade 3, students will: ● solve problems requiring the greatest or least number of two-dimensional shapes (e.g., **pattern blocks**) needed to compose a larger shape in a variety of ways (e.g., to cover an outline puzzle) (Sample problem: Compose a hexagon using different numbers of smaller shapes.); ● explain the relationships between different types of quadrilaterals (e.g., a square is a rectangle because a square has four sides and four right angles; a rhombus is a parallelogram because opposite sides of a rhombus are parallel); ● identify and describe the two-dimensional shapes that can be found in a three-dimensional figure (Sample problem: Build a structure from blocks, toothpicks, or other concrete materials, and describe it using geometric terms, so that your partner will be able to build your structure without seeing it.); ● describe and name prisms and pyramids by the shape of their base (e.g., rectangular prism, square-based pyramid); ● identify congruent two-dimensional shapes by manipulating and matching concrete materials (e.g., by translating, reflecting, or rotating **pattern blocks**).
3	*Patterning and Algebra*	61	Patterns and Relationships By the end of Grade 3, students will: ● identify, extend, and create a repeating pattern involving two attributes (e.g., size, colour, orientation, number), using a variety of tools (e.g., **pattern blocks**, attribute blocks, drawings) (Sample problem: Create a repeating pattern using three colours and two shapes.); ● identify and describe, through investigation, number patterns involving addition, subtraction, and multiplication, represented on a number line, on a calendar, and on a hundreds chart (e.g., the multiples of 9 appear diagonally in a hundreds chart); ● extend repeating, growing, and shrinking number patterns (Sample problem:Write the next three terms in the pattern 4, 8, 12, 16, ….); ● create a number pattern involving addition or subtraction, given a pattern represented on a number line or a pattern rule expressed in words (Sample problem: Make a number pattern that starts at 0 and grows by adding 7 each time.);

			• represent simple geometric patterns using a number sequence, a number line, or a bar graph (e.g., the given growing pattern of toothpick squares can be represented numerically by the sequence 4, 7, 10, …, which represents the number of toothpicks used to make each figure); • demonstrate, through investigation, an understanding that a pattern results from repeating an action (e.g., clapping, taking a step forward every second), repeating an operation (e.g., addition, subtraction), using a transformation (e.g., slide, flip, turn), or making some other repeated change to an attribute (e.g., colour, orientation).
Grade	**Strand**	**Page**	**Reference**
4	*Number Sense and Numeration*		Quantity Relationships By the end of Grade 4, students will: • demonstrate an understanding of place value in whole numbers and decimal numbers from 0.1 to 10 000, using a variety of tools and strategies (e.g., use base ten materials to represent 9307 as 9000 + 300 + 0 + 7) (Sample problem: Use the digits 1, 9, 5, 4 to create the greatest number and the least number possible, and explain your thinking.); • represent, compare, and order decimal numbers to tenths, using a variety of tools (e.g., concrete materials such as paper strips divided into tenths and base ten materials, number lines, drawings) and using standard decimal notation (Sample problem: Draw a partial number line that extends from 4.2 to 6.7, and mark the location of 5.6.); • represent fractions using concrete materials, words, and standard fractional notation, and explain the meaning of the denominator as the number of the fractional parts of a whole or a set, and the numerator as the number of fractional parts being considered; • compare and order fractions (i.e., halves, thirds, fourths, fifths, tenths) by considering the size and the number of fractional parts (e.g., ⅘ is greater than ⅗ because there are more parts in ⅘; ¼ is greater than ⅕ because the size of the part is larger in ¼); • compare fractions to the benchmarks of 0, ½, and 1 (e.g., ⅛ is closer to 0 than to ½; ⅗ is more than ½);

			● demonstrate and explain the relationship between equivalent fractions, using concrete materials (e.g., fraction circles, fraction strips, **pattern blocks**) and drawings (e.g., “I can say that 3/6 of my cubes are white, or half of the cubes are white. This means that 3/6 and ½ are equal.”); ● solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 10 000 (Sample problem: How high would a stack of 10 000 pennies be? Justify your answer.).
4	*Geometry and Spatial Sense*	71	Geometric Properties By the end of Grade 4, students will: ● draw the lines of symmetry of two-dimensional shapes, through investigation using a variety of tools (e.g., Mira, grid paper) and strategies (e.g., paper folding) (Sample problem: Use paper folding to compare the symmetry of a rectangle with the symmetry of a square.); ● identify and compare different types of quadrilaterals (i.e., rectangle, square, trapezoid, parallelogram, rhombus) and sort and classify them by their geometric properties (e.g., sides of equal length; parallel sides; symmetry; number of right angles); ● identify benchmark angles (i.e., straight angle, right angle, half a right angle), using a reference tool (e.g., paper and fasteners, **pattern blocks**, straws), and compare other angles to these benchmarks (e.g.,“The angle the door makes with the wall is smaller than a right angle but greater than half a right angle.”) (Sample problem: Use paper folding to create benchmarks for a straight angle, a right angle, and half a right angle, and use these benchmarks to describe angles found in **pattern blocks**.); ● relate the names of the benchmark angles to their measures in degrees (e.g., a right angle is 90º);

4	Geometry and Spatial Sense	71	Location and Movement By the end of Grade 4, students will: ● identify, perform, and describe reflections using a variety of tools (e.g., Mira, dot paper, technology); ● create and analyse symmetrical designs by reflecting a shape, or shapes, using a variety of tools (e.g., **pattern blocks**, Mira, geoboard, drawings), and identify the congruent shapes in the designs.
4	*Patterning and Algebra*	73	Patterns and Relationships By the end of Grade 4, students will: ● extend, describe, and create repeating, growing, and shrinking number patterns (e.g., "I created the pattern 1, 3, 4, 6, 7, 9, …. I started at 1, then added 2, then added 1, then added 2, then added 1, and I kept repeating this."); ● connect each term in a growing or shrinking pattern with its term number (e.g., in the sequence 1, 4, 7, 10, …, the first term is 1, the second term is 4, the third term is 7, and so on), and record the patterns in a table of values that shows the term number and the term; ● create a number pattern involving addition, subtraction, or multiplication, given a pattern rule expressed in words (e.g., the pattern rule "start at 1 and multiply each term by 2 to get the next term" generates the sequence 1, 2, 4, 8, 16, 32, 64, …); ● make predictions related to repeating geometric and numeric patterns (Sample problem: Create a **pattern block** train by alternating one green triangle with one red trapezoid. Predict which block will be in the 30th place.); ● extend and create repeating patterns that result from reflections, through investigation using a variety of tools (e.g., **pattern blocks**, dynamic geometry software, dot paper).

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5	*Measurement*	80	Measurement Relationships By the end of Grade 5, students will: ● select and justify the most appropriate standard unit (i.e., millimetre, centimetre, decimetre, metre, kilometre) to measure length, height, width, and distance, and to measure the perimeter of various polygons; ● create, through investigation using a variety of tools (e.g., **pattern blocks**, geoboard, grid paper) and strategies, two-dimensional shapes with the same perimeter or the same area (e.g., rectangles and parallelograms with the same base and the same height) (Sample problem: Using dot paper, how many different rectangles can you draw with a perimeter of 12 units? with an area of 12 square units?);
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6	*Measurement*	90	Measurement Relationships By the end of Grade 6, students will: ● construct a rectangle, a square, a triangle, and a parallelogram, using a variety of tools (e.g., concrete materials, geoboard, dynamic geometry software, grid paper), given the area and/or perimeter (Sample problem: Create two different triangles with an area of 12 square units, using a geoboard.); ● determine, through investigation using a variety of tools (e.g., **pattern blocks**, Power Polygons, dynamic geometry software, grid paper) and strategies (e.g., paper folding, cutting, and rearranging), the relationship between the area of a rectangle and the areas of parallelograms and triangles, by decomposing (e.g., cutting up a parallelogram into a rectangle and two congruent triangles) and composing (e.g., combining two congruent triangles to form a parallelogram) (Sample problem: Decompose a rectangle and rearrange the parts to compose a parallelogram with the same area. Decompose a parallelogram into two congruent triangles, and compare the area of one of the triangles with the area of the parallelogram.);

			• develop the formulas for the area of a parallelogram (i.e., Area of parallelogram = base x height) and the area of a triangle [i.e., Area of triangle = (base x height) ÷ 2], using the area relationships among rectangles, parallelograms, and triangles (Sample problem: Use dynamic geometry software to show that parallelograms with the same height and the same base all have the same area.); • determine, through investigation using a variety of tools (e.g., nets, concrete materials, dynamic geometry software, Polydrons) and strategies, the surface area of rectangular and triangular prisms;
6	*Patterning and Algebra*	93	Patterns and Relationships By the end of Grade 6, students will: • identify geometric patterns, through investigation using concrete materials or drawings, and represent them numerically; • make tables of values for growing patterns, given pattern rules in words (e.g., start with 3, then double each term and add 1 to get the next term), then list the ordered pairs (with the first coordinate representing the term number and the second coordinate representing the term) and plot the points in the first quadrant, using a variety of tools (e.g., graph paper, calculators, dynamic statistical software); • determine the term number of a given term in a growing pattern that is represented by a pattern rule in words,a table of values, or a graph (Sample problem: For the pattern rule “start with 1 and add 3 to each term to get the next term”, use graphing to find the term number when the term is 19.); • describe pattern rules (in words) that generate patterns by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (e.g., for 1, 3, 5, 7, 9, …, the pattern rule is “start with 1 and add 2 to each term to get the next term”), then distinguish such pattern rules from pattern rules, given in words, that describe the general term by referring to the term number (e.g., for 2, 4, 6, 8, …, the pattern rule for the general term is “double the term number”); • determine a term, given its term number, by extending growing and shrinking patterns that are generated by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (Sample problem: For the pattern 5000, 4750, 4500, 4250, 4000, 3750, …, find the 15th term. Explain your reasoning.);

			• extend and create repeating patterns that result from rotations, through investigation using a variety of tools (e.g., **pattern blocks**, dynamic geometry software, geoboards, dot paper).
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7	*Geometry and Spatial Sense*	103	Geometric Relationships By the end of Grade 7, students will: • determine, through investigation using a variety of tools (e.g., dynamic geometry software, concrete materials, geoboard), relationships among area, perimeter, corresponding side lengths, and corresponding angles of congruent shapes (Sample problem: Do you agree with the conjecture that triangles with the same area must be congruent? Justify your reasoning.); • demonstrate an understanding that enlarging or reducing two-dimensional shapes creates similar shapes; • distinguish between and compare similar shapes and congruent shapes, using a variety of tools (e.g., **pattern blocks**, grid paper, dynamic geometry software) and strategies (e.g., by showing that dilatations create similar shapes and that translations, rotations, and reflections generate congruent shapes) (Sample problem: A larger square can be composed from four congruent square **pattern blocks**. Identify another **pattern block** you can use to compose a larger shape that is similar to the shape of the block.).
7	Geometry and Spatial Sense	104	Location and Movement By the end of Grade 7, students will: • identify, perform, and describe dilatations (i.e., enlargements and reductions), through investigation using a variety of tools (e.g., dynamic geometry software, geoboard, **pattern blocks**, grid paper); • create and analyse designs involving translations, reflections, dilatations, and/or simple rotations of two-dimensional shapes, using a variety of tools (e.g., concrete materials, Mira, drawings, dynamic geometry software) and strategies (e.g., paper folding) (Sample problem: Identify transformations that may be observed in architecture or in artwork [e.g., in the art of M.C. Escher].);

			● determine, through investigation using a variety of tools (e.g., **pattern blocks**, Polydrons, grid paper, tiling software, dynamic geometry software, concrete materials), polygons or combinations of polygons that tile a plane, and describe the transformation(s) involved.
7	*Patterning and Algebra*	105	Variables, Expressions, and Equations By the end of Grade 7, students will: ● model real-life relationships involving constant rates (e.g., speed, heart rate, billing rate), using algebraic equations with variables to represent the changing quantities in the relationship (e.g., the equation p = 4t represents the relationship between the total number of people that can be seated (p) and the number of tables (t), given that each table can seat 4 people [4 people per table is the constant rate]); ● translate phrases describing simple mathematical relationships into algebraic expressions (e.g., one more than three times a number can be written algebraically as 1 + 3x or 3x + 1), using concrete materials (e.g., algebra tiles, **pattern blocks**, counters); ● evaluate algebraic expressions by substituting natural numbers for the variables; ● make connections between evaluating algebraic expressions and determining the term in a pattern using the general term (e.g., for 3, 5, 7, 9, …, the general term is the algebraic expression 2n + 1; evaluating this expression when n = 12 tells you that the 12th term is 2(12) + 1, which equals 25); ● solve linear equations of the form ax = c or c = ax and ax + b = c or variations such as b + ax = c and c = bx + a (where a, b, and c are natural numbers) by modelling with concrete materials, by inspection, or by guess and check, with and without the aid of a calculator (e.g.,“I solved x + 7 = 15 by using guess and check. First I tried 6 for x. Since I knew that 6 plus 7 equals 13 and 13, is less than 15, then I knew that x must be greater than 6.”).

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8	*Patterning and Algebra*	116	Variables, Expressions, and Equations By the end of Grade 8, students will: ● describe different ways in which algebra can be used in real-life situations (e.g., the value of $5 bills and toonies placed in a envelope for fundraising can be represented by the equation v = 5f + 2t); ● model linear relationships using tables of values, graphs, and equations (e.g., the sequence 2, 3, 4, 5, 6, … can be represented by the equation t = n + 1, where n represents the term number and t represents the term), through investigation using a variety of tools (e.g., algebra tiles, **pattern blocks**, connecting cubes, base ten materials) (Sample problem: Leah put $350 in a bank certificate that pays 4% simple interest each year. Make a table of values to show how much the bank certificate is worth after five years, using base ten materials to help you. Represent the relationship using an equation.); ● translate statements describing mathematical relationships into algebraic expressions and equations (e.g., for a collection of triangles, the total number of sides is equal to three times the number of triangles or s = 3n); ● evaluate algebraic expressions with up to three terms, by substituting fractions, decimals, and integers for the variables (e.g., y = 0.6, and z = –1); ● make connections between solving equations and determining the term number in a pattern, using the general term (e.g., for the pattern with the general term 2 n + 1, solving the equation 2 n + 1 = 17 tells you the term number when the term is 17); ● solve and verify linear equations involving a one-variable term and having solutions that are integers, by using inspection, guess and check, and a “balance” model (Sample problem:What is the value of the variable in the equation 30x – 5 = 10?).