

CORRELATION
of
the 10 UNDERSTANDING MATH PLUS PROGRAMS & UNDERSTANDING NUMERATION PLUS PROGRAMS
with
Ontario MATHEMATICS CURRICULUM STANDARDS

GRADE 9 Academic

Note: a. The Understanding Math PLUS series of programs consist of 10 programs written for Kindergarten to 10th Grade.

The 10 programs are:

- Understanding Fractions Understanding Whole Numbers and Integers
- Understanding Probability Understanding Percent
- Understanding Exponents Understanding Equations
- Understanding Algebra Understanding Graphing
- Understanding Numeration
- Understanding Measurement and Geometry

Note: b. The Understanding Numeration software for K to 3 is set up so that the teacher selects items in the following order:

Concept .. from 5 concepts .. Counting, Comparing & Ordering, Place Value, Operations and Problem Solving.

Skill .. chosen from the list of specific learning expectations

Level .. indicates the levels of development for Kindergarten to 3rd grade.

Level	Upper Range of Number
A	10
B	20
C	100
D	1000

Lesson .. 250 lessons are sequenced to build understanding of concepts.

A detailed Lesson Synopsis on the website www.neufeldmath.com to assist the teacher by stating the lesson contents but also by giving lesson suggestions.

Worksheet .. off computer worksheets are selected from the CD by a code.

Note: c. The remaining 9 Understanding Math programs for 4th to 10th grade are set up so that they can be used in a variety of teaching and learning environments ranging from a teacher centered approach with 1 computer to a student centered lab approach. The lessons can also be used in remediation, tutorial, intervention, resource, fast-tracking.

Each topic has:

- ..an interactive concept introduction, usually with a variety of graphic approaches.
- ..a number of particular examples
- ..practice questions with random questions but particular feedback
- ..a topic test with random questions and tracking
- ..off computer worksheets selected from the website .. www.neufeldmath.com

Number Sense and Algebra

Specific Expectations

Operating with Exponents

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–substitute into and evaluate algebraic expressions involving exponents (i.e., evaluate expressions involving natural-number exponents with rational number bases [e.g., evaluate $(3/2)^3$ by hand and 9.8^3 by using a calculator]) (Sample problem: A movie theatre wants to compare the volumes of popcorn in two containers, a cube with edge length 8.1 cm and a cylinder with radius 4.5 cm and height 8.0 cm. Which container holds more popcorn?);</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 1. The Meaning of Exponents Exponents, Powers, Bases Powerful Explosions Introductory Examples Examples 1, 2, 3, 4, 5 Examples – Substitution Examples 1, 2, 3, 4 Examples – Order of Operation Examples 1, 2, 3 Practice Questions</p> <p>MAT+ <u>Understanding Algebra</u> Topic 4. Patterns, Formulas, Substitution Patterns to Formulas Example... Hockey Standings Example... Counting Money Example... Angles in a Polygon Substitution is... Math Scrabble Scrabble 1, 2, 3 Challenge Substitution Examples Examples 1, 2, 3, 4</p>
<p>–describe the relationship between the algebraic and geometric representations of a single-variable term up to degree three [i.e., length, which is one dimensional, can be represented by x; area, which is two dimensional, can be represented by $(x)(x)$ or x^2; volume, which is three dimensional, can be represented by $(x)(x)(x)$, $(x^2)(x)$, or x^3];</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 1. The Meaning of Exponents Exponents, Powers, Bases Powerful Explosions Introductory Examples Examples 1, 2, 3, 4, 5 Examples – Substitution Examples 1, 2, 3, 4 Examples – Order of Operation Examples 1, 2, 3 Practice Questions</p>

	<p>Topic 2. Exponents in Formulas The Power Key An Introduction Power with a Positive Base Power with a Negative Base Adding Two Powers: Long Way Adding Two Powers: Short Way An Introduction to Formulas Area Formulas Involving Exponents Volume Formulas Involving Exponents Examples with Area Formulas Examples 1, 2, 3 Practice Questions</p>
<p>–derive, through the investigation and examination of patterns, the exponent rules for multiplying and dividing monomials, and apply these rules in expressions involving one and two variables with positive exponents;</p> <p>–extend the multiplication rule to derive and understand the power of a power rule, and apply it to simplify expressions involving one and two variables with positive exponents.</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 3. The Exponent Rules In This Topic Multiplication of Powers with the Same Base Expanding the Exponents The Pattern In General Division of Powers with the Same Base Expanding the Exponents The Pattern In General Raising a Power to an Exponent Expanding the Exponents The Pattern In General</p> <p>MAT+ <u>Understanding Algebra</u> Topic 7. Multiplying Expressions Our Problem Recall Tile Concepts Multiplying Monomials Like Terms With Tiles Without Tiles</p>

Manipulating Expressions and Solving Equations

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–simplify numerical expressions involving integers and rational numbers, with and without the use of technology;*</p>	<p>MAT+ <u>Understanding Whole Numbers and Integers</u></p> <p>Topic 5. Adding Integers Word Problems Temperature Money Car Practice Questions</p> <p>Topic 6. Subtracting Integers Word Problems The Sailboat The Bank Practice Questions</p> <p>Topic 7. Multiplying Expressions Word Problems Washing Cars The Helicopter Construction Practice Questions</p> <p>Topic 8. Dividing Expressions Word Problems Casino Plant Graham’s Walk Practice Questions</p> <p>MAT+ <u>Understanding Fractions</u></p> <p>Topic 8. Adding Fractions Word Problems Alexander’s Friends Eating Candy Goal Scoring Taking a Walk Fraction Card Game</p> <p>Topic 9. Subtracting Fractions Word Problems Pedro and Alex Race Washing the Cars</p>

	<p>Planting a Garden Practice Questions</p> <p>Topic 10. Multiplying Fractions Word Problems Boris' Money Maria's Trip Developing the Rule Example 1 Example 2 A Summary</p> <p>Topic 11. Dividing Fractions Examples without Diagrams Numerical Examples 1, 2 Central High School Practice Questions</p>
<p>–solve problems requiring the manipulation of expressions arising from applications of percent, ratio, rate, and proportion;*</p>	<p>MAT+ <u>Understanding Percent</u></p> <p>Topic 4. Ratios and Proportions Ratios and Your Body Golden Ratios Measuring Your Body Practice Question</p> <p>Topic 6. Problems Involving Percent Finding the Whole Recall Proportion School Population: Method 1... Using Proportions School Population: Method 2 Grades Problem: Method 1... Using Proportions Grades Problem: Method 2 Bike Sale: Method 1... Using Proportions Bike Sale: Method 2 Finding the Percent Theatre Problem Car Problem Percent of a Number Earnings Problem Nickel Ore Percents Greater than 100% Number Problem Order Problem Percents Less than 1%</p>

	<p>Number Problem Pencil Problem Mental Calculation Number Problem Tipping Percent Change</p>
<p>–relate their understanding of inverse operations to squaring and taking the square root, and apply inverse operations to simplify expressions and solve equations;</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 5. Square Roots Squaring Numbers Square Roots Radical Signs Square Roots of Negative Numbers Example Questions 1. Radicals First 2. The Four Equations 3. Lawn Question 4. Make a Square</p> <p>MAT+ <u>Understanding Equations</u> Topic 4. Solving Multi-Step Equations Our Problem Concepts – Examples with Tiles Concepts – Examples without Tiles Examples 1, 2, 3, 4, 5 Summary Literal Equations What Are They? How do you solve them? Why Solve the Literal Equations? A Perimeter Example A Temperature Example</p>
<p>–add and subtract polynomials with up to two variables [e.g., $(2x - 5) + (3x + 1)$, $(3x^2y + 2xy^2) + (4x^2y - 6xy^2)$], using a variety of tools (e.g., algebra tiles, computer algebra systems, paper and pencil);</p>	<p>MAT+ <u>Understanding Algebra</u> Topic 5. Adding Expressions Our Problem Adding Expressions with X and Y Tiles Examples 1, 2, 3 Adding Expressions with X-Squared Tiles Examples 1, 2, 3 Adding Expressions without Tiles Examples 1, 2 Practice Questions with Tiles Practice Questions without Tiles</p>

	<p>Topic 6. Subtracting Expressions Our Problem Subtracting Expressions with X and Y Tiles Concept Examples 1, 2 Subtracting Expressions with X-Squared Tiles Examples 1, 2 Subtracting Expressions without Tiles Practice Questions with Tiles</p>
<p>–multiply a polynomial by a monomial involving the same variable [e.g., $2x(x+4)$, $2x^2(3x^2-2x+1)$], using a variety of tools (e.g., algebra tiles, diagrams, computer algebra systems, paper and pencil);</p>	<p>MAT+ Understanding Algebra Topic 7. Multiplying Expressions Recall Tile Concepts Multiplying Monomials Like Terms With Tiles Without Tiles Multiplying Monomials and Polynomials With Tiles... Examples 1, 2, 3, 4 Without Tiles</p>
<p>–expand and simplify polynomial expressions involving one variable [e.g., $2x(4x+1) - 3x(x+2)$], using a variety of tools (e.g., algebra tiles, computer algebra systems, paper and pencil);</p>	<p>MAT+ Understanding Algebra Topic 8. Factoring Expressions Our Problem Common Factoring With Tiles Examples 1, 2 – Methods 1, 2 Without Tiles GCF Examples 1, 2 Factoring Trinomials With Tiles - Examples 1, 2 The Pattern Without Tiles – Examples 1, 2, 3, 4</p>

Linear Relation

Specific Expectations

Using Data Management to Investigate Relationships

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–interpret the meanings of points on scatter plots or graphs that represent linear relations, including scatter plots or graphs in more than one quadrant [e.g., on a scatter plot of height versus age, interpret the point (13,150) as representing a student who is 13 years old and 150 cm tall; identify points on the graph that represent students who are taller and younger than this student] (Sample problem: Given a graph that represents the relationship of the Celsius scale and the Fahrenheit scale, determine the Celsius equivalent of -5°F.);</p> <p>–pose problems, identify variables, and formulate hypotheses associated with relationships between two variables (Sample problem: Does the rebound height of a ball depend on the height from which it was dropped?);</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 2. Statistics Scatter Plot Example 1... The T-Shirt Tailor Example 2... Matching</p> <p>Topic 6. Linear Relations In This Topic What is a Linear Relation? Graphs of Linear Relations Concept Examples 1, 2, 3, 4, 5, 6 The Taxi Example – Setup Equation – Graph Equation The Elastic Example – Setup Equation – Graph Equation Lightning Example – Setup Equation – Graph Equation Line of Best Fit Examples 1, 2 Practice Questions</p>
<p>–design and carry out an investigation or experiment involving relationships between two variables, including the collection and organization of data, using appropriate methods, equipment, and/or technology (e.g., surveying; using measuring tools, scientific probes, the Internet) and techniques (e.g., making tables, drawing graphs) (Sample problem: Design and perform an experiment to measure and record the temperature of ice water in a plastic cup and ice water in a thermal mug over a 30 min period, for the purpose comparison. What factors might affect the outcome of this experiment? How could you design the experiment to account for them?);</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 2. Statistics Statistics... What is it? Collecting Data Throw a Die Throw 2 Dice Voting Primary Data - Gathering Methods Secondary Data - Gathering Methods</p>
<p>–describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain any differences between the inferences and the hypotheses (e.g., describe the trend observed in the data. Does a relationship seem to exist? Of what sort? Is the outcome consistent with your hypothesis? Identify and explain any outlying pieces of data. Suggest a formula that relates the variables. How might you vary this experiment to examine other relationships?) (Sample problem: Hypothesize the effect of the length of a pendulum on the time required for the pendulum to make five full swings. Use data to make an inference. Compare</p>	

the inference with the hypothesis. Are there other relationships you might investigate involving pendulums?).

Understanding Characteristics of Linear Relations

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–construct tables of values, graphs, and equations, using a variety of tools (e.g., graphing calculators, spreadsheets, graphing software, paper and pencil), to represent linear relations derived from descriptions of realistic situations (Sample problem: Construct a table of values, a graph, and an equation to represent a monthly cell phone plan that costs \$25, plus \$0.10 per minute of airtime.);</p> <p>–construct tables of values, scatter plots, and lines or curves of best fit as appropriate, using a variety of tools (e.g., spreadsheets, graphing software, graphing calculators, paper and pencil), for linearly related and non-linearly related data collected from a variety of sources (e.g., experiments, electronic secondary sources, patterning with concrete materials) (Sample problem: Collect data, using concrete materials or dynamic geometry software, and construct a table of values, a scatter plot, and a line or curve of best fit to represent the following relationships: the volume and the height for a square-based prism with a fixed base; the volume and the side length of the base for a square-based prism with a fixed height);</p>	<p>MAT+ Understanding Graphing</p> <p>Topic 2. Statistics Presenting Data Stem-and-Leaf Diagram Example 1... Ages of Fans Example 2... Heights of Students Bar Graph Example 1... Energy Example 2... Lengths of Rivers Histogram Example 1... Heights of Students Example 2... Roll a Die Line Graph Example 1... Life Expectancy Example 2... Software Profits Circle or Pie Graphs Example 1... Radio Station Example 2... Health Survey</p> <p>Topic 5. Relations, Equations, and Functions Relations What is a Relation? Domain and Range Example 1 – Triangles Example 2 – Tiles, Part 1 Example 3 – Tiles, Part 2 Example 4 – Running Example 5 – Hit the Ball Patterns to Words to Equations Examples 1, 2, 3, 4 Practice Questions</p>

<p>–identify, through investigation, some properties of linear relations (i.e., numerically, the first difference is a constant, which represents a constant rate of change; graphically, a straight line represents the relation), and apply these properties to determine whether a relation is linear or non-linear;</p> <p>–determine the equation of a line of best fit for a scatter plot, using an informal process (e.g., using a movable line in dynamic statistical software; using a process of trial and error on a graphing calculator; determining the equation of the line joining two carefully chosen points on the scatter plot).</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 6. Linear Relations The Taxi Example – Setup Equation – Graph Equation The Elastic Example – Setup Equation – Graph Equation Lightning Example – Setup Equation – Graph Equation Line of Best Fit Examples 1, 2 Practice Questions</p>
<p>–compare the properties of direct variation and partial variation in applications, and identify the initial value (e.g., for a relation described in words, or represented as a graph or an equation) (Sample problem: Yoga costs \$20 for registration, plus \$8 per class. Tai chi costs \$12 per class. Which situation represents a direct variation, and which represents a partial variation? For each relation, what is the initial value? Explain your answers.);</p>	

Connecting Various Representations of Linear Relations

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–determine values of a linear relation by using a table of values, by using the equation of the relation, and by interpolating or extrapolating from the graph of the relation (Sample problem: The equation $H=300 - 60t$ represents the height of a hot air balloon that is initially at 300 m and is descending at a constant rate of 60 m/min. Determine algebraically and graphically how long the balloon will take to reach a height of 160 m.);</p> <p>–describe the effects on a linear graph and make the corresponding changes to the linear equation when the conditions of the situation they represent are varied (e.g., given a partial variation graph and an equation representing the cost of producing a yearbook, describe how the graph changes if the cost per book is altered, describe how the graph changes if the fixed costs are altered, and make the corresponding changes to the equation).</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 6. Linear Relations In This Topic What is a Linear Relation? Graphs of Linear Relations Concept Examples 1, 2, 3, 4, 5, 6 The Taxi Example – Setup Equation – Graph Equation The Elastic Example – Setup Equation – Graph Equation Lightning Example – Setup Equation – Graph Equation Line of Best Fit Examples 1, 2 Practice Questions</p>
<p>–describe a situation that would explain the events illustrated by a given graph of a relationship between two variables (Sample problem: The walk of an individual is illustrated in the given graph, produced by a motion detector and a graphing calculator. Describe the walk [e.g., the initial distance from the motion detector, the rate of walk].);</p>	
<p>–determine other representations of a linear relation, given one representation (e.g., given a numeric model, determine a graphical model and an algebraic model; given a graph, determine some points on the graph and determine an algebraic model);</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 8. Equation of a Straight Line Graph $y = mx + b$ Examples 1, 2, 3, 4 Patterns to Summary Examples 5, 6, 7</p>

Analytic Geometry
Specific Expectations

Investigating the Relationship Between the Equation of a Relation and the Shape of Its Graph

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–determine, through investigation, the characteristics that distinguish the equation of a straight line from the equations of non- linear relations (e.g., use a graphing calculator or graphing software to graph a variety of linear and non-linear relations from their equations; classify the relations according to the shapes of their graphs; connect an equation of degree one to a linear relation)</p> <p>–identify, through investigation, the equation of a line in any of the forms $y=mx+ b, Ax+ By+ C=0, x=a, y=b;$</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 8. Equation of a Straight Line Graph $y = mx + b$ Examples 1, 2, 3, 4 Patterns to Summary Examples 5, 6, 7</p>
<p>–express the equation of a line in the form $y=mx+ b,$ given the form $Ax+ By+ C=0.$</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 8. Equation of a Straight Line Slope y - intercept Equation Concept Examples 1, 2, 3, 4</p>

Investigating the Properties of Slope

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–determine, through investigation, various formulas for the slope of a line segment or to determine the slope of a line segment or a line; (e.g. $m = \text{rise/run}, m = \text{the change in } y/ \text{the change in } x, \text{ etc. })$ and use the formulas to determine the slope of a line segment or line;</p> <p>–identify, through investigation with technology, the geometric significance of m and b in the equation $y=mx + b;$</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 8. Equation of a Straight Line Slope y - intercept Equation Concept Examples 1, 2, 3, 4 Parallel and Perpendicular Lines Concepts 1, 2 Examples 1, 2, 3, 4 Slope – Point Form of the Equation Example 1: Solutions 1, 2 Example 2: Solutions 1, 2, 3, 4 Special Cases Example 1 – Zero Slope Example 2 – Undefined Example to Summarize</p>
<p>–determine, through investigation, connections among the representations of a constant rate of change of a linear relation (e.g., the cost of producing a book of photographs is \$50, plus \$5 per book, so an equation is $C=50 + 5p;$ a table of</p>	

<p>values provides the first difference of 5; the rate of change has a value of 5, which is also the slope of the corresponding line; and 5 is the coefficient of the independent variable, p, in this equation);</p>	
<p>–identify, through investigation, properties of the slopes of lines and line segments (e.g., direction, positive or negative rate of change, steepness, parallelism, perpendicularity), using graphing technology to facilitate investigations, where appropriate.</p>	<p>MAT+ <u>Understanding Graphing</u> Topic 7. Slope of a Line In This Topic Introduction to Slope Slope when Driving A Ski Slope Slope of Roof Slope: Order, Steepness Factor, Definition Introductory Examples Examples 1, 2, 3, 4 Formula Parallel Lines Examples 1, 2, 3 Perpendicular Lines Examples 1, 2, 3 Positive and Negative Slopes Examples 1, 2, 3, 4 Pattern Special Slopes Examples 1, 2, 3, 4 Pattern Sketch Line Given Point and Slope Examples 1, 2, 3, 4 Slopes of Parallel Lines Examples 1, 2, 3 Slopes of Perpendicular Lines Examples 1, 2, 3 Pattern</p>

Using the Properties of Linear Relations to Solve Problems

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–graph lines by hand, using a variety of techniques (e.g., graph $y = \frac{2}{3}x - 4$ using the y-intercept and slope; graph $2x + 3y = 6$ using the x- and y-intercepts);</p> <p>–determine the equation of a line from information about the line (e.g., the slope and y-intercept; the slope and a point; two points) (Sample problem: Compare the equations of the lines parallel to and perpendicular to $y = 2x - 4$, and with the same x-intercept as $3x - 4y = 12$. Verify using dynamic geometry software.);</p> <p>–describe the meaning of the slope and y-intercept for a linear relation arising from a realistic situation (e.g., the cost to rent the community gym is \$40 per evening, plus \$2 per person for equipment rental; the vertical intercept, 40, represents the \$40 cost of renting the gym; the value of the rate of change, 2, represents the \$2 cost per person), and describe a situation that could be modelled by a given linear equation (e.g., the linear equation $M = 50 + 6d$ could model the mass of a shipping package, including 50 g for the packaging material, plus 6 g per flyer added to the package);</p>	<p>MAT+ Understanding Graphing Topic 8. Equation of a Straight Line Slope – Point Form of the Equation Example 1: Solutions 1, 2 Example 2: Solutions 1, 2, 3, 4 Special Cases Example 1 – Zero Slope Example 2 – Undefined Example to Summarize Word Problems/ Applications The Taxi Cases 1, 2 Find Equation Graph Equation Interpret Equation Summary The Walker Basketball Food</p>
<p>–identify and explain any restrictions on the variables in a linear relation arising from a realistic situation (e.g., in the relation $C = 50 + 25n$, C is the cost of holding a party in a hall and n is the number of guests; n is restricted to whole numbers of 100 or less, because of the size of the hall, and C is consequently restricted to \$50 to \$2550);</p>	
<p>–determine graphically the point of intersection of two linear relations, and interpret the intersection point in the context of an application (Sample problem: A video rental company has two monthly plans. Plan A charges a flat fee of \$30 for unlimited rentals; Plan B charges \$9, plus \$3 per video. Use a graphical model to determine the conditions under which you should choose Plan A or Plan B.).</p>	<p>MAT+ Understanding Graphing Topic 8. Equation of a Straight Line Point of Intersection of Two Lines Examples 1, 2</p>

Measurement and Geometry

Specific Expectations

Investigating the Optimal Values of Measurements

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–determine the maximum area of a rectangle with a given perimeter by constructing a variety of rectangles, using a variety of tools (e.g., geoboards, graph paper, toothpicks, a pre-made dynamic geometry sketch),and by examining various values of the area as the side lengths change and the perimeter remains constant;</p> <p>–determine the minimum perimeter of a rectangle with a given area by constructing a variety of rectangles, using a variety of tools (e.g.,geoboards, graph paper, a pre- made dynamic geometry sketch),and by examining various values of the side lengths and the perimeter as the area stays constant;</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 2. Perimeter and Area of Polygons Relationship – Area and Perimeter The Information The Graph Given Area and Perimeter – Create Shape Example 1 Example 2 Example 3 Example 4 Problems Section Length of Fence Area of a Wall The Tablecloth</p>
<p>–identify, through investigation with a variety of tools (e.g. concrete materials computer software),the effect of varying the dimensions on the surface area [or volume] of square-based prisms and cylinders, given a fixed volume [or surface area];</p> <p>–explain the significance of optimal area, surface area, or volume in various applications (e.g., the minimum amount of packaging material; the relationship between surface area and heat loss);</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 4. Solids...Volume and Surface Area Surface Area of a Solid The Concept Surface Area of a Pyramid Surface Area of a Cylinder Surface Area of a Sphere Volume of a Solid The Concept Volume of a Prism: Examples 1, 2 Volume of a Cylinder Volume of a Pyramid Volume of a Cone Volume of a Sphere Summary</p>
<p>–pose and solve problems involving maximization and minimization of measurements of geometric shapes and figures (e.g., determine the dimensions of the rectangular field with the maximum area that can be enclosed by a fixed amount of fencing, if the fencing is required on only three sides) (Sample problem: Determine the dimensions of a square-based, open- topped prism with a volume of 24 cm^3 and with the minimum surface area.).</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 9. Ratios for Areas and Volumes In This Topic Ratios for Areas and Volumes Introduction Area Ratios Volume Ratios Practice Questions</p>

Solving Problems Involving Perimeter, Area, Surface Area, and Volume

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–relate the geometric representation of the Pythagorean theorem and the algebraic representation $a^2 + b^2 = c^2$;</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 6. Pythagorean Theorem In This Topic The Right Triangle Math or Magic? Introduction Omar’s Rope Trick #1, #2 Our Rope Trick Squares on a Grid Examples 1, 2, 3, 4 Squares on the Sides of a Right Triangle Triangles 1, 2, 3 The Pythagorean Theorem The Pattern In General Theorem</p>
<p>–solve problems using the Pythagorean theorem, as required in applications (e.g., calculate the height of a cone, given the radius and the slant height, in order to determine the volume of the cone);</p>	<p>MAT+ <u>Understanding Exponents</u> Topic 6. Pythagorean Theorem Example Questions Example 1... Pole Example Example 2... Tower Example Example 3... Walking Example Example 4... Lake Example Example 5... Geometric Example Practice Questions</p>
<p>–solve problems involving the areas and perimeters of composite two-dimensional shapes (i.e., combinations of rectangles, triangles, parallelograms, trapezoids, and circles) (Sample problem: A new park is in the shape of an isosceles trapezoid with a square attached to the shortest side. The side lengths of the trapezoidal section are 200 m, 500 m, 500 m, and 800 m, and the side length of the square section is 200 m. If the park is to be fully fenced and sodded, how much fencing and sod are required?);</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 2. Perimeter and Area of Polygons Relationship – Area and Perimeter The Information The Graph Given Area and Perimeter – Create Shape Example 1 Example 2 Example 3 Example 4 Problems Section Length of Fence Area of a Wall The Tablecloth</p>

<p>–develop, through investigation (e.g., using concrete materials),the formulas for the volume of a pyramid, a cone, and a sphere (e.g., use three-dimensional figures to show that the volume of a pyramid [or cone] is the volume of a prism [or cylinder] with the same base and height, and therefore that $V_{\text{pyramid}} = V_{\text{prism}}/3$, or $V_{\text{pyramid}} = (\text{area of base})(\text{height})/3$;</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 4. Solids...Volume and Surface Area Volume of a Solid The Concept Volume of a Prism: Examples 1, 2 Volume of a Cylinder Volume of a Pyramid Volume of a Cone Volume of a Sphere</p>
<p>–determine, through investigation, the relationship for calculating the surface area of a pyramid (e.g., use the net of a square- based pyramid to determine that the surface area is the area of the square base plus the areas of the four congruent triangles);</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 4. Solids...Volume and Surface Area Surface Area of a Solid The Concept Surface Area of a Pyramid Surface Area of a Cylinder Surface Area of a Sphere</p>
<p>–solve problems involving the surface areas and volumes of prisms, pyramids, cylinders, cones, and spheres, including composite figures (Sample problem: Break-bit Cereal is sold in a single-serving size,in a box in the shape of a rectangular prism of dimensions 5 cm by 4 cm by 10 cm. The manufacturer also sells the cereal in a larger size, in a box with dimensions double those of the smaller box. Compare the surface areas and the volumes of the two boxes, and explain the implications of your answers.).</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 4. Solids...Volume and Surface Area Summary Practice Questions</p>

Investigating and Applying Geometric Relationships

By the end of this course, students will:

Expectations	Understanding Math PLUS lessons
<p>–determine, through investigation using a variety of tools (e.g., dynamic geometry software, concrete materials), and describe the properties and relationships of the interior and exterior angles of triangles, quadrilaterals, and other polygons, and apply the results to problems involving the angles of polygons (Sample problem: With the assistance of dynamic geometry software, determine the relationship between the sum of the interior angles of a polygon and the number of sides. Use your conclusion to determine the sum of the interior angles of a 20-sided polygon.);</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 6. Angles and Polygons In This Topic Parallel Lines Example with Parallel Lines Examples 1, 2 Angles in Triangles Exploration An Explanation Exterior Angles – Example Angles in Polygons Methods 1, 2 Exterior Angles in a Polygon</p>
<p>–determine, through investigation using a variety of tools (e.g., dynamic geometry software, paper folding), and describe some properties of polygons (e.g., the figure that results from joining the midpoints of the sides of a quadrilateral is a parallelogram; the diagonals of a rectangle bisect each other; the line segment joining the midpoints of two sides of a triangle is half the length of the third side), and apply the results in problem solving (e.g., given the width of the base of an A-frame tree house, determine the length of a horizontal support beam that is attached half way up the sloping sides);</p>	<p>MAT+ <u>Understanding Measurement and Geometry</u> Topic 8. Projective Geometry An Introduction Toothpicks on Isometric Dot Paper Toothpick to Cube The Views Using Isometric Grid Paper Orthographic Projections: Introduction The Cube Tool Introduction Tutorial Play with Tool Given Solid – Build it Examples 1, 2, 3, 4, 5, 6 Given Views – Build it Examples 1, 2, 3, 4, 5, 6</p>
<p>–pose questions about geometric relationships, investigate them, and present their findings, using a variety of mathematical forms (e.g., written explanations, diagrams, dynamic sketches, formulas, tables) (Sample problem: How many diagonals can be drawn from one vertex of a 20-sided polygon? How can I find out without counting them?);</p>	
<p>–illustrate a statement about a geometric property by demonstrating the statement with multiple examples, or deny the statement on the basis of a counter-example, with or without the use of dynamic geometry software (Sample problem: Confirm or deny the following statement: If a quadrilateral has perpendicular diagonals, then it is a square.).</p>	

