

Alberta's Program of Studies (Curriculum) - Mathematics - Patterns and Relations (Strand and Sub-strands with Achievement Outcomes)

Note: These strands are not intended to be discrete units of instruction. The integration of outcomes across strands makes mathematical experiences meaningful. Students should make the connection between concepts both within and across strands.

PROGRESSION IS HIGHLIGHTED IN THE FOLLOWING DOCUMENT VIA **BOLD** TEXT.

MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and embrace lifelong learning in mathematics.

MATHEMATICAL PROCESSES	Communication [C]	Connections [CN]	Mental Mathematics and Estimation [ME]	Problem Solving [PS]	Reasoning [R]	Technology [T]	Visualization [V]
Students are expected to	communicate in order to learn and express their understanding	connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines.	demonstrate fluency with mental mathematics and estimation	develop and apply new mathematical knowledge through problem solving	develop mathematical reasoning	select and use technologies as tools for learning and for solving problems	develop visualization skills to assist in processing information, making connections and solving problems

Sub-strand: Patterns									
Kindergarten		Grade 1		Grade 2		Grade 3		Grade 4	
Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators
<p><i>It is expected that students will:</i></p> <p>1. Demonstrate an understanding of repeating patterns (two or three elements) by:</p> <ul style="list-style-type: none"> identifying reproducing extending creating <p>patterns using manipulatives, sounds and actions.</p> <p>[C, CN, PS, V] [CT: P2-1.1]</p>	<p><i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i></p> <ul style="list-style-type: none"> Distinguish between repeating patterns and non-repeating sequences in a given set by identifying the part that repeats. Copy a given repeating pattern, e.g., actions, sound, colour, size, shape, orientation, and describe the pattern. Extend a variety of given repeating patterns by two more repetitions. Create a repeating pattern, using manipulatives, musical instruments or actions, and describe the pattern. Identify and describe a repeating pattern in the classroom, school and outdoors; e.g., in a familiar song, in a nursery rhyme. 	<p><i>It is expected that students will:</i></p> <p>1. Demonstrate an understanding of repeating patterns (two to four elements) by:</p> <ul style="list-style-type: none"> describing reproducing extending creating <p>patterns using manipulatives, diagrams, sounds and actions.</p> <p>[C, PS, R, V] [CT: P2-1.1]</p>	<p><i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i></p> <ul style="list-style-type: none"> Describe a given repeating pattern containing two to four elements in its core. Identify and describe errors in a given repeating pattern. Identify and describe the missing element(s) in a given repeating pattern. Create and describe a repeating pattern, using a variety of manipulatives, diagrams, sounds and actions. Reproduce and extend a given repeating pattern, using manipulatives, diagrams, sounds and actions. Identify and describe a repeating pattern in the environment, e.g., in the classroom, outdoors, using everyday language. Identify repeating events; e.g., days of the week, birthdays, seasons. 	<p><i>It is expected that students will:</i></p> <p>1. Demonstrate an understanding of repeating patterns (three to five elements) by:</p> <ul style="list-style-type: none"> describing extending comparing creating <p>patterns using manipulatives, diagrams, sounds and actions.</p> <p>[C, CN, PS, R, V]</p>	<p><i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i></p> <ul style="list-style-type: none"> Identify the core of a given repeating pattern. Describe and extend a given double attribute pattern. Explain the rule used to create a given repeating non-numerical pattern. Predict an element in a given repeating pattern, using a variety of strategies. Predict an element of a given repeating pattern, and extend the pattern to verify the prediction. Compare two given repeating patterns, and describe how they are alike/different. Create a repeating pattern where the core has three to five elements. 	<p><i>It is expected that students will:</i></p> <p>2. Demonstrate an understanding of decreasing patterns by:</p> <ul style="list-style-type: none"> describing extending comparing creating <p>numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions.</p> <p>[C, CN, PS, R, V]</p>	<p><i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i></p> <ul style="list-style-type: none"> Describe a given decreasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues. Identify the pattern rule of a given decreasing pattern, and extend the pattern for the next three terms. Identify and explain errors in a given decreasing pattern. Identify and describe various decreasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns. Compare decreasing numeric patterns of counting backward by 2s, 5s, 10s, 25s and 100s. Create a concrete, pictorial or symbolic decreasing pattern for a given pattern rule. Create a concrete, pictorial or symbolic decreasing pattern; and describe the relationship, using a pattern rule. Solve a given problem, using decreasing patterns. Identify and describe decreasing patterns in the environment. Identify and apply a pattern rule to determine missing elements for a given pattern. Describe the strategy used to determine missing elements in a given decreasing pattern. 	<p><i>It is expected that students will:</i></p> <p>1. Identify and describe patterns found in tables and charts.</p> <p>[C, CN, PS, V] [CT: C2-2.3]</p>	<p><i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i></p> <ul style="list-style-type: none"> Identify and describe a variety of patterns in a multiplication chart. Determine the missing element(s) in a given table or chart. Identify the error(s) in a given table or chart. Describe the pattern found in a given table or chart.
<p>2. Sort a set of objects based on a single attribute, and explain the sorting rule.</p> <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> Identify a common attribute in a given set of objects. Sort a given set of objects, using a single attribute, e.g., colour, and explain the sorting rule. 	<p>2. Sort objects, using one attribute, and explain the sorting rule.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> Represent a given repeating pattern, using another mode; e.g., actions to sound, colour to shape, ABC ABC to bear eagle fish bear eagle fish. Describe a given repeating pattern, using a letter code; e.g., ABC ABC. 	<p>3. Sort a set of objects, using two attributes, and explain the sorting rule.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> Determine the differences between two given pre-sorted sets, and explain the sorting rule. Identify and name two common attributes of items within a given pre-sorted group. Choose two attributes to sort a given set of objects, sort the set, and explain the sorting rule. 	<p>3. Sort objects or numbers, using one or more than one attribute.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> Classify a given set of numbers according to the number of digits. Classify a given set of numbers as odd or even. Classify a given set of numbers as fractions or whole numbers. Determine the difference between two given pre-sorted sets of objects that have been sorted based on two attributes, and explain a possible sorting rule used to sort them. Record the sorting of a set of objects, using tools such as Venn diagrams. Sort a given set of objects or numbers in more than one way, and explain how the sorting rules are different. 	<p>2. Translate among different representations of a pattern, such as a table, a chart or concrete materials.</p> <p>[C, CN, V]</p>	<ul style="list-style-type: none"> Create a concrete representation of a given pattern displayed in a table or chart. Create a table or chart from a given concrete representation of a pattern.
<p>3. Translate repeating patterns from one representation to another.</p> <p>[C, CN, R, V]</p>	<ul style="list-style-type: none"> Identify a common attribute in a given set of objects. Choose a single attribute to sort a given set of objects, sort the set, and explain the sorting rule. Sort a given set of objects, using a given sorting rule. Determine the difference between two given pre-sorted sets of objects, and explain a possible sorting rule used to sort them. 	<ul style="list-style-type: none"> Identify a common attribute in a given set of objects. Choose a single attribute to sort a given set of objects, sort the set, and explain the sorting rule. Sort a given set of objects, using a given sorting rule. Determine the difference between two given pre-sorted sets of objects, and explain a possible sorting rule used to sort them. 	<ul style="list-style-type: none"> Identify a common attribute in a given set of objects. Choose a single attribute to sort a given set of objects, sort the set, and explain the sorting rule. Sort a given set of objects, using a given sorting rule. Determine the difference between two given pre-sorted sets of objects, and explain a possible sorting rule used to sort them. 	<p>3. Demonstrate an understanding of increasing patterns by:</p> <ul style="list-style-type: none"> describing reproducing extending creating <p>numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions.</p> <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> Identify and describe increasing patterns in a variety of given contexts; e.g., hundred chart, number line, addition tables, calendar, lining pattern or drawings. Represent the relationship in a given increasing pattern, concretely and pictorially. Identify errors in a given increasing pattern. Explain the rule used to create a given increasing pattern. Create an increasing pattern, and explain the pattern rule. Represent a given increasing pattern, using another mode; e.g., colour to shape. Solve a given problem, using increasing patterns. Identify and describe increasing patterns in the environment; e.g., house-room numbers, book pages, calendar, pine cones, leap years. Determine missing elements in a given concrete, pictorial or symbolic increasing pattern, and explain the reasoning. 	<p>1. Demonstrate an understanding of increasing patterns by:</p> <ul style="list-style-type: none"> describing extending comparing creating <p>numerical (numbers to 1000) and non-numerical patterns using manipulatives, diagrams, sounds and actions.</p> <p>[C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> Describe a given increasing pattern by stating a pattern rule that includes the starting point and a description of how the pattern continues; e.g., for 42, 44, 46 ... the pattern rule is start at 42 and add 2 each time. Identify the pattern rule of a given increasing pattern, and extend the pattern for the next three terms. Identify and explain errors in a given increasing pattern. Locate and describe various increasing patterns found on a hundred chart, such as horizontal, vertical and diagonal patterns. Compare numeric patterns of counting by 2s, 5s, 10s, 25s and 100s. Create a concrete, pictorial or symbolic representation of an increasing pattern for a given pattern rule. Create a concrete, pictorial or symbolic increasing pattern; and describe the relationship, using a pattern rule. Solve a given problem, using increasing patterns. Identify and describe increasing patterns in the environment. Identify and apply a pattern rule to determine missing elements for a given pattern. Describe the strategy used to determine missing elements in a given increasing pattern. 	<p>3. Represent, describe and extend patterns and relationships, using charts and tables, to solve problems.</p> <p>[C, CN, PS, R, V] [CT: C2-2.3]</p>	<ul style="list-style-type: none"> Translate the information in a given problem into a table or chart. Identify and extend the patterns in a table or chart to solve a given problem. Complete a given Carroll diagram to solve a problem. Determine where new elements belong in a given Carroll diagram. Identify a sorting rule for a given Venn diagram. Describe the relationship shown in a given Venn diagram when the circles intersect, when one circle is contained in the other and when the circles are separate. Determine where new elements belong in a given Venn diagram. Solve a given problem by using a chart or diagram to identify mathematical relationships.

Alberta's Program of Studies (Curriculum) - Mathematics - Patterns and Relations (Strand and Sub-strands with Achievement Outcomes)

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MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and embrace lifelong learning in mathematics.

MATHEMATICAL PROCESS	Communication [C]	Connections [CN]	Mental Mathematics and Estimation [ME]	Problem Solving [PS]	Reasoning [R]	Technology [T]	Visualization [V]
Students are expected to	communicate in order to learn and express their understanding	connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines.	demonstrate fluency with mental mathematics and estimation	develop and apply new mathematical knowledge through problem solving	develop mathematical reasoning	select and use technologies as tools for learning and for solving problems	develop visualization skills to assist in processing information, making connections and solving problems

Sub-Strand: Variables and Equations											
Kindergarten		Grade 1			Grade 2			Grade 3		Grade 4	
Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators		
<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>	<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>		
NA	NA	<p>4. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20).</p> <p>[C, CN, R, V]</p>	<p>* Construct two equal sets, using the same objects (same shape and mass), and demonstrate their equality of number, using a balance (limited to 20 elements).</p> <p>* Construct two unequal sets, using the same objects (same shape and mass), and demonstrate their inequality of number, using a balance (limited to 20 elements).</p> <p>* Determine if two given concrete sets are equal or unequal, and explain the process used.</p>	<p>4. Demonstrate and explain the meaning of equality and inequality concretely and pictorially.</p> <p>[C, CN, R, V]</p>	<p>* Determine whether two given quantities of the same object (same shape and mass) are equal by using a balance.</p> <p>* Construct and draw two unequal sets, using the same object (same shape and mass), and explain the reasoning.</p> <p>* Demonstrate how to change two given sets, equal in number, to create inequality.</p> <p>* Choose from three or more given sets the one that does not have a quantity equal to the others, and explain why.</p>	<p>4. Solve one-step addition and subtraction equations involving a symbol to represent an unknown number.</p> <p>[C, CN, PS, R, V]</p>	<p>* Explain the purpose of the symbol in a given addition or subtraction equation with one unknown, e.g., in the equation $3 + \square = 10$, the triangle represents the number that would make the equation true.</p> <p>* Create an addition or subtraction equation with one unknown to represent a given combining or separating action.</p> <p>* Provide an alternative symbol for the unknown in a given addition or subtraction equation.</p> <p>* Solve, using manipulatives, a given addition or subtraction equation with one unknown that represents combining or separating actions.</p> <p>* Solve a given addition or subtraction equation with one unknown, using a variety of strategies, including guess and test.</p>	<p>4. Solve one-step equations involving a symbol to represent an unknown number.</p> <p>[C, CN, PS, R, V]</p>	<p>* Explain the purpose of the symbol in a given addition, subtraction, multiplication or division equation with one unknown, e.g., $3x + 5 = 6$.</p> <p>* Express a given pictorial or concrete representation of an equation in symbolic form.</p> <p>* Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.</p> <p>* Create a problem for a given equation with one unknown.</p>		
		<p>5. Record equalities, using the equal symbol.</p> <p>[C, CN, PS, V]</p>	<p>* Represent a given equality, using manipulatives or pictures.</p> <p>* Represent a given pictorial or concrete equality in symbolic form.</p> <p>* Provide examples of equalities where the given sum or difference is on either the left or right side of the equal symbol (=).</p> <p>* Record different representations of the same quantity (0 to 20) as equalities.</p>	<p>5. Record equalities and inequalities symbolically, using the equal symbol or the not equal symbol.</p> <p>[C, CN, R, V]</p>	<p>* Determine whether two sides of a given number sentence are equal (=) or not equal (\neq). Write the appropriate symbol and justify the answer.</p> <p>* Model equalities, using a variety of concrete representations, and record the equalities symbolically.</p> <p>* Model inequalities, using a variety of concrete representations, and record the inequalities symbolically.</p>	<p>* Solve a given addition or subtraction equation when the unknown is on the left or the right side of the equation.</p> <p>* Explain why the unknown in a given addition or subtraction equation has only one value.</p>	<p>5. Express a given problem as an equation in which a symbol is used to represent an unknown number.</p> <p>[C, CN, PS, R]</p>	<p>* Represent and solve a given one-step equation concretely, pictorially or symbolically.</p> <p>* Solve a given one-step equation, using guess and test.</p> <p>* Describe, orally, the meaning of a given one-step equation with one unknown.</p> <p>* Solve a given equation when the unknown is on the left or right side of the equation.</p> <p>* Represent and solve a given addition or subtraction problem involving a "part-part-whole" or comparison context, using a symbol to represent the unknown.</p> <p>* Represent and solve a given multiplication or division problem involving equal grouping or partitioning (equal sharing), using a symbol to represent the unknown.</p>			

Alberta's Program of Studies (Curriculum) - Mathematics - Patterns and Relations (Strand and Sub-strands with Achievement Outcomes)

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MATHEMATICAL PROCESSES	Communication [C]	Connections [CN]	Mental Mathematics and Estimation [ME]	Problem Solving [PS]	Reasoning [R]	Technology [T]	Visualization [V]
Students are expected to	communicate in order to learn and express their understanding	connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines.	demonstrate fluency with mental mathematics and estimation	develop and apply new mathematical knowledge through problem solving	develop mathematical reasoning	select and use technologies as tools for learning and for solving problems	develop visualization skills to assist in processing information, making connections and solving problems

Sub-strand: Patterns									
Grade 5		Grade 6		Grade 7		Grade 8		Grade 9	
Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators
<p>1. Determine the pattern rule to make predictions about subsequent elements. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one. Describe, orally or in writing, a given pattern, using mathematical language such as one more, one less, five more. Write a mathematical expression to represent a given pattern, such as $r + 1$, $r - 1$, $r + 5$. Describe the relationship in a given table or chart, using a mathematical expression. Determine and explain why a given number is or is not the next element in a pattern. Predict subsequent elements in a given pattern. Solve a given problem by using a pattern rule to determine subsequent elements. Represent a given pattern visually to verify predictions. 	<p>1. Represent and describe patterns and relationships, using graphs and tables. [C, CN, ME, PS, R, V] [CT: C6-2.3]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Translate a pattern to a table of values, and graph the table of values (limited to linear graphs with discrete elements). Create a table of values from a given pattern or a given graph. Describe, using everyday language, orally or in writing, the relationship shown on a graph. 	<p>1. Demonstrate an understanding of oral and written patterns and their equivalent linear relations. [C, CN, R]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Formulate a linear relation to represent the relationship in a given oral or written pattern. Provide a context for a given linear relation that represents a pattern. Represent a pattern in the environment, using a linear relation. 	<p>1. Graph and analyze two-variable linear relations. [C, ME, PS, R, T, V] [CT: F0-3.3]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Determine the missing value in an ordered pair for a given equation. Create a table of values by substituting values for a variable in the equation of a given linear relation. Construct a graph from the equation of a given linear relation (limited to discrete data). Describe the relationship between the variables of a given graph. 	<p>1. Generalize a pattern arising from problem-solving context, using a linear equation, and verify by substitution. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Write an expression representing a given pictorial, oral or written pattern. Write a linear equation to represent a given context. Describe a context for a given linear equation. Solve, using a linear equation, a given problem that involves pictorial, oral and written linear patterns. Write a linear equation representing the pattern in a given table of values, and verify the equation by substituting values from the table.
		<p>2. Demonstrate an understanding of the relationships within tables of values to solve problems. [C, CN, PS, R] [CT: C6-2.3]</p>	<p>Generate values in one column of a table of values, given values in the other column and a pattern rule.</p> <ul style="list-style-type: none"> State, using mathematical language, the relationship in a given table of values. Create a concrete or pictorial representation of the relationship shown in a table of values. Predict the value of an unknown term, using the relationship in a table of values, and verify the prediction. Formulate a rule to describe the relationship between two columns of numbers in a table of values. Identify missing elements in a given table of values. Identify errors in a given table of values. Describe the pattern within each column of a given table of values. Create a table of values to record and reveal a pattern to solve a given problem. 	<p>2. Create a table of values from a linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems. [C, CN, PS, R, V] [CT: C7-3.1]</p>	<p>Create a table of values for a given linear relation by substituting values for the variable.</p> <ul style="list-style-type: none"> Create a table of values, using a linear relation, and graph the table of values (limited to discrete elements). Sketch the graph from a table of values created for a given linear relation, and describe the patterns found in the graph to draw conclusions; e.g., graph the relationship between n and $2n + 3$. Describe, using everyday language in spoken or written form, the relationship shown on a graph to solve problems. Match a set of linear relations to a set of graphs. 			<p>2. Graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V] [CT: C7-3.1, P2-3.2]</p>	<p>Describe the pattern found in a given graph.</p> <ul style="list-style-type: none"> Graph a given linear relation, including horizontal and vertical lines. Match given equations of linear relations with their corresponding graphs. Extend a given graph (extrapolate) to determine the value of an unknown element. Interpolate the approximate value of one variable on a given graph, given the value of the other variable. Extrapolate the approximate value of one variable from a given graph, given the value of the other variable. Solve a given problem by graphing a linear relation and analyzing the graph.

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Sub-Strand: Variables and Equations									
Grade 5		Grade 6		Grade 7		Grade 8			
Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators	Specific Outcome	Achievement Indicators		
<p>3. Solve problems involving single-variable, one-step equations with whole number coefficients and whole number solutions. [C, CN, PS, R]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Express a given problem as an equation where the unknown is represented by a letter variable. Solve a given single-variable equation with the unknown in any of the terms; e.g., $n + 2 = 5$, $4 + a = 7$, $6 + r = 2$, $10 = 2c$. Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically. Create a problem for a given equation. 	<p>3. Represent generalizations arising from number relationships, using equations with letter variables. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Write and explain the formula for finding the perimeter of any given rectangle. Write and explain the formula for finding the area of any given rectangle. Develop and justify equations using letter variables that illustrate the commutative property of addition and multiplication; e.g., $a + b = b + a$ or $a \cdot b = b \cdot a$. Describe the relationship in a given table, using a mathematical expression. Represent a pattern rule, using a simple mathematical expression such as $4t$ or $2n + 1$. 	<p>4. Explain the difference between an expression and an equation. [C, CN]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Identify and provide an example of a constant term, numerical coefficient and variable in an expression and an equation. Explain what a variable is and how it is used in a given expression. Provide an example of an expression and an equation, and explain how they are similar and different. 	<p>2. Model and solve problems concretely, pictorially and symbolically, using linear equations of the form: • $ax = b$ • $\frac{1}{2}x = b$, $x \neq 0$ • $ax + b = c$, $x \neq 0$ • $\frac{1}{2}x + b = c$, $x \neq 0$ where a, b and c are integers. [C, CN, PS, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model a given problem with a linear equation; and solve the equation, using concrete models, e.g., counters, integer tiles. Verify the solution to a given linear equation, using a variety of methods, including concrete materials, diagrams and substitution. Draw a visual representation of the steps used to solve a given linear equation, and record each step symbolically. Solve a given linear equation symbolically. Identify and correct an error in a given incorrect solution of a linear equation. Apply the distributive property to solve a given linear equation; e.g., $2(x + 3) = 5$ is equivalent to $2x + 6 = 5$. Solve a given problem, using a linear equation, and record the process. 	<p>4. Model and solve problems, using linear equations of the form: • $ax = b$ • $\frac{1}{2}x = b$, $x \neq 0$ • $ax + b = c$ • $\frac{1}{2}x + b = c$, $x \neq 0$ where a, b, c, d, e and f are rational numbers. [C, CN, PS, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model the solution of a given linear equation, using concrete or pictorial representations, and record the process. Verify by substitution whether a given rational number is a solution to a given linear equation. Solve a given linear equation symbolically. Identify and correct an error in a given incorrect solution of a linear equation. Represent a given problem, using a linear equation, and record the process.
<p>2. Express a given problem as an equation in which a letter variable is used to represent an unknown number (limited to whole numbers). [C, CN, PS, R]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Explain the purpose of the letter variable in a given addition, subtraction, multiplication or division equation with one unknown; e.g., $36 \div n = 6$. Express a given pictorial or concrete representation of an equation in symbolic form. Identify the unknown in a problem, and represent the problem with an equation. Create a problem for a given equation with one unknown. 	<p>4. Express a given problem as an equation in which a letter variable is used to represent an unknown number. [C, CN, PS, R]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Identify the unknown in a problem where the unknown could have more than one value, and represent the problem with an equation. Create a problem for a given equation with one unknown. Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically. 	<p>3. Evaluate an expression, given the value of the variables. [CN, R]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Substitute a value for an unknown in a given expression, and evaluate the expression. 	<p>4. Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model the solution of a given linear equation, using concrete or pictorial representations, and record the process. Verify by substitution whether a given rational number is a solution to a given linear equation. Solve a given linear equation symbolically. Identify and correct an error in a given incorrect solution of a linear equation. Apply the distributive property to solve a given linear equation; e.g., $2(x + 3) = 5$ is equivalent to $2x + 6 = 5$. Solve a given problem, using a linear equation, and record the process. 	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model and solve problems, using linear equations of the form: <ul style="list-style-type: none"> $ax = b$ $\frac{1}{2}x = b$, $x \neq 0$ $ax + b = c$ $\frac{1}{2}x + b = c$, $x \neq 0$ where a, b, c, d, e and f are rational numbers. Model and solve problems, using linear equations of the form: <ul style="list-style-type: none"> $ax = b$ $\frac{1}{2}x = b$, $x \neq 0$ $ax + b = c$ $\frac{1}{2}x + b = c$, $x \neq 0$ where a, b, c, d, e and f are rational numbers. Model and solve problems, using linear equations of the form: <ul style="list-style-type: none"> $ax = b$ $\frac{1}{2}x = b$, $x \neq 0$ $ax + b = c$ $\frac{1}{2}x + b = c$, $x \neq 0$ where a, b, c, d, e and f are rational numbers. 	
<p>3. Demonstrate and explain the meaning of preservation of equality, concretely and pictorially. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model the preservation of equality for addition, using concrete materials (e.g., a balance, pictorial representations), and explain and record the process. Model the preservation of equality for subtraction, using concrete materials (e.g., a balance, pictorial representations), and explain and record the process. Model the preservation of equality for multiplication, using concrete materials (e.g., a balance, pictorial representations), and explain and record the process. Model the preservation of equality for division, using concrete materials (e.g., a balance, pictorial representations), and explain and record the process. 	<p>3. Demonstrate an understanding of preservation of equality: concretely, pictorially and symbolically. • applying preservation of equality to solve equations. [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model the preservation of equality for each of the four operations, using concrete materials or pictorial representations; explain the process orally, and record the process symbolically. Write equivalent terms of a given equation by applying the preservation of equality, and verify, using concrete materials; e.g., $3b = 12$ is the same as $3b \div 3 = 12 \div 3$ or $2r = 7$ is the same as $3(2r) = 3(7)$. Solve a given problem by applying preservation of equality. 	<p>6. Model and solve, concretely, pictorially and symbolically, problems that can be represented by one-step linear equations of the form $a + x = b$, where a and b are integers. [CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Represent a given problem with a linear equation; and solve the equation, using concrete models, e.g., counters, integer tiles. Draw a visual representation of the steps required to solve a given linear equation. Solve a given problem, using a linear equation. Verify the solution to a given linear equation, using concrete materials and diagrams. Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality. 	<p>6. Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Create a concrete model or a pictorial representation for a given polynomial expression. Write the expression for a given model of a polynomial. Identify the variables, degree, number of terms and coefficients, including the constant term, of a given simplified polynomial expression. Describe a situation for a given first degree polynomial expression. Match equivalent polynomial expressions given in simplified form; e.g., $4x - 3x + 2$ is equivalent to $3x + 4x + 2$. 		
<p>7. Model and solve, concretely, pictorially and symbolically, problems that can be represented by linear equations of the form: • $ax + b = c$ • $ax = b$ • $\frac{1}{2}x = b$, $x \neq 0$ where a, b and c are whole numbers. [CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model a given problem with a linear equation; and solve the equation, using concrete models, e.g., counters, integer tiles. Draw a visual representation of the steps used to solve a given linear equation. Solve a given problem, using a linear equation, and record the process. Verify the solution to a given linear equation, using concrete materials and diagrams. Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality. 	<p>7. Model and solve, concretely, pictorially and symbolically, problems that can be represented by linear equations of the form: • $ax + b = c$ • $ax = b$ • $\frac{1}{2}x = b$, $x \neq 0$ where a, b and c are whole numbers. [CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model a given problem with a linear equation; and solve the equation, using concrete models, e.g., counters, integer tiles. Draw a visual representation of the steps used to solve a given linear equation. Solve a given problem, using a linear equation, and record the process. Verify the solution to a given linear equation, using concrete materials and diagrams. Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality. 	<p>6. Model and solve, concretely, pictorially and symbolically, problems that can be represented by linear equations of the form: • $ax + b = c$ • $ax = b$ • $\frac{1}{2}x = b$, $x \neq 0$ where a, b and c are whole numbers. [CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model a given problem with a linear equation; and solve the equation, using concrete models, e.g., counters, integer tiles. Draw a visual representation of the steps used to solve a given linear equation. Solve a given problem, using a linear equation, and record the process. Verify the solution to a given linear equation, using concrete materials and diagrams. Substitute a possible solution for the variable in a given linear equation into the original linear equation to verify the equality. 	<p>6. Model, record and explain the operations of addition and subtraction of polynomials, concretely, pictorially and symbolically (limited to polynomials of degree less than or equal to 2). [C, CN, PS, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model addition of two given polynomial expressions concretely or pictorially, and record the process symbolically. Model subtraction of two given polynomial expressions concretely or pictorially, and record the process symbolically. Identify like terms in a given polynomial expression. Apply a personal strategy for addition or subtraction of two given polynomial expressions, and record the process symbolically. Refine personal strategies to increase their efficiency. Identify equivalent polynomial expressions from a given set of polynomial expressions, including pictorial and symbolic representations. Identify the error(s) in a given simplification of a given polynomial expression. 		
<p>7. Model, record and explain the operations of multiplication and division of polynomials (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically. [C, CN, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial. Refine personal strategies to increase their efficiency. Provide examples of equivalent polynomial expressions. Identify the error(s) in a given simplification of a given polynomial expression. 	<p>7. Model, record and explain the operations of multiplication and division of polynomials (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically. [C, CN, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial. Refine personal strategies to increase their efficiency. Provide examples of equivalent polynomial expressions. Identify the error(s) in a given simplification of a given polynomial expression. 	<p>7. Model, record and explain the operations of multiplication and division of polynomials (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically. [C, CN, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial. Refine personal strategies to increase their efficiency. Provide examples of equivalent polynomial expressions. Identify the error(s) in a given simplification of a given polynomial expression. 	<p>7. Model, record and explain the operations of multiplication and division of polynomials (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically. [C, CN, R, V]</p>	<p>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</p> <ul style="list-style-type: none"> Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically. Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial. Refine personal strategies to increase their efficiency. Provide examples of equivalent polynomial expressions. Identify the error(s) in a given simplification of a given polynomial expression. 		