

Number and Numerical Operations Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
STANDARD 4.1 —All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways. Building upon knowledge and skills gained in preceding grades, by the end of Grade 6, students will:	
4.1.6 A. Number Sense	
1. Use real-life experiences, physical materials, and technology to construct meanings for numbers (unless otherwise noted, all indicators for grade 6 pertain to these sets of numbers as well). <ul style="list-style-type: none"> ▶ All integers ▶ All fractions as part of a whole, as subset of a set, as a location on a number line, and as divisions of whole numbers ▶ All decimals 	SE: pp. 4-7, 8, 10, 12-15, 16-19, 20-23, 24, 26-27, 28, 30-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
2. Recognize the decimal nature of United States currency and compute with money.	SE: pp. 20, 24, 32, 33, 38, 63, 67, 69 70, 74
3. Demonstrate a sense of the relative magnitudes of numbers.	SE: pp. 28-31, 40-41, 44-47, 59
4. Explore the use of ratios and proportions in a variety of situations.	SE: pp. 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71
5. Understand and use whole-number percents between 1 and 100 in a variety of situations.	SE: pp. 60-63, 64-67, 68-71
6. Use whole numbers, fractions, and decimals to represent equivalent forms of the same number.	SE: pp. 41, 60-63, 64-67, 68-71
7. Develop and apply number theory concepts in problem solving situations. <ul style="list-style-type: none"> ▶ Primes, factors, multiples ▶ Common multiples, common factors 	
8. Compare and order numbers.	SE: pp. 28-31, 40-41, 44-47, 59

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<p>4.1.6 B. Numerical Operations</p>	
<p>1. Recognize the appropriate use of each arithmetic operation in problem situations.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Construct, use, and explain procedures for performing calculations with fractions and decimals with:</p> <ul style="list-style-type: none"> ▶ Pencil-and-paper ▶ Mental math ▶ Calculator 	<p>SE: pp. 24, 30, 32-34, 38, 40-41, 44-47, 51, 52-55, 56-59, 60-63, 64-67, 68-71</p>
<p>3. Use an efficient and accurate pencil-and-paper procedure for division of a 3-digit number by a 2-digit number.</p>	<p>SE: pp. 35, 49, 53, 61, 69, 72-75, 76-77</p>
<p>4. Select pencil-and-paper, mental math, or a calculator as the appropriate computational method in a given situation depending on the context and numbers.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Find squares and cubes of whole numbers.</p>	<p>SE: pp. 13-15</p>
<p>6. Check the reasonableness of results of computations.</p>	<p>SE: pp. 27, 35, 39</p>
<p>7. Understand and use the various relationships among operations and properties of operations.</p>	<p>SE: pp. 11, 16, 24-27, 28-31, 32-35, 36-39</p>
<p>8. Understand and apply the standard algebraic order of operations for the four basic operations, including appropriate use of parentheses.</p>	<p>SE: pp. 12-15, 16-19, 20-23, 75</p>

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4.1.6 C. Estimation	
1. Use a variety of strategies for estimating both quantities and the results of computations.	
2. Recognize when an estimate is appropriate, and understand the usefulness of an estimate as distinct from an exact answer.	
3. Determine the reasonableness of an answer by estimating the result of operations.	
4. Determine whether a given estimate is an overestimate or an underestimate.	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.2—All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena. Building upon knowledge and skills gained in preceding grades, by the end of Grade 6, students will:</p>	
<p>4.2.6 A. Geometric Properties</p>	
<p>1. Understand and apply concepts involving lines and angles.</p> <ul style="list-style-type: none"> ▶ Notation for line, ray, angle, line segment ▶ Properties of parallel, perpendicular, and intersecting lines ▶ Sum of the measures of the interior angles of a triangle is 180° 	
<p>2. Identify, describe, compare, and classify polygons and circles.</p> <ul style="list-style-type: none"> ▶ Triangles by angles and sides ▶ Quadrilaterals, including squares, rectangles, parallelograms, trapezoids, rhombi ▶ Polygons by number of sides ▶ Equilateral, equiangular, regular ▶ All points equidistant from a given point form a circle 	
<p>3. Identify similar figures.</p>	<p>SE: pp. 52-55, 56-59</p>
<p>4. Understand and apply concepts of congruence and symmetry (line and rotational).</p>	<p>SE: p. 52</p>
<p>5. Compare properties of cylinders, prisms, cones, pyramids, and spheres.</p>	
<p>6. Identify, describe, and draw the faces or shadows (projections) of three-dimensional geometric objects from different perspectives.</p>	
<p>7. Identify a three-dimensional shape with given projections (top, front and side views).</p>	

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8. Identify a three-dimensional shape with a given net (i.e., a flat pattern that folds into a 3D shape).	
4.2.6 B. Transforming Shapes	
1. Use a translation, a reflection, or a rotation to map one figure onto another congruent figure.	
2. Recognize, identify, and describe geometric relationships and properties as they exist in nature, art, and other real-world settings.	SE: pp. 52-55, 56-59
4.2.6 C. Coordinate Geometry	
1. Create geometric shapes with specified properties in the first quadrant on a coordinate grid.	
4.2.6 D. Units of Measurement	
1. Select and use appropriate units to measure angles, area, surface area, and volume.	SE: pp. 13, 14, 21, 71
2. Use a scale to find a distance on a map or a length on a scale drawing.	SE: pp. 56-59
3. Convert measurement units within a system (e.g., 3 feet = ___ inches).	SE: pp. 44-47, 48-51
4. Know approximate equivalents between the standard and metric systems (e.g., one kilometer is approximately 6/10 of a mile).	
5. Use measurements and estimates to describe and compare phenomena.	SE: pp. 44-47, 59

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<p>4.2.6 E. Measuring Geometric Objects</p>	
<p>1. Use a protractor to measure angles.</p>	
<p>2. Develop and apply strategies and formulas for finding perimeter and area.</p> <ul style="list-style-type: none"> ▶ Triangle, square, rectangle, parallelogram, and trapezoid ▶ Circumference and area of a circle 	<p>SE: pp. 13, 21</p>
<p>3. Develop and apply strategies and formulas for finding the surface area and volume of rectangular prisms and cylinders.</p>	
<p>4. Recognize that shapes with the same perimeter do not necessarily have the same area and vice versa.</p>	
<p>5. Develop informal ways of approximating the measures of familiar objects (e.g., use a grid to approximate the area of the bottom of one's foot).</p>	

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.3—All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. Building upon knowledge and skills gained in preceding grades, by the end of Grade 6, students will:</p>	
<p>4.3.6 A. Patterns</p>	
<p>1. Recognize, describe, extend, and create patterns involving whole numbers and rational numbers.</p> <ul style="list-style-type: none"> ▶ Descriptions using tables, verbal rules, simple equations, and graphs ▶ Formal iterative formulas (e.g., NEXT = NOW * 3) ▶ Recursive patterns, including Pascal’s Triangle (where each entry is the sum of the entries above it) and the Fibonacci Sequence: 1, 1, 2, 3, 5, 8, ... (where NEXT = NOW + PREVIOUS) 	<p>SE: pp. 8-11, 16, 72-75, 76-79</p>
<p>4.3.6 B. Functions and Relationships</p>	
<p>1. Describe the general behavior of functions given by formulas or verbal rules (e.g., graph to determine whether increasing or decreasing, linear or not).</p>	
<p>4.3.6 C. Modeling</p>	
<p>1. Use patterns, relations, and linear functions to model situations.</p> <ul style="list-style-type: none"> ▶ Using variables to represent unknown quantities ▶ Using concrete materials, tables, graphs, verbal rules, algebraic expressions/equations/inequalities 	<p>SE: pp. 9, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-41, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

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<p>2. Draw freehand sketches of graphs that model real phenomena and use such graphs to predict and interpret events.</p> <ul style="list-style-type: none"> ▶ Changes over time ▶ Relations between quantities ▶ Rates of change (e.g., when is plant growing slowly/rapidly, when is temperature dropping most rapidly/slowly) 	<p>SE: pp. 76-79</p>
<p>4.3.6 D. Procedures</p>	
<p>1. Solve simple linear equations with manipulatives and informally</p> <ul style="list-style-type: none"> ▶ Whole-number coefficients only, answers also whole numbers ▶ Variables on one or both sides of equation 	<p>SE: pp. 24-27, 28-31, 32-35, 36-39, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Understand and apply the properties of operations and numbers</p> <ul style="list-style-type: none"> ▶ Distributive property ▶ The product of a number and its reciprocal is 1 	
<p>3. Evaluate numerical expressions.</p>	<p>SE: pp. 12-15, 16-19</p>
<p>4. Extend understanding and use of inequality.</p> <ul style="list-style-type: none"> ▶ Symbols (\geq, \neq, \leq) 	<p>SE: pp. 40-41, 44-47</p>

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
<p>STANDARD 4.4—All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data. Building upon knowledge and skills gained in preceding grades, by the end of Grade 6, students will:</p>	
<p>4.4.6 A. Data Analysis</p>	
<p>1. Collect, generate, organize, and display data. ▶ Data generated from surveys</p>	
<p>2. Read, interpret, select, construct, analyze, generate questions about, and draw inferences from displays of data. ▶ Bar graph, line graph, circle graph, table, histogram ▶ Range, median, mean ▶ Calculators and computers used to record and process information</p>	<p>SE: p. 65</p>
<p>3. Respond to questions about data, generate their own questions and hypotheses, and formulate strategies for answering their questions and testing their hypotheses.</p>	
<p>4.4.6 B. Probability</p>	
<p>1. Determine probabilities of events. ▶ Event, complementary event, probability of an event ▶ Multiplication rule for probabilities ▶ Probability of certain event is 1 and of impossible event is 0 ▶ Probabilities of event and complementary event add up to 1</p>	

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2. Determine probability using intuitive, experimental, and theoretical methods (e.g., using model of picking items of different colors from a bag). <ul style="list-style-type: none"> ▶ Given numbers of various types of items in a bag, what is the probability that an item of one type will be picked ▶ Given data obtained experimentally, what is the likely distribution of items in the bag 	
3. Explore compound events.	
4. Model situations involving probability using simulations (with spinners, dice) and theoretical models.	
5. Recognize and understand the connections among the concepts of independent outcomes, picking at random, and fairness.	
4.4.6 C. Discrete Mathematics—Systematic Listing and Counting	
1. Solve counting problems and justify that all possibilities have been enumerated without duplication. <ul style="list-style-type: none"> ▶ Organized lists, charts, tree diagrams, tables ▶ Venn diagrams 	
2. Apply the multiplication principle of counting. <ul style="list-style-type: none"> ▶ Simple situations (e.g., you can make $3 \times 4 = 12$ outfits using 3 shirts and 4 skirts). ▶ Number of ways a specified number of items can be arranged in order (concept of permutation) ▶ Number of ways of selecting a slate of officers from a class (e.g., if there are 23 students and 3 officers, the number is $23 \times 22 \times 21$) 	

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<p>3. List the possible combinations of two elements chosen from a given set (e.g., forming a committee of two from a group of 12 students, finding how many handshakes there will be among ten people if everyone shakes each other person’s hand once).</p>	
<p>4.4.6 D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms</p>	
<p>1. Devise strategies for winning simple games (e.g., start with two piles of objects, each of two players in turn removes any number of objects from a single pile, and the person to take the last group of objects wins) and express those strategies as sets of directions.</p>	
<p>2. Analyze vertex-edge graphs and tree diagrams.</p> <ul style="list-style-type: none"> ▶ Can a picture or a vertex-edge graph be drawn with a single line? (degree of vertex) ▶ Can you get from any vertex to any other vertex? (connectedness) 	
<p>3. Use vertex-edge graphs to find solutions to practical problems.</p> <ul style="list-style-type: none"> ▶ Delivery route that stops at specified sites but involves least travel ▶ Shortest route from one site on a map to another 	

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.5—All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas. At each grade level, with respect to content appropriate for that grade level, students will:</p>	
<p>4.5.6 A. Problem Solving</p>	
<p>1. Learn mathematics through problem solving, inquiry, and discovery.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Solve problems that arise in mathematics and in other contexts.</p> <ul style="list-style-type: none"> ▶ Open-ended problems ▶ Non-routine problems ▶ Problems with multiple solutions ▶ Problems that can be solved in several ways 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and apply a variety of appropriate problem-solving strategies (e.g., “try a simpler problem” or “make a diagram”) to solve problems.</p>	<p>SE: pp. 9, 11, 16, 52-55, 56-59, 60-63, 65, 71, 76-79</p>
<p>4. Pose problems of various types and levels of difficulty.</p>	
<p>5. Monitor their progress and reflect on the process of their problem solving activity.</p>	
<p>4.5.6 B. Communication</p>	
<p>1. Use communication to organize and clarify mathematical thinking.</p> <ul style="list-style-type: none"> ▶ Reading and writing ▶ Discussion, listening, and questioning 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Analyze and evaluate the mathematical thinking and strategies of others.	
4. Use the language of mathematics to express mathematical ideas precisely.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.6 C. Connections	
1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).	SE: pp. 9, 11, 48-51, 52-55, 56-59, 72-75, 76-79
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).	SE: pp. 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.	SE: pp. 4-7, 8, 10, 12-15, 16-19, 20-23, 24, 26-27, 28, 30-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4. Apply mathematics in practical situations and in other disciplines.	SE: pp. 4-7, 8, 10, 12-15, 16-19, 20-23, 24, 26-27, 28, 30-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).	

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<p>6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.</p>	<p>SE: pp. 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4.5.6 D. Reasoning</p>	
<p>1. Recognize that mathematical facts, procedures, and claims must be justified.</p>	<p>SE: pp. 24, 31, 35, 36, 63, 71, 75, 76-78</p>
<p>2. Use reasoning to support their mathematical conclusions and problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and use various types of reasoning and methods of proof.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Make and investigate mathematical conjectures.</p> <ul style="list-style-type: none"> ▶ Counterexamples as a means of disproving conjectures ▶ Verifying conjectures using informal reasoning or proofs 	
<p>6. Evaluate examples of mathematical reasoning and determine whether they are valid.</p>	

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4.5.6 E. Representations	
1. Create and use representations to organize, record, and communicate mathematical ideas. <ul style="list-style-type: none"> ▶ Concrete representations (e.g., base-ten blocks or algebra tiles) ▶ Pictorial representations (e.g., diagrams, charts, or tables) ▶ Symbolic representations (e.g., a formula) ▶ Graphical representations (e.g., a line graph) 	SE: pp. 4-7, 11, 13, 14, 21, 52-55, 56-59, 65, 71, 72-75, 76-79
2. Select, apply, and translate among mathematical representations to solve problems.	SE: pp. 4-7, 8, 10-11, 14-15, 16-17, 40-43, 47, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.6 F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	
5. Use computer software to make and verify conjectures about geometric objects.	
6. Use computer-based laboratory technology for mathematical applications in the sciences.	

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<p>4.1.7 A. Number Sense</p>	
<p>1. Extend understanding of the number system by constructing meanings for the following (unless otherwise noted, all indicators for grade 7 pertain to these sets of numbers as well).</p> <ul style="list-style-type: none"> ▶ Rational numbers ▶ Percents ▶ Whole numbers with exponents 	<p>SE: pp. 4-7, 8-11, 14-15, 60-63, 64-67</p>
<p>2. Demonstrate a sense of the relative magnitudes of numbers.</p>	<p>SE: pp. 4-5, 7, 40-41, 44-46, 56-59</p>
<p>3. Understand and use ratios, proportions, and percents (including percents greater than 100 and less than 1) in a variety of situations.</p>	<p>SE: pp. 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 75</p>
<p>4. Compare and order numbers of all named types.</p>	<p>SE: pp. 4-5, 7, 12-13, 15, 16, 18, 40-43, 44-46</p>
<p>5. Use whole numbers, fractions, decimals, and percents to represent equivalent forms of the same number.</p>	<p>SE: pp. 60-63, 64-67</p>
<p>6. Understand that all fractions can be represented as repeating or terminating decimals.</p>	<p>SE: pp. 57, 65</p>
<p>4.1.7 B. Numerical Operations</p>	
<p>1. Use and explain procedures for performing calculations with integers and all number types named above with:</p> <ul style="list-style-type: none"> ▶ Pencil-and-paper ▶ Mental math ▶ Calculator 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

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2. Use exponentiation to find whole number powers of numbers.	SE: pp. 4-7, 8-11, 14-15
3. Understand and apply the standard algebraic order of operations, including appropriate use of parentheses.	SE: pp. 8-11, 12-15, 16-17, 19
4.1.7 C. Estimation	
1. Use equivalent representations of numbers such as fractions, decimals, and percents to facilitate estimation.	SE: pp. 8, 10

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<p>4.2.7 A. Geometric Properties</p>	
<p>1. Understand and apply properties of polygons.</p> <ul style="list-style-type: none"> ▶ Quadrilaterals, including squares, rectangles, parallelograms, trapezoids, rhombi ▶ Regular polygons 	<p>SE: p. 55</p>
<p>2. Understand and apply the concept of similarity.</p> <ul style="list-style-type: none"> ▶ Using proportions to find missing measures ▶ Scale drawings ▶ Models of 3D objects 	<p>SE: pp. 52-55, 56-59</p>
<p>3. Use logic and reasoning to make and support conjectures about geometric objects.</p>	
<p>4.2.7 B. Transforming Shapes</p>	
<p>1. Understand and apply transformations.</p> <ul style="list-style-type: none"> ▶ Finding the image, given the pre-image, and vice-versa ▶ Sequence of transformations needed to map one figure onto another ▶ Reflections, rotations, and translations result in images congruent to the pre-image ▶ Dilations (stretching/shrinking) result in images similar to the pre-image 	
<p>4.2.7 C. Coordinate Geometry</p>	
<p>1. Use coordinates in four quadrants to represent geometric concepts.</p>	
<p>2. Use a coordinate grid to model and quantify transformations (e.g., translate right 4 units).</p>	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press</p>
<p>4.2.7 D. Units of Measurement</p>	
<p>1. Solve problems requiring calculations that involve different units of measurement within a measurement system (e.g., 4' 3" plus 7' 10" equals 12' 1").</p>	<p>SE: pp. 44-46, 48-51, 56-59</p>
<p>2. Select and use appropriate units and tools to measure quantities to the degree of precision needed in a particular problem-solving situation.</p>	
<p>3. Recognize that all measurements of continuous quantities are approximations.</p>	
<p>4.2.7 E. Measuring Geometric Objects</p>	
<p>1. Develop and apply strategies for finding perimeter and area.</p> <ul style="list-style-type: none"> ▶ Geometric figures made by combining triangles, rectangles and circles or parts of circles ▶ Estimation of area using grids of various sizes 	<p>SE: pp. 11, 14-15</p>
<p>2. Recognize that the volume of a pyramid or cone is one-third of the volume of the prism or cylinder with the same base and height (e.g., use rice to compare volumes of figures with same base and height).</p>	

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press</p>
<p>STANDARD 4.3—All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. Building upon knowledge and skills gained in preceding grades, by the end of Grade 7, students will:</p>	
<p>4.3.7 A. Patterns</p>	
<p>1. Recognize, describe, extend, and create patterns involving whole numbers, rational numbers, and integers.</p> <ul style="list-style-type: none"> ▶ Descriptions using tables, verbal and symbolic rules, graphs, simple equations or expressions ▶ Finite and infinite sequences ▶ Generating sequences by using calculators to repeatedly apply a formula 	<p>SE: pp. 72-75, 76-79</p>
<p>4.3.7 B. Functions and Relationships</p>	
<p>1. Graph functions, and understand and describe their general behavior.</p> <ul style="list-style-type: none"> ▶ Equations involving two variables 	<p>SE: pp. 76-79</p>
<p>4.3.7 C. Modeling</p>	
<p>1. Analyze functional relationships to explain how a change in one quantity can result in a change in another, using pictures, graphs, charts, and equations.</p>	<p>SE: pp. 15, 68-71, 72-75, 76-79</p>

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press</p>
<p>2. Use patterns, relations, symbolic algebra, and linear functions to model situations.</p> <ul style="list-style-type: none"> ▶ Using manipulatives, tables, graphs, verbal rules, algebraic expressions/equations/inequalities ▶ Growth situations, such as population growth and compound interest, using recursive (e.g., NOW-NEXT) formulas (cf. science standard 5.5 and social studies standard 6.6) 	<p>SE: pp. 8, 10-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4.3.7 D. Procedures</p>	
<p>1. Use graphing techniques on a number line.</p> <ul style="list-style-type: none"> ▶ Absolute value ▶ Arithmetic operations represented by vectors (arrows) (e.g., "$-3 + 6$" is "left 3, right 6") 	
<p>2. Solve simple linear equations informally and graphically.</p> <ul style="list-style-type: none"> ▶ Multi-step, integer coefficients only (although answers may not be integers) ▶ Using paper-and-pencil, calculators, graphing calculators, spreadsheets, and other technology 	<p>SE: pp. 16-18, 28, 30, 36-38, 72-75, 76-79</p>
<p>3. Create, evaluate, and simplify algebraic expressions involving variables.</p> <ul style="list-style-type: none"> ▶ Order of operations, including appropriate use of parentheses ▶ Substitution of a number for a variable 	<p>SE: pp. 6, 8-11, 12-15, 16-19</p>
<p>4. Understand and apply the properties of operations, numbers, equations, and inequalities.</p> <ul style="list-style-type: none"> ▶ Additive inverse ▶ Multiplicative inverse 	<p>SE: pp. 20-23, 24-27, 28-31, 32-35, 36-39, 44, 46, 72-75</p>

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press
<p>STANDARD 4.4—All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data. Building upon knowledge and skills gained in preceding grades, by the end of Grade 7, students will:</p>	
<p>4.4.7 A. Data Analysis</p>	
<p>1. Select and use appropriate representations for sets of data, and measures of central tendency (mean, median, and mode).</p> <ul style="list-style-type: none"> ▶ Type of display most appropriate for given data ▶ Box-and-whisker plot, upper quartile, lower quartile ▶ Scatter plot ▶ Calculators and computer used to record and process information 	
<p>2. Make inferences and formulate and evaluate arguments based on displays and analysis of data.</p>	
<p>4.4.7 B. Probability</p>	
<p>1. Interpret probabilities as ratios, percents, and decimals.</p>	
<p>2. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models.</p> <ul style="list-style-type: none"> ▶ Frequency, relative frequency 	
<p>3. Estimate probabilities and make predictions based on experimental and theoretical probabilities.</p>	
<p>4. Play and analyze probability-based games, and discuss the concepts of fairness and expected value.</p>	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press
4.4.7 C. Discrete Mathematics—Systematic Listing and Counting	
1. Apply the multiplication principle of counting. <ul style="list-style-type: none"> ▶ Permutations: ordered situations with replacement (e.g., number of possible license plates) vs. ordered situations without replacement (e.g., number of possible slates of 3 class officers from a 23 student class) 	
2. Explore counting problems involving Venn diagrams with three attributes (e.g., there are 15, 20, and 25 students respectively in the chess club, the debating team, and the engineering society; how many different students belong to the three clubs if there are 6 students in chess and debating, 7 students in chess and engineering, 8 students in debating and engineering, and 2 students in all three?).	
3. Apply techniques of systematic listing, counting, and reasoning in a variety of different contexts.	
4.4.7 D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms	
1. Use vertex-edge graphs to represent and find solutions to practical problems. <ul style="list-style-type: none"> ▶ Finding the shortest network connecting specific sites ▶ Finding the shortest route on a map from one site to another ▶ Finding the shortest circuit on a map that makes a tour of specified sites 	

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press</p>
<p>STANDARD 4.5—All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas. At each grade level, with respect to content appropriate for that grade level, students will:</p>	
<p>4.5.7 A. Problem Solving</p>	
<p>1. Learn mathematics through problem solving, inquiry, and discovery.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Solve problems that arise in mathematics and in other contexts.</p> <ul style="list-style-type: none"> ▶ Open-ended problems ▶ Non-routine problems ▶ Problems with multiple solutions ▶ Problems that can be solved in several ways 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and apply a variety of appropriate problem-solving strategies (e.g., “try a simpler problem” or “make a diagram”) to solve problems.</p>	<p>SE: pp. 6, 8, 10-11, 28-31, 64-67, 68-70, 72-75, 76-79</p>
<p>4. Pose problems of various types and levels of difficulty.</p>	
<p>5. Monitor their progress and reflect on the process of their problem solving activity.</p>	
<p>4.5.7 B. Communication</p>	
<p>1. Use communication to organize and clarify mathematical thinking.</p> <ul style="list-style-type: none"> ▶ Reading and writing ▶ Discussion, listening, and questioning 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press
2. Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Analyze and evaluate the mathematical thinking and strategies of others.	SE: p. 42
4. Use the language of mathematics to express mathematical ideas precisely.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.7 C. Connections	
1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).	SE: pp. 4-6, 8, 10-11, 14-15, 19, 32, 33, 36, 38, 48-50, 52-55, 56-59, 62, 68-71, 76-79
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).	SE: pp. 4-7, 28-31, 44-47, 48-51, 52-55, 56-59, 60-63, 68-71, 72-75, 76-79
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.	SE: pp. 4-7, 8, 10-11, 12-13, 15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-70, 75, 76-79
4. Apply mathematics in practical situations and in other disciplines.	SE: pp. 4-7, 8, 10-11, 12-13, 15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-70, 75, 76-79
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).	
6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.	SE: pp. 16-19, 24-27, 28-31, 32-35, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press
4.5.7 D. Reasoning	
1. Recognize that mathematical facts, procedures, and claims must be justified.	SE: pp. 11, 18, 27, 28, 30, 34, 38, 39, 46, 55, 70, 74, 76, 79
2. Use reasoning to support their mathematical conclusions and problem solutions.	SE: pp. 4-7, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Select and use various types of reasoning and methods of proof.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
5. Make and investigate mathematical conjectures. <ul style="list-style-type: none"> ▶ Counterexamples as a means of disproving conjectures ▶ Verifying conjectures using informal reasoning or proofs 	
6. Evaluate examples of mathematical reasoning and determine whether they are valid.	
4.5.7 E. Representations	
1. Create and use representations to organize, record, and communicate mathematical ideas. <ul style="list-style-type: none"> ▶ Concrete representations (e.g., base-ten blocks or algebra tiles) ▶ Pictorial representations (e.g., diagrams, charts, or tables) ▶ Symbolic representations (e.g., a formula) ▶ Graphical representations (e.g., a line graph) 	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra</i> New Readers Press
2. Select, apply, and translate among mathematical representations to solve problems.	SE: pp. 4-7, 16-17, 19, 40-43, 44-46, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.7 F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	
5. Use computer software to make and verify conjectures about geometric objects.	
6. Use computer-based laboratory technology for mathematical applications in the sciences.	

<p align="center">Number and Numerical Operations Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.1—All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways. Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:</p>	
<p>4.1.8 A. Number Sense</p>	
<p>1. Extend understanding of the number system by constructing meanings for the following (unless otherwise noted, all indicators for grade 8 pertain to these sets of numbers as well):</p> <ul style="list-style-type: none"> ▶ Rational numbers ▶ Percents ▶ Exponents ▶ Roots ▶ Absolute values ▶ Numbers represented in scientific notation 	<p>SE: pp. 44-47, 48-51, 55, 72-75</p>
<p>2. Demonstrate a sense of the relative magnitudes of numbers.</p>	<p>SE: pp. 4-7, 60-63, 68-71</p>
<p>3. Understand and use ratios, proportions, and percents (including percents greater than 100 and less than 1) in a variety of situations.</p>	<p>SE: pp. 16, 18, 36-39, 40-43, 44-47, 48-51, 60-63, 64-67</p>
<p>4. Compare and order numbers of all named types.</p>	<p>SE: pp. 4-7, 8-9, 11, 60-63, 68-71</p>
<p>5. Use whole numbers, fractions, decimals, and percents to represent equivalent forms of the same number.</p>	<p>SE: pp. 44-47, 48-51</p>
<p>6. Recognize that repeating decimals correspond to fractions and determine their fractional equivalents.</p> <ul style="list-style-type: none"> ▶ $5/7 = 0.714285714285 \dots = \overline{0.714285}$ 	

Number and Numerical Operations Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
7. Construct meanings for common irrational numbers, such as π (pi) and the square root of 2.	
4.1.8 B. Numerical Operations	
1. Use and explain procedures for performing calculations involving addition, subtraction, multiplication, division, and exponentiation with integers and all number types named above with: <ul style="list-style-type: none"> ▶ Pencil-and-paper ▶ Mental math ▶ Calculator 	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
2. Use exponentiation to find whole number powers of numbers.	SE: pp. 55, 72-75
3. Find square and cube roots of numbers and understand the inverse nature of powers and roots.	
4. Solve problems involving proportions and percents.	SE: pp. 36-39, 40-43, 44-47, 48-51
5. Understand and apply the standard algebraic order of operations, including appropriate use of parentheses.	SE: pp. 4-7, 8-11, 52-55, 64-67, 68-71, 72-75, 76-79
4.1.8 C. Estimation	
1. Estimate square and cube roots of numbers.	
2. Use equivalent representations of numbers such as fractions, decimals, and percents to facilitate estimation.	
3. Recognize the limitations of estimation and assess the amount of error resulting from estimation.	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.2—All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena. Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:</p>	
<p>4.2.8 A. Geometric Properties</p>	
<p>1. Understand and apply concepts involving lines, angles, and planes.</p> <ul style="list-style-type: none"> ▶ Complimentary and supplementary angles ▶ Vertical angles ▶ Bisectors and perpendicular bisectors ▶ Parallel, perpendicular, and intersecting planes ▶ Intersection of plane with cube, cylinder, cone, and sphere 	
<p>2. Understand and apply the Pythagorean theorem.</p>	
<p>3. Understand and apply properties of polygons.</p> <ul style="list-style-type: none"> ▶ Quadrilaterals, including squares, rectangles, parallelograms, trapezoids, rhombi ▶ Regular polygons ▶ Sum of measures of interior angles of a polygon ▶ Which polygons can be used alone to generate a tessellation and why 	<p>SE: p. 23</p>
<p>4. Understand and apply the concept of similarity.</p> <ul style="list-style-type: none"> ▶ Using proportions to find missing measures ▶ Scale drawings ▶ Models of 3D objects 	<p>SE: pp. 40-43</p>
<p>5. Use logic and reasoning to make and support conjectures about geometric objects.</p>	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>4.2.8 B. Transforming Shapes</p>	
<p>1. Understand and apply transformations.</p> <ul style="list-style-type: none"> ▶ Finding the image, given the pre-image, and vice-versa ▶ Sequence of transformations needed to map one figure onto another ▶ Reflections, rotations, and translations result in images congruent to the pre-image ▶ Dilations (stretching/shrinking) result in images similar to the pre-image 	<p>SE: pp. 40-43</p>
<p>2. Use iterative procedures to generate geometric patterns.</p> <ul style="list-style-type: none"> ▶ Fractals (e.g., the Koch Snowflake) ▶ Self-similarity ▶ Construction of initial stages ▶ Patterns in successive stages (e.g., number of triangles in each stage of Sierpinski's Triangle). 	
<p>4.2.8 C. Coordinate Geometry</p>	
<p>1. Use coordinates in four quadrants to represent geometric concepts.</p>	<p>SE: pp. 43, 75</p>
<p>2. Use a coordinate grid to model and quantify transformations (e.g., translate right 4 units).</p>	<p>SE: p. 43</p>
<p>4.2.8 D. Units of Measurement</p>	
<p>1. Solve problems requiring calculations that involve different units of measurement within a measurement system (e.g., 4' 3" plus 7' 10" equals 12' 1").</p>	<p>SE: pp. 8-10, 41-43, 67</p>

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>2. Use approximate equivalents between standard and metric systems to estimate measurements (e.g., 5 kilometers is about 3 miles).</p>	
<p>3. Recognize that the degree of precision needed in calculations depends on how the results will be used and the instruments used to generate the measurements.</p>	
<p>4. Select and use appropriate units and tools to measure quantities to the degree of precision needed in a particular problem-solving situation.</p>	
<p>5. Recognize that all measurements of continuous quantities are approximations.</p>	
<p>6. Solve problems that involve compound measurement units, such as speed (miles per hour), air pressure (pounds per square inch), and population density (persons per square mile).</p>	<p>SE: pp. 19, 36-39, 60-63, 64-67, 79</p>
<p>4.2.8 E. Measuring Geometric Objects</p>	
<p>1. Develop and apply strategies for finding perimeter and area.</p> <ul style="list-style-type: none"> ▶ Geometric figures made by combining triangles, rectangles and circles or parts of circles. ▶ Estimation of area using grids of various sizes. ▶ Impact of a dilation on the perimeter and area of a 2-dimensional figure. 	
<p>2. Recognize that the volume of a pyramid or cone is one-third of the volume of the prism or cylinder with the same base and height (e.g., use rice to compare volumes of figures with same base and height).</p>	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>3. Develop and apply strategies and formulas for finding the surface area and volume of a three-dimensional figure.</p> <ul style="list-style-type: none"> ▶ Volume – prism, cone, pyramid ▶ Surface area – prism (triangular or rectangular base), pyramid (triangular or rectangular base) ▶ Impact of a dilation on the surface area and volume of a three-dimensional figure 	
<p>4. Use formulas to find the volume and surface area of sphere.</p>	

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.3—All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:</p>	
<p>4.3.8 A. Patterns</p>	
<p>1. Recognize, describe, extend, and create patterns involving whole numbers, rational numbers, and integers.</p> <ul style="list-style-type: none"> ▶ Descriptions using tables, verbal and symbolic rules, graphs, simple equations or expressions ▶ Finite and infinite sequences ▶ Arithmetic sequences (i.e., sequences generated by repeated addition of a fixed number, positive or negative) ▶ Geometric sequences (i.e., sequences generated by repeated multiplication by a fixed positive ratio, greater than 1 or less than 1) ▶ Generating sequences by using calculators to repeatedly apply a formula 	<p>SE: pp. 51, 52-55, 60-63, 64-67, 76-79</p>
<p>4.3.8 B. Functions and Relationships</p>	
<p>1. Graph functions, and understand and describe their general behavior.</p> <ul style="list-style-type: none"> ▶ Equations involving two variables ▶ Rates of change (informal notion of slope) 	<p>SE: pp. 60-63, 64-67, 76-79</p>
<p>2. Recognize and describe the difference between linear and exponential growth, using tables, graphs, and equations).</p>	

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>4.3.8 C. Modeling</p>	
<p>1. Analyze functional relationships to explain how a change in one quantity can result in a change in another, using pictures, graphs, charts, and equations.</p>	<p>SE: pp. 51, 52-55, 60-63, 64-67, 72-75, 76-79</p>
<p>2. Use patterns, relations, symbolic algebra, and linear functions to model situations.</p> <ul style="list-style-type: none"> ▶ Using concrete materials (manipulatives), tables, graphs, verbal rules, algebraic expressions/equations/inequalities ▶ Growth situations, such as population growth and compound interest, using recursive (e.g., NOW-NEXT) formulas (cf. science standard 5.5 and social studies standard 6.6) 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 76-79</p>
<p>4.3.8 D. Procedures</p>	
<p>1. Use graphing techniques on a number line.</p> <ul style="list-style-type: none"> ▶ Absolute value ▶ Arithmetic operations represented by vectors (arrows) (e.g., “-3 + 6” is “left 3, right 6”) 	
<p>2. Solve simple linear equations informally, graphically, and using formal algebraic methods.</p> <ul style="list-style-type: none"> ▶ Multi-step, integer coefficients only (although answers may not be integers) ▶ Using paper-and-pencil, calculators, graphing calculators, spreadsheets, and other technology 	<p>SE: pp. 4-7, 8-11, 20-23, 44-47, 52-55, 64-67, 76-79</p>
<p>3. Solve simple linear inequalities.</p>	<p>SE: pp. 24-27, 28-31, 32-35, 68-71</p>

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>4. Create, evaluate, and simplify algebraic expressions involving variables.</p> <ul style="list-style-type: none"> ▶ Order of operations, including appropriate use of parentheses ▶ Distributive property ▶ Substitution of a number for a variable ▶ Translation of a verbal phrase or sentence into an algebraic expression, equation, or inequality, and vice versa 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Understand and apply the properties of operations, numbers, equations, and inequalities.</p> <ul style="list-style-type: none"> ▶ Additive inverse ▶ Multiplicative inverse ▶ Addition and multiplication properties of equality ▶ Addition and multiplication properties of inequalities 	<p>SE: pp. 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 76-79</p>

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
<p>STANDARD 4.4—All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data. Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:</p>	
<p>4.4.8 A. Data Analysis</p>	
<p>1. Select and use appropriate representations for sets of data, and measures of central tendency (mean, median, and mode).</p> <ul style="list-style-type: none"> ▶ Type of display most appropriate for given data ▶ Box-and-whisker plot, upper quartile, lower quartile ▶ Scatter plot ▶ Calculators and computer used to record and process information ▶ Finding the median and mean (weighted average) using frequency data ▶ Effect of additional data on measures of central tendency 	<p>SE: pp. 23, 31, 56-59</p>
<p>2. Make inferences and formulate and evaluate arguments based on displays and analysis of data.</p>	<p>SE: pp. 56-59, 60-63, 66-67</p>
<p>3. Estimate lines of best fit and use them to interpolate within the range of data.</p>	<p>SE: pp. 58-59</p>
<p>4.4.8 B. Probability</p>	
<p>1. Interpret probabilities as ratios, percents, and decimals.</p>	
<p>2. Determine probabilities of compound events.</p>	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
3. Explore the probabilities of conditional events (e.g., if there are seven marbles in a bag, three red and four green, what is the probability that two marbles picked from the bag, without replacement are both red).	
4. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models. ▶ Frequency, relative frequency	
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.	
6. Play and analyze probability-based games, and discuss the concepts of fairness and expected value.	
4.4.8 C. Discrete Mathematics—Systematic Listing and Counting	
1. Apply the multiplication principle of counting. <ul style="list-style-type: none"> ▶ Permutations: ordered situations with replacement (e.g., number of possible license plates) vs. ordered situations without replacement (e.g., number of possible slates of 3 class officers from a 23 student class) ▶ Factorial notation ▶ Concept of combinations (e.g., number of possible delegations of 3 out of 23 students) 	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Explore counting problems involving Venn diagrams with three attributes (e.g., there are 15, 20, and 25 students respectively in the chess club, the debating team, and the engineering society; how many different students belong to the three clubs if there are 6 students in chess and debating, 7 students in chess and engineering, 8 students in debating and engineering, and 2 students in all three?)	
3. Apply techniques of systematic listing, counting, and reasoning in a variety of different contexts.	
4.4.8 D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms	
1. Use vertex-edge graphs and algorithmic thinking to represent and find solutions to practical problems. <ul style="list-style-type: none"> ▶ Finding the shortest network connecting specified sites ▶ Finding a minimal route that includes every street (e.g., for trash pick-up) ▶ Finding the shortest route on a map from one site to another ▶ Finding the shortest circuit on a map that makes a tour of specified sites ▶ Limitations of computers (e.g., the number of routes for a delivery truck visiting n sites is $n!$, so finding the shortest circuit by examining all circuits would overwhelm the capacity of any computer, now or in the future, even if n is less than 100) 	

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.5—All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas. At each grade level, with respect to content appropriate for that grade level, students will:</p>	
<p>4.5.8 A. Problem Solving</p>	
<p>1. Learn mathematics through problem solving, inquiry, and discovery.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Solve problems that arise in mathematics and in other contexts.</p> <ul style="list-style-type: none"> ▶ Open-ended problems ▶ Non-routine problems ▶ Problems with multiple solutions ▶ Problems that can be solved in several ways 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and apply a variety of appropriate problem-solving strategies (e.g., “try a simpler problem” or “make a diagram”) to solve problems.</p>	<p>SE: pp. 11, 20-23, 25-26, 40-43, 51, 52-55, 56-59, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Pose problems of various types and levels of difficulty.</p>	
<p>5. Monitor their progress and reflect on the process of their problem solving activity.</p>	
<p>4.5.8 B. Communication</p>	
<p>1. Use communication to organize and clarify mathematical thinking.</p> <ul style="list-style-type: none"> ▶ Reading and writing ▶ Discussion, listening, and questioning 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>3. Analyze and evaluate the mathematical thinking and strategies of others.</p>	
<p>4. Use the language of mathematics to express mathematical ideas precisely.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4.5.8 C. Connections</p>	
<p>1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).</p>	<p>SE: pp. 4-6, 11, 14, 18-19, 20, 22-23, 25-27, 28-31, 35, 40-43, 52-55, 60-63, 64-67, 76-79</p>
<p>2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).</p>	<p>SE: pp. 12-15, 16-19, 20-23, 24-27, 28-31, 36-39, 40-43, 44-47, 48-51, 52-55, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Recognize that mathematics is used in a variety of contexts outside of mathematics.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 21-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Apply mathematics in practical situations and in other disciplines.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 21-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).</p>	
<p>6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 60-63, 64-67, 68-71, 72-75, 76-79</p>

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>4.5.8 D. Reasoning</p>	
<p>1. Recognize that mathematical facts, procedures, and claims must be justified.</p>	<p>SE: pp. 10, 11, 18, 36-38, 54, 55, 58, 60, 63</p>
<p>2. Use reasoning to support their mathematical conclusions and problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and use various types of reasoning and methods of proof.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Make and investigate mathematical conjectures.</p> <ul style="list-style-type: none"> ▶ Counterexamples as a means of disproving conjectures ▶ Verifying conjectures using informal reasoning or proofs 	
<p>6. Evaluate examples of mathematical reasoning and determine whether they are valid.</p>	
<p>4.5.8 E. Representations</p>	
<p>1. Create and use representations to organize, record, and communicate mathematical ideas.</p> <ul style="list-style-type: none"> ▶ Concrete representations (e.g., base-ten blocks or algebra tiles) ▶ Pictorial representations (e.g., diagrams, charts, or tables) ▶ Symbolic representations (e.g., a formula) ▶ Graphical representations (e.g., a line graph) 	<p>SE: pp. 4-7, 8-11, 20-23, 25-26, 28-29, 40-43, 44, 46, 51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Select, apply, and translate among mathematical representations to solve problems.	SE: pp. 4-7, 11, 20-23, 25-26, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.8 F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	
5. Use computer software to make and verify conjectures about geometric objects.	
6. Use computer-based laboratory technology for mathematical applications in the sciences.	

<p align="center">Number and Numerical Operations Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.1—All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.1.12 A. Number Sense</p>	
<p>1. Extend understanding of the number system to all real numbers.</p>	
<p>2. Compare and order rational and irrational numbers.</p>	
<p>3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.</p>	
<p>4.1.12 B. Numerical Operations</p>	
<p>1. Extend understanding and use of operations to real numbers and algebraic procedures.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.</p>	
<p>3. Perform operations on matrices. ► Addition and subtraction ► Scalar multiplication</p>	
<p>4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.</p>	<p>SE: pp. 60, 63</p>
<p>4.1.12 C. Estimation</p>	
<p>1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.</p>	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.2—All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.2.12 A. Geometric Properties</p>	
<p>1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).</p>	<p>SE: pp. 6, 18</p>
<p>2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).</p>	
<p>3. Apply the properties of geometric shapes.</p> <ul style="list-style-type: none"> ▶ Parallel lines – transversal, alternate interior angles, corresponding angles ▶ Triangles <ul style="list-style-type: none"> a. Conditions for congruence b. Segment joining midpoints of two sides is parallel to and half the length of the third side c. Triangle Inequality ▶ Minimal conditions for a shape to be a special quadrilateral ▶ Circles – arcs, central and inscribed angles, chords, tangents ▶ Self-similarity 	
<p>4. Use reasoning and some form of proof to verify or refute conjectures and theorems.</p> <ul style="list-style-type: none"> ▶ Verification or refutation of proposed proofs ▶ Simple proofs involving congruent triangles ▶ Counterexamples to incorrect conjectures 	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>4.2.12 B. Transforming Shapes</p>	
<p>1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.</p>	
<p>2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.</p>	
<p>3. Determine whether two or more given shapes can be used to generate a tessellation.</p>	
<p>4. Generate and analyze iterative geometric patterns.</p> <ul style="list-style-type: none"> ▶ Fractals (e.g., Sierpinski’s Triangle) ▶ Patterns in areas and perimeters of self-similar figures ▶ Outcome of extending iterative process indefinitely 	
<p>4.2.12 C. Coordinate Geometry</p>	
<p>1. Use coordinate geometry to represent and verify properties of lines.</p> <ul style="list-style-type: none"> ▶ Distance between two points ▶ Midpoint and slope of a line segment ▶ Finding the intersection of two lines ▶ Lines with the same slope are parallel ▶ Lines that are perpendicular have slopes whose product is -1 	<p>SE: pp. 28-31, 32-35, 36-39, 41, 44-47, 68-71</p>

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>2. Show position and represent motion in the coordinate plane using vectors. ▶ Addition and subtraction of vectors</p>	
<p>4.2.12 D. Units of Measurement</p>	
<p>1. Understand and use the concept of significant digits.</p>	
<p>2. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation. ▶ Degree of accuracy of a given measurement tool ▶ Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements</p>	
<p>4.2.12 E. Measuring Geometric Objects</p>	
<p>1. Use techniques of indirect measurement to represent and solve problems. ▶ Similar triangles ▶ Pythagorean theorem ▶ Right triangle trigonometry (sine, cosine, tangent)</p>	<p>SE: pp. 18, 68-71</p>
<p>2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures. ▶ Approximation of area using grids of different sizes ▶ Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets ▶ Estimation of area, perimeter, volume, and surface area</p>	

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.3—All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.3.12 A. Patterns</p>	
<p>1. Use models and algebraic formulas to represent and analyze sequences and series.</p> <ul style="list-style-type: none"> ▶ Explicit formulas for nth terms ▶ Sums of finite arithmetic series ▶ Sums of finite and infinite geometric series 	
<p>2. Develop an informal notion of limit.</p>	
<p>3. Use inductive reasoning to form generalizations.</p>	
<p>4.3.12 B. Functions and Relationships</p>	
<p>1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.</p>	<p>SE: pp. 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 64-67, 72-75</p>
<p>2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.</p> <ul style="list-style-type: none"> ▶ Slope of a line or curve ▶ Domain and range ▶ Intercepts ▶ Continuity ▶ Maximum/minimum ▶ Estimating roots of equations ▶ Intersecting points as solutions of systems of equations ▶ Rates of change 	<p>SE: pp. 26-27, 31, 32-35, 36-39, 40-41, 44-47, 64-67</p>

<p style="text-align: center;">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>3. Understand and perform transformations on commonly-used functions.</p> <ul style="list-style-type: none"> ▶ Translations, reflections, dilations ▶ Effects on linear and quadratic graphs of parameter changes in equations ▶ Using graphing calculators or computers for more complex functions 	
<p>4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.</p> <ul style="list-style-type: none"> ▶ Linear vs. non-linear ▶ Symmetry ▶ Increasing/decreasing on an interval 	
<p>4.3.12 C. Modeling</p>	
<p>1. Use functions to model real-world phenomena and solve problems that involve varying quantities.</p> <ul style="list-style-type: none"> ▶ Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years) ▶ Direct and inverse variation ▶ Absolute value ▶ Expressions, equations and inequalities ▶ Same function can model variety of phenomena ▶ Growth/decay and change in the natural world ▶ Applications in mathematics, biology, and economics (including compound interest) 	<p>SE: pp. 4-7, 8-11, 12-15, 18-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-41, 43, 44-47, 48-51, 53-55, 56-59, 61-63, 64-67, 72-75, 76-79</p>

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>2. Analyze and describe how a change in an independent variable leads to change in a dependent one.</p>	<p>SE: pp. 24-27, 28-31, 32-35, 36-39, 40-41, 44-47, 48-51, 64-67, 72-75, 76-79</p>
<p>3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).</p>	
<p>4.3.12 D. Procedures</p>	
<p>1. Evaluate and simplify expressions.</p> <ul style="list-style-type: none"> ▶ Add and subtract polynomials ▶ Multiply a polynomial by a monomial or binomial ▶ Divide a polynomial by a monomial 	
<p>2. Select and use appropriate methods to solve equations and inequalities.</p> <ul style="list-style-type: none"> ▶ Linear equations – algebraically ▶ Quadratic equations – factoring (when the coefficient of x^2 is 1) and using the quadratic formula ▶ All types of equations using graphing, computer, and graphing calculator techniques 	<p>SE: pp. 8-11, 12-15, 16-19, 20-23, 26-27, 28-31, 32-35, 36-39, 43, 44-47, 48-51, 52-55, 56-59, 72-75, 76-79</p>
<p>3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.</p>	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
<p>STANDARD 4.4—All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.4.12 A. Data Analysis</p>	
<p>1. Use surveys and sampling techniques to generate data and draw conclusions about large groups.</p> <ul style="list-style-type: none"> ▶ Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling) 	
<p>2. Evaluate the use of data in real-world contexts.</p> <ul style="list-style-type: none"> ▶ Accuracy and reasonableness of conclusions drawn ▶ Bias in conclusions drawn (e.g., influence of how data is displayed) ▶ Statistical claims based on sampling 	
<p>3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.</p>	
<p>4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of data.</p>	
<p>5. Analyze data using technology, and use statistical terminology to describe conclusions.</p> <ul style="list-style-type: none"> ▶ Measures of dispersion: variance, standard deviation, outliers ▶ Correlation coefficient ▶ Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean) 	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
4.4.12 B. Probability	
1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.	
2. Use concepts and formulas of area to calculate geometric probabilities.	
3. Model situations involving probability with simulations (using spinners, dice, calculators, and computers) and theoretical models, and solve problems using these models.	
4. Determine probabilities in complex situations. <ul style="list-style-type: none"> ▶ Conditional events ▶ Complementary events ▶ Dependent and independent events 	
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.	
6. Understand and use the “law of large numbers” (that experimental results tend to approach theoretical probabilities after a large number of trials).	
4.4.12 C. Discrete Mathematics—Systematic Listing and Counting	
1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students).	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.	
3. Justify solutions to counting problems.	
4. Recognize and explain relationships involving combinations and Pascal's Triangle, and apply those methods to situations involving probability.	
4.4.12 D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms	
1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems. <ul style="list-style-type: none"> ▶ Circuits that include every edge in a graph ▶ Circuits that include every vertex in a graph ▶ Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring ▶ Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures) 	
3. Explore strategies for making fair decisions. <ul style="list-style-type: none"> ▶ Combining individual preferences into a group decision (e.g., determining winner of an election or selection process) ▶ Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment) 	

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.5—All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas. At each grade level, with respect to content appropriate for that grade level, students will:</p>	
<p>4.5.12 A. Problem Solving</p>	
<p>1. Learn mathematics through problem solving, inquiry, and discovery.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Solve problems that arise in mathematics and in other contexts.</p> <ul style="list-style-type: none"> ▶ Open-ended problems ▶ Non-routine problems ▶ Problems with multiple solutions ▶ Problems that can be solved in several ways 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and apply a variety of appropriate problem-solving strategies (e.g., “try a simpler problem” or “make a diagram”) to solve problems.</p>	<p>SE: pp. 5, 24-27, 28-31, 32-35, 36-39, 40-42, 44-47, 48-51, 56-59, 60-63, 64-67, 71, 72-75</p>
<p>4. Pose problems of various types and levels of difficulty.</p>	
<p>5. Monitor their progress and reflect on the process of their problem solving activity.</p>	
<p>4.5.12 B. Communication</p>	
<p>1. Use communication to organize and clarify mathematical thinking.</p> <ul style="list-style-type: none"> ▶ Reading and writing ▶ Discussion, listening, and questioning 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>3. Analyze and evaluate the mathematical thinking and strategies of others.</p>	
<p>4. Use the language of mathematics to express mathematical ideas precisely.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4.5.12 C. Connections</p>	
<p>1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).</p>	<p>SE: pp. 16-19, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 56-59, 64-67, 68-71</p>
<p>2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).</p>	<p>SE: pp. 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 52-55, 56-59, 64-67, 72-75, 76-79</p>
<p>3. Recognize that mathematics is used in a variety of contexts outside of mathematics.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 18-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-41, 43, 44-47, 48-51, 53-55, 56-59, 61-63, 64-67, 72-75, 76-79</p>
<p>4. Apply mathematics in practical situations and in other disciplines.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 18-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-41, 43, 44-47, 48-51, 53-55, 56-59, 61-63, 64-67, 72-75, 76-79</p>
<p>5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).</p>	
<p>6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>4.5.12 D. Reasoning</p>	
<p>1. Recognize that mathematical facts, procedures, and claims must be justified.</p>	<p>SE: pp. 27, 40, 42</p>
<p>2. Use reasoning to support their mathematical conclusions and problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and use various types of reasoning and methods of proof.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Make and investigate mathematical conjectures.</p> <ul style="list-style-type: none"> ▶ Counterexamples as a means of disproving conjectures ▶ Verifying conjectures using informal reasoning or proofs 	
<p>6. Evaluate examples of mathematical reasoning and determine whether they are valid.</p>	
<p>4.5.12 E. Representations</p>	
<p>1. Create and use representations to organize, record, and communicate mathematical ideas.</p> <ul style="list-style-type: none"> ▶ Concrete representations (e.g., base-ten blocks or algebra tiles) ▶ Pictorial representations (e.g., diagrams, charts, or tables) ▶ Symbolic representations (e.g., a formula) ▶ Graphical representations (e.g., a line graph) 	<p>SE: pp. 5, 16-19, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52, 54, 56-59, 64-67, 68-71, 73-74</p>

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Select, apply, and translate among mathematical representations to solve problems.	SE: pp. 5, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 56-59, 64-67, 71
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79
4.5.12 F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	
5. Use computer software to make and verify conjectures about geometric objects.	
6. Use computer-based laboratory technology for mathematical applications in the sciences.	

<p align="center">Number and Numerical Operations Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.1—All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.1.12A. Number Sense</p>	
<p>1. Extend understanding of the number system to all real numbers.</p>	
<p>2. Compare and order rational and irrational numbers.</p>	
<p>3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.</p>	
<p>4.1.12B. Numerical Operations</p>	
<p>1. Extend understanding and use of operations to real numbers and algebraic procedures.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.</p>	
<p>3. Perform operations on matrices. ► Addition and subtraction ► Scalar multiplication</p>	
<p>4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.</p>	<p>SE: pp. 60-62</p>
<p>4.1.12C. Estimation</p>	
<p>1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.</p>	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>STANDARD 4.2—All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.2.12A. Geometric Properties</p>	
<p>1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).</p>	<p>SE: pp. 6, 8-9, 12-14, 19, 58, 70</p>
<p>2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).</p>	
<p>3. Apply the properties of geometric shapes.</p> <ul style="list-style-type: none"> ▶ Parallel lines – transversal, alternate interior angles, corresponding angles ▶ Triangles <ul style="list-style-type: none"> a. Conditions for congruence b. Segment joining midpoints of two sides is parallel to and half the length of the third side c. Triangle Inequality ▶ Minimal conditions for a shape to be a special quadrilateral ▶ Circles – arcs, central and inscribed angles, chords, tangents ▶ Self-similarity 	
<p>4. Use reasoning and some form of proof to verify or refute conjectures and theorems.</p> <ul style="list-style-type: none"> ▶ Verification or refutation of proposed proofs ▶ Simple proofs involving congruent triangles ▶ Counterexamples to incorrect conjectures 	

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>4.2.12B. Transforming Shapes</p>	
<p>1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.</p>	
<p>2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.</p>	
<p>3. Determine whether two or more given shapes can be used to generate a tessellation.</p>	
<p>4. Generate and analyze iterative geometric patterns.</p> <ul style="list-style-type: none"> ▶ Fractals (e.g., Sierpinski’s Triangle) ▶ Patterns in areas and perimeters of self-similar figures ▶ Outcome of extending iterative process indefinitely 	
<p>4.2.12C. Coordinate Geometry</p>	
<p>1. Use coordinate geometry to represent and verify properties of lines.</p> <ul style="list-style-type: none"> ▶ Distance between two points ▶ Midpoint and slope of a line segment ▶ Finding the intersection of two lines ▶ Lines with the same slope are parallel ▶ Lines that are perpendicular have slopes whose product is -1 	<p>SE: pp. 24-27, 28-31, 33, 48-51, 68-71</p>

<p style="text-align: center;">Geometry and Measurement Strands and Cumulative Progress Indicators</p>	<p style="text-align: center;"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>2. Show position and represent motion in the coordinate plane using vectors.</p> <ul style="list-style-type: none"> ▶ Addition and subtraction of vectors 	
<p>4.2.12D. Units of Measurement</p>	
<p>1. Understand and use the concept of significant digits.</p>	
<p>3. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation.</p> <ul style="list-style-type: none"> ▶ Degree of accuracy of a given measurement tool ▶ Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements 	
<p>4.2.12E. Measuring Geometric Objects</p>	
<p>1. Use techniques of indirect measurement to represent and solve problems.</p> <ul style="list-style-type: none"> ▶ Similar triangles ▶ Pythagorean theorem ▶ Right triangle trigonometry (sine, cosine, tangent) 	<p>SE: pp. 6, 68-71</p>
<p>2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures.</p> <ul style="list-style-type: none"> ▶ Approximation of area using grids of different sizes ▶ Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets ▶ Estimation of area, perimeter, volume, and surface area 	

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>STANDARD 4.3—All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.3.12A. Patterns</p>	
<p>1. Use models and algebraic formulas to represent and analyze sequences and series.</p> <ul style="list-style-type: none"> ▶ Explicit formulas for nth terms ▶ Sums of finite arithmetic series ▶ Sums of finite and infinite geometric series 	<p>SE: p. 15</p>
<p>2. Develop an informal notion of limit.</p>	
<p>3. Use inductive reasoning to form generalizations.</p>	
<p>4.3.12B. Functions and Relationships</p>	
<p>1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.</p>	<p>SE: pp. 20-23, 24-27, 28-31, 33, 40-43, 45-47, 48-51, 56-59, 64-67, 68-71</p>
<p>2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.</p> <ul style="list-style-type: none"> ▶ Slope of a line or curve ▶ Domain and range ▶ Intercepts ▶ Continuity ▶ Maximum/minimum ▶ Estimating roots of equations ▶ Intersecting points as solutions of systems of equations ▶ Rates of change 	<p>SE: pp. 20-23, 24-27, 28-31, 33, 45, 47, 48-51, 64-67</p>

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>3. Understand and perform transformations on commonly-used functions.</p> <ul style="list-style-type: none"> ▶ Translations, reflections, dilations ▶ Effects on linear and quadratic graphs of parameter changes in equations ▶ Using graphing calculators or computers for more complex functions 	
<p>4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.</p> <ul style="list-style-type: none"> ▶ Linear vs. non-linear ▶ Symmetry ▶ Increasing/decreasing on an interval 	
<p>4.3.12C. Modeling</p>	
<p>1. Use functions to model real-world phenomena and solve problems that involve varying quantities.</p> <ul style="list-style-type: none"> ▶ Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years) ▶ Direct and inverse variation ▶ Absolute value ▶ Expressions, equations and inequalities ▶ Same function can model variety of phenomena ▶ Growth/decay and change in the natural world ▶ Applications in mathematics, biology, and economics (including compound interest) 	<p>SE: pp. 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36, 38-39, 40-43, 45-47, 48-51, 52-55, 56-59, 63, 64-65, 67, 70, 72-75, 76-79</p>

<p align="center">Patterns and Algebra Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
<p>2. Analyze and describe how a change in an independent variable leads to change in a dependent one.</p>	<p>SE: pp. 20-23, 24-27, 28-31, 32-35, 40-43, 44-47, 48-51, 52-55, 56-59, 67, 72-75, 76-79</p>
<p>3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).</p>	
<p>4.3.12D. Procedures</p>	
<p>1. Evaluate and simplify expressions.</p> <ul style="list-style-type: none"> ▶ Add and subtract polynomials ▶ Multiply a polynomial by a monomial or binomial ▶ Divide a polynomial by a monomial 	<p>SE: pp. 60-62</p>
<p>2. Select and use appropriate methods to solve equations and inequalities.</p> <ul style="list-style-type: none"> ▶ Linear equations – algebraically ▶ Quadratic equations – factoring (when the coefficient of x^2 is 1) and using the quadratic formula ▶ All types of equations using graphing, computer, and graphing calculator techniques 	<p>SE: pp. 8-11, 12-15, 16-19, 20-23, 28-31, 34-35, 36-39, 40-43, 45-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.</p>	<p>SE: p. 16</p>

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
<p>STANDARD 4.4—All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:</p>	
<p>4.4.12A. Data Analysis</p>	
<p>1. Use surveys and sampling techniques to generate data and draw conclusions about large groups.</p> <ul style="list-style-type: none"> ▶ Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling) 	
<p>2. Evaluate the use of data in real-world contexts.</p> <ul style="list-style-type: none"> ▶ Accuracy and reasonableness of conclusions drawn ▶ Bias in conclusions drawn (e.g., influence of how data is displayed) ▶ Statistical claims based on sampling 	<p>SE: p. 27</p>
<p>3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.</p>	
<p>4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of data.</p>	
<p>5. Analyze data using technology, and use statistical terminology to describe conclusions.</p> <ul style="list-style-type: none"> ▶ Measures of dispersion: variance, standard deviation, outliers ▶ Correlation coefficient ▶ Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean) 	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
4.4.12B. Probability	
1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.	
2. Use concepts and formulas of area to calculate geometric probabilities.	
3. Model situations involving probability with simulations (using spinners, dice, calculators, and computers) and theoretical models, and solve problems using these models.	
4. Determine probabilities in complex situations. <ul style="list-style-type: none"> ▶ Conditional events ▶ Complementary events ▶ Dependent and independent events 	
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.	
6. Understand and use the “law of large numbers” (that experimental results tend to approach theoretical probabilities after a large number of trials).	
4.4.12C. Discrete Mathematics—Systematic Listing and Counting	
1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students).	

Data Analysis, Probability, and Discrete Mathematics Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i>
2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.	
3. Justify solutions to counting problems.	
4. Recognize and explain relationships involving combinations and Pascal's Triangle, and apply those methods to situations involving probability.	
4.4.12D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms	
1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems. <ul style="list-style-type: none"> ▶ Circuits that include every edge in a graph ▶ Circuits that include every vertex in a graph ▶ Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring ▶ Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures) 	
2. Explore strategies for making fair decisions. <ul style="list-style-type: none"> ▶ Combining individual preferences into a group decision (e.g., determining winner of an election or selection process) ▶ Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment) 	

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press</p>
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<p>4.5.12A. Problem Solving</p>	
<p>1. Learn mathematics through problem solving, inquiry, and discovery.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Solve problems that arise in mathematics and in other contexts.</p> <ul style="list-style-type: none"> ▶ Open-ended problems ▶ Non-routine problems ▶ Problems with multiple solutions ▶ Problems that can be solved in several ways 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and apply a variety of appropriate problem-solving strategies (e.g., “try a simpler problem” or “make a diagram”) to solve problems.</p>	<p>SE: pp. 4, 6, 8-10, 16-19, 20-23, 24-27, 28-31, 33, 40-43, 45-47, 48-51, 52-55, 56-59, 63, 64-67, 68-71</p>
<p>4. Pose problems of various types and levels of difficulty.</p>	
<p>5. Monitor their progress and reflect on the process of their problem solving activity.</p>	
<p>4.5.12B. Communication</p>	
<p>1. Use communication to organize and clarify mathematical thinking.</p> <ul style="list-style-type: none"> ▶ Reading and writing ▶ Discussion, listening, and questioning 	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>2. Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

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<p>3. Analyze and evaluate the mathematical thinking and strategies of others.</p>	<p>SE: pp. 27, 39</p>
<p>4. Use the language of mathematics to express mathematical ideas precisely.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4.5.12C. Connections</p>	
<p>1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).</p>	<p>SE: pp. 6, 8-9, 12-15, 19, 20-23, 24-27, 28-31, 33, 40-43, 48-51, 52-55, 56-59, 60-63, 68-71</p>
<p>2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).</p>	<p>SE: pp. 16-19, 28-31, 33, 40-43, 44-47, 48-51, 52-55, 56-59, 63, 68-71</p>
<p>3. Recognize that mathematics is used in a variety of contexts outside of mathematics.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36, 38-39, 40-43, 45-47, 48-51, 52-55, 56-59, 63, 64-65, 67, 70, 72-75, 76-79</p>
<p>4. Apply mathematics in practical situations and in other disciplines.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36, 38-39, 40-43, 45-47, 48-51, 52-55, 56-59, 63, 64-65, 67, 70, 72-75, 76-79</p>
<p>5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).</p>	
<p>6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>

<p align="center">Mathematical Processes Strands and Cumulative Progress Indicators</p>	<p align="center"><i>Write Math Answers to Open-Ended Questions in Algebra, New Readers Press</i></p>
<p>4.5.12D. Reasoning</p>	
<p>1. Recognize that mathematical facts, procedures, and claims must be justified.</p>	<p>SE: pp. 15, 22, 26, 27, 51, 55, 71, 78, 79</p>
<p>2. Use reasoning to support their mathematical conclusions and problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>3. Select and use various types of reasoning and methods of proof.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.</p>	<p>SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-79</p>
<p>5. Make and investigate mathematical conjectures.</p> <ul style="list-style-type: none"> ▶ Counterexamples as a means of disproving conjectures ▶ Verifying conjectures using informal reasoning or proofs 	
<p>6. Evaluate examples of mathematical reasoning and determine whether they are valid.</p>	
<p>4.5.12E. Representations</p>	
<p>1. Create and use representations to organize, record, and communicate mathematical ideas.</p> <ul style="list-style-type: none"> ▶ Concrete representations (e.g., base-ten blocks or algebra tiles) ▶ Pictorial representations (e.g., diagrams, charts, or tables) ▶ Symbolic representations (e.g., a formula) ▶ Graphical representations (e.g., a line graph) 	<p>SE: pp. 4-7, 8-10, 12-15, 16-19, 20-23, 24-27, 28-31, 33, 40-43, 44-47, 48-51, 56-59, 60-63, 64-67, 68-71, 73-75</p>

Mathematical Processes Strands and Cumulative Progress Indicators	<i>Write Math Answers to Open-Ended Questions in Algebra,</i> New Readers Press
2. Select, apply, and translate among mathematical representations to solve problems.	SE: pp. 6, 8-10, 16-19, 20-23, 24-27, 28-31, 33, 40-43, 45-47, 48-51, 56-59, 63, 64-67, 68-71
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: pp. 4-7, 8-11, 12-15, 16-19, 20-23, 24-27, 28-31, 32-35, 36-39, 40-43, 44-47, 48-51, 52-55, 56-59, 60-63, 64-67, 68-71, 72-75, 76-69
4.5.12F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	
5. Use computer software to make and verify conjectures about geometric objects.	
6. Use computer-based laboratory technology for mathematical applications in the sciences.	