

Knowledge of Algebra, Patterns, and Functions

Content Standard 1.0: Students will algebraically represent, model, analyze, and solve mathematical and real-world problems involving patterns and functional relationships.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8																										
<p>1.4.1</p> <p>.1 generalize a pattern by stating a rule.</p> <p>1.4.1.2 complete a function (one-step) table using a given rule.</p> <p>Clarifying Examples: Given dot paper, the student draws squares of increasing size and completes a table that shows the number of dots in the perimeter and in the center of each square. The student states a rule based on the table.</p> <p>Clarifying Examples: The student completes tables and generalizes a rule for a situation such as:</p> <p>Marie jogs 3 miles per day.</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th># of days</th> <th># of miles</th> </tr> </thead> <tbody> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> </tbody> </table>	# of days	# of miles	1	3	2		3		4		5		<p>1.5.1</p> <p>.1 recognize, describe, and extend numerical and geometric patterns and functional relationships.</p> <p>.2 analyze patterns and generalize rules illustrated in patterns.</p> <p>.3 write the rule for a given function (one-step) table.</p> <p>Clarifying Examples:</p> <p>The student describes and extends patterns such as those of triangular numbers, perfect square numbers, and those formed by powers of 10.</p> <p>The student completes the pattern of $1/3, 3/9, 9/27 \dots$</p>	<p>1.5.1 <i>recognize, describe, and extend patterns and functional relationships.</i></p> <ul style="list-style-type: none"> • <i>analyze patterns and generalize rules illustrated in patterns.</i> (MLO 1.1) • <i>function (one-step) table.</i> (MLO write the rule for a given 1.2) 	<p>1.6.1</p> <p>.1 use and create tables to extend a pattern and produce a rule.</p> <p>.2 identify and extend simple arithmetic or geometric sequences.</p> <p>.3 identify and use patterning as a strategy to solve problems.</p> <p>Clarifying Examples: Given a situation where the front steps of a porch are being built using cinder blocks, with the first step requiring one block, the second, two blocks, and the third, three blocks, the student determines the number of blocks needed for eight steps.</p> <p>Given the length of the side of a square, the student makes a table that shows the area of that square and other squares that are created when the side of the square is</p>	<p>1.7.1</p> <p>.1 describe, extend, analyze, and represent a wide variety of patterns to investigate functional relationships and solve problems.</p> <p>.2 determine whether functions are linear or nonlinear when given graphic examples.</p> <p>.3 describe and apply the recursive relationship of simple arithmetic and geometric sequences verbally, in a table, or a graph.</p> <p>Clarifying Example: Given the graphs of various functions, the student identifies those that are linear and those that are not.</p>	<p>1.8.1</p> <p>.1 use written, oral, and symbolic language to identify and describe patterns, sequences, and functions.</p> <p>.2 determine whether functions are discrete or continuous.</p> <p>Clarifying Examples: Given the following , the student completes Row 6 and writes the entries for row 7.</p> <table border="1" style="margin-left: 20px;"> <tbody> <tr><td>Row 1</td><td>1</td></tr> <tr><td>Row 2</td><td>1 1</td></tr> <tr><td>Row 3</td><td>1 2 1</td></tr> <tr><td>Row 4</td><td>1 3 3 1</td></tr> <tr><td>Row 5</td><td>1 4 6 4 1</td></tr> <tr><td>Row 6</td><td>1 5 _ _ 5 1</td></tr> <tr><td>Row 7</td><td></td></tr> </tbody> </table> <p>Given the above pattern, the student finds the sum of each row and determines a rule that describes those sums using written, oral, and symbolic language.</p> <p>Given a table of values that shows the costs of pizza that varies according to the number of toppings, the student describes the relationship between the cost and the number of toppings.</p>	Row 1	1	Row 2	1 1	Row 3	1 2 1	Row 4	1 3 3 1	Row 5	1 4 6 4 1	Row 6	1 5 _ _ 5 1	Row 7		<p>1.8.1a <i>recognize, describe, and extend patterns and functional relationships.</i></p> <ul style="list-style-type: none"> • <i>identify and extend a simple arithmetic or geometric sequence.</i> (MLO 1.1) • <i>describe the recursive relationship of simple arithmetic and geometric sequences verbally, in a table, or a graph.</i> (MLO 1.2) <p>1.8.1b <i>produce rules that explain how a change in one variable in a relationship affects the other variable.</i> (MLO 1.3)</p> <p>1.8.1c <i>determine whether functions are discrete or continuous.</i></p> <p>1.8.1d <i>determine whether functions are</i></p>
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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>1.4.2 .1 write numeric expressions in equivalent forms using the commutative and associative properties. Clarifying Examples: Given $7 + 3$, the student uses the commutative property to write an equal expression.</p>	<p>1.5.2 .1 write numeric expressions in equivalent forms. .2 use grouping symbols to apply the associative property and evaluate expressions. Clarifying Examples: Given a problem such as $32 \times 25 \times 4$, the student changes the order and/or uses grouping symbols to make a problem easier to solve: for example, $32 \times (25 + 4)$. Given $7 \times 3 + 2$, the student lists equivalent expressions such as $21 + 2$.</p>	<p>1.5.2a write numeric expressions in equivalent forms. (MLO 1.3) 1.5.2b use grouping symbols to evaluate expressions. (MLO 1.4)</p>		<p>1.7.2 .1 simplify expressions, using the order of operations, on expressions involving the four operations, exponents, and parentheses. .2 simplify expressions by applying the commutative, associative, and distributive properties and justify.</p>	<p>1.8.2 .1 combine like terms in variable expressions.</p>	<p>1.8.2 <i>simplify expressions by combining like terms and applying order of operations.</i></p> <ul style="list-style-type: none"> • <i>use mathematical properties to justify the steps in simplifying algebraic expressions.</i>

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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>1.4.3</p> <p>.1 use variables in open sentences.</p> <p>.2 solve for the unknown in an equation with one operation using whole numbers.</p>	<p>1.5.3</p> <p>.1 write and evaluate simple algebraic expressions in one variable using substitution.</p> <p>Clarifying Example: Given $n = 7$, the student evaluates the following: $6n$; $41 - n$; $n/2$.</p>	<p>1.5.3 solve for the unknown in an equation (one unknown, one operation) with whole number coefficients. (MLO 1.5)</p> <ul style="list-style-type: none"> <i>writes simple algebraic expressions in one unknown and evaluate by substitution.</i> 	<p>1.6.3</p> <p>.1 solve one-step linear equations using whole numbers, decimals, and fractions.</p> <p>.2 evaluate simple algebraic expressions and simple formulas, including area, perimeter, and distance.</p> <p>.3 describe real-world situations represented by simple algebraic expressions or equations.</p> <p>.4 recognize and use the equality properties to solve for an unknown value in an equation.</p> <p>Clarifying Example: Given a one-step equation like $6n = 42$, the student solves it using inverse operations.</p>	<p>1.7.3</p> <p>.1 use variables and appropriate operations to write expressions.</p> <p>.2 model, identify, and solve 2-step linear equations and inequalities using concrete and informal methods.</p> <p>.3 solve one- and two-step linear equations and inequalities in one variable.</p> <p>.4 apply formulas and evaluate algebraic expressions when given variable values.</p> <p>Clarifying Example: Given that the formula for converting a temperature from Celsius degrees to Fahrenheit degrees is $F = 1.8C + 32$, the student finds the Celsius equivalent of 0° F.</p>	<p>1.8.3</p> <p>.1 solve linear equations and inequalities in one variable using mathematical properties.</p> <p>.2 solve problems involving direct and inverse variation.</p> <p>.3 determine the rate of change (slope) of a linear function when represented graphically, numerically, or algebraically.</p> <p>Clarifying Example: Given the formula $C = 2.5y$ where C is the circumference of the tree trunk in centimeters and y is the age of the tree in years and that the cross-section of the tree trunk is a circle. Find the radius of the trunk of a 20-year-old tree.</p>	<p>1.8.3a evaluate algebraic expressions and apply formulas. (MLO 1.4)</p> <p>1.8.3b solve linear equations and inequalities in one variable <i>using mathematical properties</i>. (MLO 1.5)</p> <p>1.8.3c <i>describe a real-world situation represented by an algebraic expression or equation..</i></p> <p>1.8.3d <i>solve problems involving direct and inverse variation.</i></p> <p>1.8.3e <i>determine the slope of a linear function represented graphically, numerically, or algebraically.</i></p>

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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
	<p>1.5.4 .1 represent relationships using graphs and tables. Clarifying Example: Given data showing student armspans and heights, organize and graph class measurements.</p>	<p>1.5.4 <i>represent relationships using graphs and tables.</i></p>	<p>1.6.4 .1 match a graphic representation of a situation to a written description. .2 represent and interpret a quantitative relationship in a table or graph. Clarifying Example: Given a particular phone plan has a \$15 base rate and \$0.12 per minute for time in use, the student creates a table and graph and relates each to the calling plan.</p>	<p>1.7.4 .1 use coordinate graphs to interpret patterns and relationships. .2 represent and interpret quantitative relationships in a table or graph using rational numbers.</p>	<p>1.8.4 .1 represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in the situation represented by the graph.</p>	<p>1.8.4 <i>represent and interpret quantitative relationships in a table or graph.</i></p>
	<p>1.5.5 .1 identify and graph points using ordered pairs in the first quadrant of the coordinate plane.</p>	<p>1.5.5 <i>plot points on a coordinate plane.</i></p>	<p>1.6.5 .1 graph ordered pairs in the four quadrants of a coordinate plane. .2 generate and graph a set of ordered pairs using a given rule. Clarifying Example: Given $y = 2x$, the student creates a table and graphs the ordered pairs.</p>	<p>1.7.5 .1 solve inequalities and graph the solutions on a number line.</p>	<p>1.8.5 .1 verify that points lie on a line, given an equation of the line. ✓.2 graph linear equations on a coordinate plane.</p>	<p>1.8.5a <i>graph ordered pairs in the four quadrants of a coordinate plane.</i></p> <ul style="list-style-type: none"> graph linear equations on a coordinate plane. (MLO 1.6) <p>1.8.5b <i>solve inequalities and graph the solutions on a number line.</i></p>

Knowledge of Geometry

Content Standard 2.0: Students will apply the properties of one-, two-, and three-dimensional geometric figures to describe, reason, and solve problems about shape, size, position, and motion of objects.

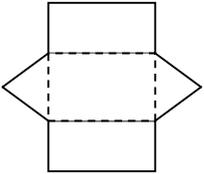
By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>2.4.1.</p> <p>.1 use manipulatives, pictorial representations, and appropriate vocabulary (sides, angles, edges, vertices, and faces) to identify and describe the attributes of solid figures.</p> <p>.2 identify parallelism and perpendicularity of geometric figures and real-world objects.</p> <p>Clarifying Examples: Given clues to identify a shape.</p> <ul style="list-style-type: none"> • I am a solid with a square base, eight edges, and five vertices; or • I am a solid with six congruent sides. <p>The student identifies examples of intersecting, parallel, and perpendicular line segments and their midpoints in the real world. For example, in football, the 50-yard line intersects</p>	<p>2.5.1</p> <p>.1 identify, describe, compare, and classify two- and three-dimensional figures by relevant properties including the number and size of angles, the number of vertices, the number of edges, and the shapes of faces.</p> <p>.2 identify and draw circles and identify relationships among the radius, diameter, and circumference.</p> <p>Clarifying Examples: Compare and contrast a rectangular pyramid and a triangular prism using their geometric properties, including the number of faces, vertices, and edges of each.</p> <p>Develop a list of attributes of a pyramid that distinguishes it from other three-dimensional figures.</p>	<p>2.5.1 compare one-, two-, and three-dimensional figures to one another <i>and relate them to real-world objects.</i> (MLO 2.1)</p> <ul style="list-style-type: none"> • classify two- and three-dimensional figures by sides, angles, <i>edges</i>, vertices, and faces. (MLO 2.2) • identify parallelism and perpendicularity of geometric figures <i>and real-world objects</i>. (MLO 2.3) • identify and describe the attributes of solid figures. (MLO 2.6) 	<p>2.6.1</p> <p>.1 use a variety of triangles and quadrilaterals to draw conclusions about the sum of the measure of their interior angles.</p> <p>.2 identify and predict the effect of combining and dividing geometric shapes into other shapes.</p> <p>.3 identify or describe diagonal lines or line segments.</p> <p>Clarifying Examples: With geometric software, determine the sum of the angles in various polygons, including triangles and quadrilaterals.</p>	<p>2.7.1</p> <p>.1 identify parallel, perpendicular, intersecting, and skew lines and apply properties of parallelism and perpendicularity to problem situations.</p>	<p>2.8.1</p> <p>✓ .1 determine the sum of the measures of interior angles of polygons by partitioning into triangles.</p> <p>✓ .2 apply the properties of two- and three-dimensional figures to solve problems.</p> <p>Clarifying Example: Given 24 cubes, the student determines the number of different rectangular prisms that can be built and the largest and smallest possible surface area.</p>	<p>2.8.1 <i>apply properties of two- and three-dimensional figures to problem situations.</i></p> <ul style="list-style-type: none"> • <i>describe two- and three-dimensional geometric figures using number of sides, faces, vertices, diagonals, and sums of angles.</i> (MLO 2.1) • <i>identify parallel, perpendicular, intersecting, and</i> • <i>skew lines and apply properties of parallelism and perpendicularity to problem situations.</i>

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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>2.4.2</p> <p>.1 identify, classify, and sketch acute, right, and obtuse angles and relate them to real-world examples.</p> <p>Clarifying Example: Using a clock from the classroom wall, the student classifies the angles created by the hands of the clock at various times during the school day.</p>	<p>2.5.2</p> <p>.1 identify and label the vertex and rays of an angle.</p> <p>Clarifying Example: Given a drawing of a parallelogram that has no right angles, the student labels the figure and identifies acute and obtuse angles and vertices.</p>	<p>2.5.2 identify, classify, measure, and draw acute, right, and obtuse angles.(MLO 2.4)</p>	<p>2.6.2</p> <p>.1 determine missing angle measures using estimation and direct and indirect measurements.</p> <p>.2 measure angles in triangles.</p> <p>.3 define and identify angles as adjacent, complementary or supplementary.</p> <p>.4 classify triangles and quadrilaterals by sides and by angles.</p> <p>Clarifying Example: Given various triangles, the student estimates the number of degrees in a given angle and uses a protractor to check the measurement’s accuracy.</p>	<p>2.7.2</p> <p>.1 define and identify interior, exterior, alternate exterior, alternate interior, and corresponding angles that are formed by two lines cut by a transversal.</p> <p>.2 identify and apply congruent and supplementary relationships of angles formed by cutting parallel lines by a transversal.</p> <p>.3 use properties of vertical, complementary, and supplementary angles to determine the measure of other angles.</p> <p>Clarifying Examples: Given parallel lines cut by a transversal and one angle measure, the student determines all missing angle measures.</p> <p>Given the measurements of two angles of a triangle, the student uses the fact that the angles of all triangles total 180° to find the third</p>	<p>2.8.2</p> <p>1 use the Pythagorean Theorem to solve problems by determining length of the missing side of a right triangle.</p> <p>.2 find measures of interior and exterior angles of a triangle.</p> <p>Clarifying Examples: Given that a tower that supports a telescope casts a shadow 40 meters long, and that the distance from the top of the tower to the end of the shadow is 50 meters, the student finds the height of the tower.</p>	<p>2.8.2a <i>use the properties of angles and triangles. classify triangles by sides and by angles.</i></p> <ul style="list-style-type: none"> • <i>determine missing angle measures.</i> • <i>determine angle measure using estimation, direct, and indirect measurements. (MLO 2.2)</i> • <i>use the Pythagorean Theorem to solve problems by determining the missing side of a right triangle. (MLO 2.3)</i> • <i>identify and determine missing angle measures for adjacent, vertical, complementary, and supplementary angles.</i> • <i>identify and</i>

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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>2.4.3</p> <p>.1 identify, draw, label, and describe points, lines, line segments, and rays.</p> <p>.2 draw circles, triangles, and quadrilaterals, given their dimensions.</p> <p>Clarifying Example: Given a familiar software program or geometric tools, the student constructs a parallelogram with sides of 5 cm and 7 cm.</p>	<p>2.5.3</p> <p>.1 draw geometric figures using tools and technology.</p>	<p>2.5.3 <i>construct or draw geometric figures using tools and technology.</i></p> <ul style="list-style-type: none"> <i>draw, label, describe, and identify: points, lines, line segments, and rays.</i> draw circles, squares, triangles, and rectangles, given their dimensions. (MLO 2.5) 	<p>2.6.3</p> <p>.1 draw and analyze geometric figures on a coordinate plane.</p> <p>.2 draw circles, angles, triangles, and quadrilaterals based on given measurements using a variety of tools and methods.</p> <p>.3 make a model of a three-dimensional figure from a two-dimensional drawing.</p> <p>.4 make a two-dimensional drawing of a three-dimensional figure.</p> <p>Clarifying Example: Given patty paper, the student constructs angle and segment bisectors.</p> <p>Given the following figure, the student describes the shape that would be formed if it were folded along the dotted lines to form a solid figure.</p> 	<p>2.7.3</p> <p>.1 use a compass and straightedge to construct basic elements of geometric figures including angles, segments, bisectors, and perpendicular lines.</p>	<p>2.8.3</p> <p>✓.1 use a compass and straightedge to construct triangles and rectangles.</p> <p>Clarifying Example: Given a straightedge and a compass or geometry software, the student constructs a rectangle by drawing parallel and perpendicular lines.</p>	<p>2.8.3 <i>construct or draw geometric figures using tools and technology.</i></p> <ul style="list-style-type: none"> use a compass and straightedge to construct angles, rectangles, circles, and other geometric figures. (MLO 2.4) <i>draw and analyze geometric figures on a coordinate plane.</i>

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Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>2.4.4</p> <p>.1 identify and describe transformations: translations (slides), reflections (flips), and rotations (turns).</p> <p>Clarifying Examples: Use graph paper to demonstrate geometric transformations.</p> <p>Given a piece of paper and a triangle, the student identifies the transformations that allow the triangle to tessellate.</p>	<p>2.5.4</p> <p>.1 identify transformations in a tessellation.</p>	<p>2.5.4 identify transformations: translations, reflections, and rotations. (MLO 2.7)</p>	<p>2.6.4</p> <p>.1 locate, give coordinates of, and graph plane figures that are the results of reflections and translations in all quadrants of the coordinate plane.</p> <p>.2 locate, give the coordinates of, and graph plane figures that are the results of rotations (multiples of 90 degrees).</p> <p>Clarifying Example: Given a figure ABCD with the following points—A (-4, -2); B (-2, 2); C (1, 2); and D (5, -2)—the student graphs the transformation when the figure is moved six units</p>	<p>2.7.4</p> <p>.1 identify, describe the effect, and perform combinations of transformations on figures in the coordinate plane.</p>	<p>2.8.4</p> <p>✓.1 graph plane figures that are similar to a given figure (dilations).</p>	<p>2.8.4 draw and describe the results of translations, reflections, rotations, dilations, and combinations of transformations. (MLO 2.5)</p>
			<p>2.6.5</p> <p>.1 identify congruent and similar figures.</p>	<p>2.7.5</p> <p>.1 name corresponding parts of congruent and similar figures</p> <p>.2 define and apply properties of congruent figures.</p> <p>.3 define and apply properties of similar figures.</p> <p>Clarifying Example: Given two similar figures, the measurements of one of the figures, and the ratio between the measurements of the two figures, find the</p>	<p>2.8.5</p> <p>✓.1 apply the properties of equality and proportionality to solve problems involving congruent and similar figures.</p>	<p>2.8.5 apply properties of congruence and similarity to solve problems. (MLO 2.6)</p>

Knowledge of Measurement

Content Standard 3.0: Students will identify attributes, units, and systems of measurements and apply a variety of techniques, formulas, tools, and technology for determining measurements.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>3.4.1 .1 identify the appropriate measurable attribute to solve a problem.</p>	<p>3.5.1 .1 identify the appropriate measurable attribute to solve a problem. Clarifying Example: Given a real-world situation involving wallpaper or paint, the student describes what kind of measurement information is needed in order to buy the correct amount.</p>	<p>3.5.1 <i>identify the appropriate measurable attribute to solve a problem.</i></p>				

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<p>3.4.2 .1 use standard units (yards, meters, and other units) to measure objects.</p>	<p>3.5.2 .1 use protractors to measure angles. .2 select and use appropriate tool and units to measure objects.</p>	<p>3.5.2a use protractors to measure <i>angles</i>. (MLO 2.8) 3.5.2.b use standard units (yards, meters, degrees, <i>and other units</i>) to measure <i>objects</i>. (MLO 2.9)</p>	<p>3.6.2 .1 select tools and units to measure accurately in given situations. .2 compare, convert, and estimate units of measure of length, time, weight, mass, capacity and volume within the same measurement system. .3 compare relative sizes of both customary and metric units.</p>	<p>3.7.2 .1 select tools and units to measure accurately and determine the degree of precision. .2 demonstrate an understanding of precision, error, and tolerance in measurement. Clarifying Example: Given that the edge of a cube is measured as 2 inches and that the margin of error is, at most, 3%, the student determines the possible variance in the volume of the cube.</p>	<p>3.8.2 ✓ .1 estimate conversions between units of the same measurement system to solve problems.</p>	<p>3.8.2 select tools and units to measure accurately <i>and determine the degree of precision</i>. (MLO 2.7)</p>

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<p>3.4.3</p> <p>.1 develop and use formulas to solve problems involving perimeters and areas of rectangles, including squares.</p> <p>.2 estimate and determine elapsed time.</p> <p>.3 identify equivalent periods of time, including relationships between and among seconds, minutes, hours, days, months, and years.</p> <p>.4 estimate and determine the volume of a rectangular prism using manipulatives.</p> <p>.5 determine and use equivalent units within the same system.</p> <p>Clarifying Examples: Given an area of 12 square units, the student finds all of the possible rectangles using grid paper and compares perimeters.</p>	<p>3.5.3</p> <p>.1 estimate and determine the perimeter of polygons.</p> <p>.2 estimate and determine the area of rectangles and estimate the area within any closed figure.</p> <p>.3 develop and use formulas to determine the volume of rectangular prisms.</p> <p>.4 differentiate between and use appropriate units of measure for two-and three-dimensional objects.</p> <p>Clarifying Example: Given physical or pictorial models, the student determines the number of cubic inches in one cubic foot.</p>	<p>3.5.3a estimate and determine the perimeter of polygons and real-world objects. (MLO 2.10)</p> <p>3.5.3b estimate and determine the area of rectangles and estimate the area within any closed figure. (MLO 2.11)</p> <p>3.5.3c estimate and determine the volume of a rectangular prism using manipulatives and formulas. (MLO 2.12)</p> <p>3.5.3d estimate and determine elapsed time. (MLO 2.13)</p> <p>3.5.3e <i>determine and use</i> equivalent units within the same system. (MLO 2.14)</p>	<p>3.6.3</p> <p>.1 develop and use formulas, using related formulas and models, to determine areas of polygons such as triangles, parallelograms, trapezoids, and circles.</p> <p>.2 determine the relationship between the diameter and the circumference of a circle.</p> <p>.3 estimate and compute the circumference and area of a circle using formulas and other methods.</p> <p>Clarifying Examples: Given that the diameter of a circular flowerbed is increased so that its area becomes four times as large, while it remains circular, the student identifies the change in the circumference.</p> <p>Given paper and pencil, the student models the fact that two identical triangles make a parallelogram with twice the area of each triangle.</p> <p>Given a paper model of a parallelogram, the</p>	<p>3.7.3</p> <p>.1 use models to find and derive a formula for surface area and volume of prisms and cylinders.</p> <p>.2 use formulas to find the surface area and volume of basic three-dimensional figures, including prisms and cylinders.</p> <p>.3 determine relationships between length and area and describe how a change in one affects the other.</p>	<p>3.8.3</p> <p>✓.1 determine relationships among length, area, and volume and describe how a change in one measure affects the others.</p> <p>Clarifying Example: Given cubes, the student demonstrates that when the lengths of all the dimensions of a solid are multiplied by a scale factor, the surface area is multiplied by the square of the scale factor, and the volume is multiplied by the cube of the scale factor.</p>	<p>3.8.3a estimate and determine the circumference and area of circles. (MLO 2.8)</p> <p>3.8.3b estimate and determine the area of figures by measuring, partitioning, and using formulas. (MLO 2.9)</p> <p>3.8.3c estimate and determine the volume and surface area of cylinders, triangular prisms, and other solids. (MLO 2.10)</p> <p>3.8.3d <i>determine relationships between length, area, and volume and describe how a change in one measure affects the others.</i></p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>3.4.4 .1 use perimeter, area, volume, and elapsed time to solve problems. Clarifying Example: Given a rectangle with an area of 30 sq. units and a length of 6 units, the student determines the width.</p>	<p>3.5.4 .1 use an organized approach, appropriate strategies, and technology as needed to solve multi-step problems involving length, weight, time, capacity, temperature, perimeter, area, and volume. Clarifying Examples: Given a classroom schedule of daily events such as music and morning recess, the student finds elapsed time between events during the day.</p>	<p>3.5.4 use perimeter, area, volume, and elapsed time to solve problems. (MLO 2.15)</p>		<p>3.7.4 .1 use ratios and proportions to create scale drawings and models. .2 write, solve, and apply proportions. .3 read and interpret drawings and models made to scale. Clarifying Examples: Given a variety of geometric figures, the student uses proportions to express relationships between corresponding parts of similar figures.</p>	<p>3.8.4 ✓ .1 use proportions, rates, and scale drawings to solve problems. Clarifying Example: When asked, the student converts 80 miles per hour into feet per second, or 20 ounces per minute into quarts per day.</p>	<p>3.8.4a use proportions, rates, and scale drawings to solve problems. (MLO 2.11)</p>

Knowledge of Statistics

Content Standard 4.0: Students will collect, organize, display, analyze, and interpret data to make decisions and predictions.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
		<p>4.5.1 <i>gather relevant data and compare data sets to answer a question.</i> (MLO 3.1)</p>	<p>4.6.1</p> <p>.1 identify and compare different ways of selecting a sample.</p> <p>.2 conduct and use the results of a simple statistical investigation to answer a question.</p> <p>.3 construct convincing arguments to support conclusions based on analysis of data and interpretation of graphs.</p> <p>Clarifying Example: Given a question such as “Should vegetarian dishes be added to the school lunch menu,” the student selects and justifies a particular sampling method such as convenience sampling, response to a survey, or random sampling.</p>		<p>4.8.1</p> <p>.1 design, conduct, analyze, and communicate the results of a statistical experiment.</p> <p>Clarifying Example: Given an opportunity, the student writes a survey question, gathers and analyzes the data, and communicates the findings.</p>	<p>4.8.1 <i>conduct and use the results of a statistical investigation to answer a question.</i> (MLO 3.1)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>4.4.2</p> <p>.1 organize and display data in a variety of ways, including line plots and line graphs.</p> <p>.2 discuss the appropriateness and inappropriateness of various data displays as they relate to the type of data and the purpose of the display.</p> <p>Clarifying Example: Given the data that results from recording the temperature every half-hour during the school day, the student selects an appropriate graphic display and explains</p>	<p>4.5.2</p> <p>.1 collect and organize data using a variety of graphic representations, including tables, stem and leaf plots, line plots, and line graphs.</p> <p>.2 select and defend the selection of particular graphic displays.</p> <p>Clarifying Example: Given 50 pennies, the student constructs a stem and leaf plot to display the years, grouped by decades, during which each coin was minted.</p>	<p>4.5.2 organize and display data using stem and leaf plots, line plots, and line graphs. (MLO 3.2)</p>	<p>4.6.2</p> <p>.1 interpret, organize, and display data, with and without technology, using various formats, including frequency tables and circle graphs.</p> <p>Clarifying Example: Given data that shows the number of students that ride the bus, ride with parents, or walk to school for two different classes, the student creates a circle graph for each class and compares the results.</p>	<p>4.7.2</p> <p>.1 organize and display data, with and without technology, using a variety of displays, including box and whisker plots, scatter plots and back-to-back stem and leaf plots.</p> <p>.2 draw circle graphs using ratios, proportions, and percents.</p> <p>.3 use box and whisker plots to compare two sets of data.</p> <p>Clarifying Example: Given the scores of a math test from 2 different classes, students construct box and whisker plots and compare the performance of 2 the classes.</p>	<p>4.8.2</p> <p>.1 organize and display data, with and without technology, using a variety of displays.</p> <p>Clarifying Example: Given several similar triangles, students measure the lengths of the bases, find areas, and display the data in a scatter plot.</p>	<p>4.8.2 <i>interpret,</i> organize, and display data using frequency tables, circle graphs, box and whisker plots, scatter plots, and histograms. (MLO 3.2)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>4.4.3 .1 analyze and interpret line plots, line graphs, and circle graphs. Clarifying Example: Given a graph which displays the amount of food consumed by 2 gerbils and which shows 1) the amount of food consumed each week for a period of 10 weeks, 2) that the amount of food is increasing each week although not at a perfectly steady rate, and 3) that the rate of increase is leveling off, the student answers questions such as:</p> <ul style="list-style-type: none"> • what does the graph show about the change in the gerbils eating habits? • how might the graph look if one of the gerbils escaped? 	<p>4.5.3 .1 analyze and interpret stem and leaf plots and double line graphs.</p>	<p>4.5.3 analyze and interpret stem and leaf plots, circle graphs, line plots, and line graphs. (MLO 3.3)</p>	<p>4.6.3 .1 analyze and interpret data using various formats, including frequency tables. Clarifying Example: Given a circle graph that shows the popularity of local radio stations, the student makes comparisons and predictions based on the available data.</p>	<p>4.7.3 .1 analyze and interpret data in a variety of displays, including, box and whisker plots, scatter plots and back-to-back stem and leaf plots.</p>	<p>4.8.3 .1 analyze and interpret distributions of data by using a number of different methods. .2 make predictions about a set of data given the line of best fit. .3 fit a line to a set of data and make a prediction about the data. Clarifying Example: Given data from fast food containers, the student plots the number of fat grams and calories from fat, finds the line of best fit, and makes predictions about other foods.</p>	<p>4.8.3a analyze and interpret frequency tables, box and whisker plots, and scatter plots. (MLO 3.3)</p> <p>4.8.3b make predictions about a set of linear data given the line of best fit. (MLO 3.4)</p> <p>4.8.3c <i>fit a line to a set of linear data and make predictions about the data.</i></p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>4.4.4</p> <p>.1 determine and distinguish among mean, median, mode, and range using concrete materials.</p> <p>Clarifying Example: Given cubes, the student arranges them to represent six families with three, five, four, five, six, and seven family members. The student finds the mode and then rearranges the cubes to find the mean.</p>	<p>4.5.4</p> <p>.1 explain how mean, median, mode, and range of a data set are different.</p> <p>.2 use the range, mean, median, and mode to describe a set of data.</p> <p>.3 compute and compare range, mean, median, and mode of data sets.</p>	<p>4.5.4 find the mean, median, mode, and range of a data set and explain how these measures are different. (MLO 3.4)</p>	<p>4.6.4</p> <p>.1 select and justify mean, median, or mode of a data set as the best representation of a typical value of a data set.</p> <p>Clarifying Example: Given data such as:</p> <p style="padding-left: 40px;">Test Scores</p> <p>4 5</p> <p>5 2 7</p> <p>6 3 5 9</p> <p>7 2 2 2 7 8</p> <p>8 1 2 2 4 4 6 7 8</p> <p>9 0 6 6 8 9</p> <p>the student answers the question “How did your class do on the last test?” by describing the data in terms of mean, median, and mode and also explaining which</p>	<p>4.7.4</p> <p>.1 use the measures of central tendency (mean, median, mode) to compare two sets of data.</p>	<p>4.8.4</p> <p>.1 analyze the relationship between mean, median, mode, and range of a data set.</p>	<p>4.8.4 select and justify mean, median, mode, or range of a data set as the best representation of data. (MLO 3.5)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
			<p>4.6.5</p> <p>.1 recognize and identify the misuses of statistical and numerical data.</p> <p>.2 analyze why the way in which data are displayed might influence the conclusion reached.</p> <p>.3 analyze the effect a change of scale will have on graphs.</p>	<p>4.7.5</p> <p>.1 evaluate the validity of claims based on analysis of data.</p> <p>.2 identify data that represent sampling errors and explain why a sample might be biased.</p>	<p>4.8.5</p> <p>.1 evaluate arguments that are based on data analysis for accuracy and validity.</p>	<p><i>4.8.5 examine the misinterpretation of statistics; identify factors leading to faulty interpretation or representation of data, including choice of sample population, graphical display, scale, and use of statistical measures.</i></p>

Knowledge of Probability

Content Standard 5.0: Students will use experimental methods and theoretical reasoning to determine probabilities, to make predictions, and to solve problems about events whose outcomes involve random variation.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>5.4.1</p> <p>.1 manipulate concrete objects to determine possible combinations of the objects.</p> <p>.2 identify and represent all possible outcomes for a simple probability situation in an organized way (e.g., tables, grids, tree diagrams).</p> <p>Clarifying Examples: Given the situation of flipping three coins at the same time, the student determines all the possible outcomes using two different methods.</p> <p>Given a situation with 3 flavors of yogurt—vanilla, chocolate, and strawberry—and 2 flavors of cones—plain and sugar, the student determines all possible single-flavor</p>		<p>5.5.1 list all possible outcomes of an event with a limited number of possible results. (MLO 3.5)</p>	<p>5.6.1</p> <p>.1 find all possible outcomes of experiments using such methods as lists, tree diagrams, area models, and organized lists.</p> <p>Clarifying Example: Given an experiment, such as flipping a penny, a nickel, and a quarter at the same time, the student determines all possible outcomes using a tree diagram or an organized list.</p>		<p>5.8.1</p> <p>✓.1 distinguish between permutations and combinations.</p> <p>✓.2 apply the Fundamental Counting Principle to solve problems.</p> <p>Clarifying Example: Given five finalists in a contest, the student determines the number of ways two finalists can be chosen from the group of five and then compares it to the number of ways first-place and second-place finalists can be chosen from the same group of five.</p>	<p>5.8.1 determine outcomes of events using counting techniques, <i>including permutations and combinations</i>. (MLO 3.6)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>5.4.2</p> <p>.1 find the probability of an event with equally likely outcomes and express the probability as a fraction from 0 (impossible) up to and including 1 (certain).</p> <p>Clarifying Example: Given a gumball machine with five blues, five yellows, five reds, and five greens, the student describes the possibility of getting a red gumball as a fraction, and then describes the possibility of getting a black gumball.</p>	<p>5.5.2</p> <p>.1 use a fraction or a ratio to describe the probability of an event.</p> <p>Clarifying Example: Given a regular number cube, numbered from 1 to 6, the student determines the likelihood of rolling a 3 and of rolling a 9 and expresses each as a ratio.</p>	<p>5.5.2 find the probability of an event with equally likely outcomes and express as a fraction or ratio. (MLO 3.6)</p>	<p>5.6.2</p> <p>.1 find the probability of events.</p> <p>.2 use data to estimate the probability of future events.</p> <p>.3 represent probabilities as ratios, decimals between 0 and 1, and percentages between 0 and 100.</p> <p>Clarifying Example: Given 20 cards numbered from 1 to 20, the student finds such probabilities as the probability that a selected card will be a multiple of 3, or that a selected card will be a multiple of 4, justifying his or her answer.</p>		<p>5.8.2</p> <p>.1 find the probability of an event that does not have equally likely outcomes.</p> <p>.2 find the probability of dependent and independent events using various methods, including constructing a sample space.</p> <p>Clarifying Examples: Given a spinner with 4 different outcomes, not all of which are equally likely, the student uses the central angle measures to determine the theoretical probability.</p> <p>Given a hat that contains the names of 10 boys and 15 girls, the student determines the probability of selecting two girls' names with and without replacing the names in the hat after each name is drawn.</p>	<p>5.8.2a find the probability of an event that does not have equally likely outcomes. (MLO 3.7)</p> <ul style="list-style-type: none"> express the probability of an event as a ratio, decimal, or percent. (MLO 3.8) <p>5.8.2b find the probability of simple dependent and independent events <i>using various methods, including constructing a sample space</i>. (MLO 3.9)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
	<p>5.5.3 .1 conduct an experiment and make a prediction based on the outcomes of the experiment. Clarifying Example: Given various devices that generate random outcomes such as coins, number cubes, and spinners, the student conducts simple experiments and makes predictions about future events.</p>	<p><i>5.5.3 conduct an experiment and make a prediction based on the outcomes of the experiment. (MLO 3.7)</i></p>	<p>5.6.3 .1 predict the probability of an event based on the outcomes of an actual event or experiment and compare the results to the theoretical probability of the event. Clarifying Example: Given a spinner with 3 different outcomes that are not all equally likely, the student spins the spinner 100 times, records the results, compares results to theoretical probability, and predicts the probability of future events.</p>		<p>5.8.3 .1 predict the probability of compound events based on the outcomes of an actual event or a simulation. Clarifying Example: Given a computer maze with six gates and a computer-simulated toss of a coin (heads opens the gate and tails leaves the gate closed), the student finds the probability of going all the way to the finish on the first turn.</p>	<p><i>5.8.3 conduct and predict the probability of an event, based on the outcomes of an actual event or a simulation. (MLO 3.10)</i></p>

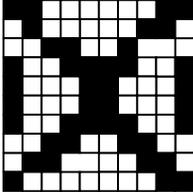
Knowledge of Number Relationships and Computation

Content Standard 6.0: Students will describe, represent, and apply numbers and their relationships, and they will estimate and compute using mental strategies, paper/pencil, and technology.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.1</p> <p>.1 read and write numbers less than one million and more than one hundred using standard and expanded notation.</p> <p>.2 use place value through millions.</p> <p>.3 recognize and name equivalent fractions.</p> <p>.4 use positive and negative numbers in concrete situations.</p> <p>Clarifying Examples:</p> <p>Write 134,793 in expanded notation.</p> <p>Given that the high temperature of the day was 3° F, and the weather report predicts that the temperature will fall 11°, the student finds the predicted low temperature for the night.</p>	<p>6.5.1</p> <p>.1 read, write, and represent interchangeably simple fractions, decimals, and percents using symbols, words, and models.</p> <p>Clarifying Examples:</p> <p>Given a 10 x 10 grid with 52 of the cells shaded, the student expresses the shaded amount as a fraction, decimal, and percent, and explains why each is correct.</p> <p>Given paper and pencil, the student draws a number line that is eight inches long and that extends from 0 to 1. The student then places 2/3, 3/4, and 5/8 on the number line and writes decimal equivalents for each.</p>	<p>6.5.1 read, write, and represent simple fractions, decimals, and percents using symbols, words, <i>and models</i>. (MLO 4.1)</p> <ul style="list-style-type: none"> <i>read and write standard form and expanded notation for numbers through millions.</i> 	<p>6.6.1</p> <p>.1 read, write, and represent numbers using exponents</p> <p>Clarifying Examples: The student writes a number such as 32 in exponential notation.</p>	<p>6.7.1</p> <p>.1 recognize and appropriately use exponential, scientific, and calculator notation.</p> <p>Clarifying Example: Given a very small number such as 0.00078, which represents the thickness in meters of a piece of paper, the student describes it in terms of relative size, expresses it using scientific notation, and computes with it using calculator notation.</p> <p>Given a very large number such as 4,378,000,000,000,000, which represents the distance in miles between two suns, the student describes it in terms of relative size, expresses it using scientific notation, and computes with it using calculator notation.</p>	<p>6.8.1</p> <p>✓.1 determine which representation of a rational number is appropriate for a given situation.</p>	<p>6.8.1 read, write, and represent rational numbers in a variety of forms, including exponents, scientific notation, and percents. (MLO 4.1)</p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.2</p> <p>.1 model and identify the place value of each digit in whole numbers that are less than one million and greater than one hundred.</p> <p>.2 compare and order fractions, including improper fractions, and mixed numbers with like denominators.</p> <p>.3 identify and compare decimals to the hundredths using numerals, pictures, and concrete objects.</p> <p>Clarifying Examples: Explain the difference between one-tenth and one-hundredth of a dollar.</p> <p>Explain whether or not 1.50 and 1.5 are equal, and why.</p>	<p>6.5.2</p> <p>.1 compare and order decimals to the thousandths place and describe them using place value concepts.</p> <p>.2 compare and order fractions in equivalent forms, including improper fractions and mixed numbers with like and unlike denominators.</p> <p>.3 compare order, and describe integers on a number line.</p> <p>Clarifying Example: Use base 10 blocks to compare and explain the difference between 5.9 and 0.59.</p>	<p>6.5.2a compare and order decimals <i>to the nearest thousandth and describe them using place value concepts.</i> (MLO 4.2)</p> <p>6.5.2b compare and order fractions in equivalent forms, <i>including improper fractions and mixed numbers with like and unlike denominators.</i> (MLO 4.3)</p>	<p>6.6.2</p> <p>.1 compare, order, and describe rational numbers in equivalent forms.</p> <p>Clarifying Example: Identify the percent of the square that is shaded and tell whether that is more or less than $\frac{4}{5}$.</p> 	<p>6.7.2.</p> <p>.1 describe the magnitude of numbers.</p> <p>.2 determine the absolute value of rational numbers.</p>		<p>6.8.2 compare, order, and describe rational numbers in equivalent forms. (MLO 4.2)</p> <ul style="list-style-type: none"> determine the <i>absolute value</i> of rational numbers.

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.3</p> <p>.1 find multiples of numbers.</p> <p>.2 find factors of numbers.</p>	<p>6.5.3</p> <p>.1 identify prime and composite numbers less than 100.</p> <p>.2 find the prime factorization of a composite number.</p> <p>.3 find the greatest common factor and least common multiple of numbers.</p> <p>.4 use number theory concepts of primes, factors, multiples, and rules of divisibility to show number relationships.</p> <p>Clarifying Example: Given the number 36, the student finds the prime factorization.</p> <p>Given the number 90, the student uses the rules of divisibility to determine which of the following are factors: 2, 3, 4, and 5.</p> <p>There are 50 people in a 10K road race. Every sixth finisher in the race receives a T-shirt. Every eighth finisher in the race receives a hat—the student uses multiples to decide how many people will receive both a hat and a T-shirt.</p>	<p>6.5.3 use number theory concepts of primes, factors, multiples, and rules of divisibility to show number relationships. (MLO 4.4)</p>				

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.4 .1 demonstrate mastery of multiplication and division fact families.</p>		<p>6.5.4 <i>demonstrate proficiency with multiplication and division facts.</i></p>				

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.5</p> <p>.1 multiply any whole number by a two- or three-digit factor.</p> <p>.2 divide any whole number by a one-digit divisor and interpret remainders.</p> <p>.3 estimate products to determine reasonableness of answers.</p> <p>.4 add and subtract fractional numbers with like denominators, explaining the process and recording the results.</p> <p>.5 use models and pictures to multiply a fraction by a whole number and a whole number by a fraction.</p> <p>.6 add and subtract decimals (tenths and hundredths), explaining the process and recording results.</p> <p>Clarifying Example: Given the problem $24 \div 4 = 6$, the student explains what happens to the solution when the:</p> <ul style="list-style-type: none"> • divisor doubles • dividend doubles • divisor is halved 	<p>6.5.5</p> <p>.1 compute with whole numbers.</p> <p>.2 use models and pictures to illustrate multiplying a whole number by a decimal number.</p> <p>.3 add and subtract fractions, mixed numbers and decimals.</p> <p>.4 multiply and divide decimals by whole numbers.</p>	<p>6.5.5a multiply and divide whole numbers and interpret remainders. (MLO 4.5)</p> <p>6.5.5b add and subtract fractions, <i>mixed numbers</i>, and decimals <i>and express answers in simplest form</i>. (MLO 4.6)</p> <p>6.5.5c multiply and divide decimals by whole numbers. (MLO 4.7)</p>	<p>6.6.5</p> <p>.1 add, subtract, multiply, and divide with decimals and fractions, including mixed numbers, expressing answers in simplest form.</p> <p>Clarifying Example: Express the number 1 as the sum of four different fractions.</p>	<p>6.7.5</p> <p>.1 model and explain the addition, subtraction, multiplication, and division of integers.</p> <p>.2 add, subtract, multiply, and divide integers.</p> <p>Clarifying Examples: Given the opportunity, the student creates a real-world example to illustrate that a negative number multiplied by a positive number has a negative product.</p>	<p>6.8.5</p> <p>✓.1 add, subtract, multiply, and divide with rational numbers.</p> <p>✓.2 describe the relationship between roots and powers.</p> <p>✓.3 calculate powers and square roots of numbers.</p> <p>✓.4 model and apply the rules of exponents.</p> <p>✓.5 multiply and divide by powers of ten.</p> <p>Clarifying Examples: Given $(7.3 \times 10^7) \div (2.4 \times 10^4)$ the student uses the rules of exponents to simplify the expression.</p>	<p>6.8.5 add, subtract, multiply, and divide rational numbers. (MLO 4.3)</p> <ul style="list-style-type: none"> • <i>calculate powers and square roots of numbers.</i> • <i>use the rules of exponents to combine rational numbers.</i> • <i>multiply and divide by powers of ten.</i>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.6</p> <p>.1 simplify numerical expressions involving parentheses.</p> <p>Clarifying Example: Given the following two problems: $(8 \times 4) \times 25 =$ $8 \times (4 \times 25) =$ the student solves each, comparing and explaining the results.</p>	<p>6.5.6</p> <p>.1 use mathematical properties to solve problems.</p> <p>.2 explain and apply number relationships using the mathematical properties of operations, including associative (addition and multiplication) and multiplicative inverse.</p> <p>.3 recognize and use identity and zero properties.</p> <p>Clarifying Example: Given $\frac{1}{3}$ and $\frac{1}{5}$, the student explains why forms of 1 such as $\frac{5}{5}$ or $\frac{3}{3}$ are used to create fractions with common denominators.</p>	<p>6.5.6 <i>use mathematical properties to solve problems.</i></p> <ul style="list-style-type: none"> <i>explain and apply number relationships using the mathematical properties of operations, including associative (addition and multiplication) and multiplicative inverse.</i> <i>simplify numerical expressions involving addition, subtraction, multiplication,</i> 	<p>6.6.6</p> <p>.1 use the order of operations to simplify numerical expressions.</p> <p>.2 use the distributive property to compute products.</p>		<p>6.8.6</p> <p>.1 explain and apply number relationships using the mathematical properties of operations, including the distributive property and the additive and multiplicative inverses.</p>	<p>6.8.6 <i>explain and apply number relationships using the mathematical properties of operations, including distributive and additive inverse.</i></p>

By the end of the following grades, students will know and be able to do everything in the previous grade and master the following content:

Grade 4	Grade 5	Maryland State Standards Grade 5	Grade 6	Grade 7	Grade 8	Maryland State Standards Grade 8
<p>6.4.7</p> <p>.1 use a variety of strategies to solve estimation problems with fractions and decimals.</p> <p>.2 identify and describe the relationship between fractions and decimals.</p>	<p>6.5.7</p> <p>.1 apply a variety of strategies to solve problems with fractions, decimals, and percents.</p> <p>.2 use estimation to solve problems with fractions and decimals.</p> <p>.3 compute percentages of 10, 20, 25, 50, and 100 percent of a number.</p> <p>Clarifying Example: Given that $\frac{1}{3}$ of a gallon of paint is needed to paint a nightstand and $\frac{5}{8}$ of a gallon is needed to paint a chest, the student estimates to decide whether or not one gallon will be sufficient.</p>	<p>6.5.7a <i>apply strategies to solve problems with fractions and decimals.</i></p> <ul style="list-style-type: none"> use estimation to solve problems with fractions and decimals. (MLO 4.8) identify and describe the relationship among fractions, decimals, and percents. (MLO 4.9) represent fractions, decimals, and percents in equivalent forms. (MLO 4.10) <i>compute percentages of 10, 20, 25, 50, and 100 percent of a number.</i> 	<p>6.6.7</p> <p>.1 use estimation and mental math to solve problems with fractions, decimals, and percents, explaining the reasoning involved.</p> <p>.2 determine equivalent ratios, decimals, and percents.</p> <p>.3 determine ratios, rates, and unit rates in the context of a problem.</p> <p>Clarifying Examples: Given that it takes one basket on a Ferris wheel about 2 minutes and 25 seconds to make a complete circle, the student estimates the number of complete circles in a typical 15-minute ride.</p> <p>Given the following:</p> <ul style="list-style-type: none"> 44% of 25 12.48×5 $9 \frac{2}{3} + 3 \frac{3}{4}$ <p>the student explains how to estimate each mentally.</p>	<p>6.7.7</p> <p>.1 use estimation to solve problems involving proportional reasoning.</p> <p>.2 use strategies to solve problems involving ratios, proportions, and percents.</p> <p>Clarifying Examples: Given an 8-inch by 10-inch photo in a 10-inch by 12-inch frame, the student determines whether or not the frame is similar to the photo and justifies his or her answer.</p> <p>Given this situation—there is a 10% shipping and handling charge and a 6.5% sales tax on some items shipped to your school, the student decides if his or her school is better off if the tax is computed and charged before or after the shipping, and uses examples to support his or her answer.</p> <p>Given grid paper, the student models proportions by reducing or enlarging drawings.</p>	<p>6.8.7</p> <p>✓.1 estimate powers and square roots to solve problems.</p> <p>✓.2 apply the concepts of ratios, rates, unit rates, and percents to real-world problems, including rate of increase/decrease, discount, commission, sales tax, and simple interest.</p> <p>✓.3 select and apply mathematical properties to solve problems with real numbers.</p>	<p>6.8.7a <i>select and apply strategies and mathematical properties to solve problems with rational numbers.</i></p> <ul style="list-style-type: none"> use estimation to solve problems with rational numbers. (MLO 4.4) <i>estimate powers and square roots to solve problems.</i> <i>estimate the value of radicals and numbers expressed with exponents to solve problems.</i> <p>6.8.7b <i>apply ratios, proportions, and percents to solve problems.</i> (MLO 4.5)</p> <ul style="list-style-type: none"> <i>determine equivalent ratios, decimals, and percents.</i> <i>determine ratios, rates, and unit rates in the context of a problem.</i> <i>apply the concepts of ratios, rates, and percents to real-world problems, including rate of increase/decrease, discount,</i>

Process of Problem Solving

Content Standard 7.0: Students will demonstrate their ability to apply a wide variety of mathematical concepts, processes, and skills to solve a broad range of problems.

Rationale

The process of problem solving should permeate the entire mathematics instructional program and provide the authentic context in which mathematical concepts and skills are learned. Problem solving must go beyond performing simple and complex computations. It should involve challenging, thought-provoking questions, speculations, investigations, and explorations.

In order to solve problems, students will be able to:

- use information to identify and define the question(s) within a problem (MLO 5.1, SFS 2.2, SFS 2.4)
- make a plan and decide what information *is needed or missing* and steps needed to solve the problem (MLO 5.2, SFS 2.4)
- choose the appropriate operation(s) for a given problem situation (MLO 5.3)
- *create or select* and then apply appropriate problem-solving strategies to solve a problem from **visual** (draw a picture, create a **graph**), **numerical** (guess and check, look for a pattern), and **symbolic** (write an **equation**) **perspectives** (MLO 5.4, SFS 2.4)
- *analyze multi-step problem-solving situations* (SFS 2.4)
- organize, interpret, and use relevant information (MLO 5.5, SFS 2.2, SFS 2.4)
- select and use appropriate tools and technology (MLO 5.6, SFS 2.4)
- *persevere through to a solution*
- *verify the conclusion based on the data and the processes used* (SFS 2.4)
- *communicate the conclusion with appropriate mathematical justification* (SFS 3.2)
- show that no solution or multiple solutions may exist (MLO 5.7, SFS 3.2)
- *ascribe a meaning to the solution in the context of the problem*
- identify alternate ways to find a solution (MLO 5.8, SFS 2.4)
- apply what was learned to a new *and/or more complex* problem (MLO 5.9, SFS 2.4)

Process of Communication

Content Standard 8.0: Students will demonstrate their ability to organize and consolidate their mathematical thinking in order to analyze and use information, and will present ideas with words, symbols, visual displays, and technology.

Rationale

Communication plays an important role in helping students make the connections between previously learned and newly acquired knowledge. Explaining, justifying, predicting, and defending ideas orally and in writing can clarify understanding of concepts and principles and can provide opportunities to assess understanding and thinking.

In order to communicate mathematically, students will be able to:

- *discuss, read, listen, and observe to obtain mathematical information from a variety of sources* (SFS 3.2)
- use multiple representations to express mathematical concepts and solutions (MLO 5.10, SFS 2.4)
- represent problem situations and express their solutions using **concrete**, pictorial, tabular, graphical, and algebraic methods (MLO 5.11, SFS 3.1)
- *clarify meaning by asking questions, supporting solutions with evidence, and explaining mathematical ideas in oral and written forms* (SFS 3.1)
- use mathematical language and symbolism appropriately (MLO 5.12, SFS 3.2)
- *organize, interpret, and describe situations mathematically by providing mathematical ideas and evidence in oral and written form* (MLO 5.13, SFS 3.1, SFS 3.2)
- *give and use feedback to revise mathematical thinking/presentations/solutions* (SFS 3.1, SFS 3.3)
- present results in written, oral, and visual forms (MLO 5.14, SFS 3.1, SFS 3.2)
- *describe the reasoning and processes used in order to reach the solution to a problem*

Process of Reasoning

Content Standard 9.0: Students will demonstrate their ability to reason mathematically, using inductive and deductive reasoning, and to evaluate mathematical situations. Students will justify and draw conclusions.

Rationale

Reasoning, analyzing, and thinking logically are essential to knowing and doing mathematics. Constructing **valid arguments** in problem settings and evaluating the arguments of others are important skills to be developed over time through a variety of experiences.

- justify why an answer or approach to a problem is reasonable (MLO 5.15, SFS 2.2)
- make and test generalizations based upon investigation or observation (MLO 5.16, SFS 2.2)
- make predictions or draw conclusions from available information (MLO 5.17, SFS 2.2)
- analyze statements and provide examples which support or refute them (MLO 5.18, SFS 2.2)
- *follow and judge the validity of arguments by applying inductive and deductive thinking (MLO 5.19, SFS 2.2)*
- *use methods of proof, including direct, indirect, paragraph, and/or contradiction*
- use supporting data to explain why a chosen method and a solution are mathematically correct (MLO 5.20, SFS 2.2)
- *analyze mathematical situations using manipulatives, technology, patterns, relationships, spatial and proportional reasoning (SFS 2.2)*
- *use if...then statements to formulate valid arguments or proofs*
- *use manipulatives to model and justify solutions*

Process of Connections

Content Standard 10.0: Students will demonstrate their ability to relate and apply mathematics within the discipline, to other content areas, and to daily life.

Rationale

Connections help students view mathematics as an integrated whole rather than an isolated set of topics. Connections also help students acknowledge the relevance and usefulness of mathematics, both in and out of school, because it is important for students to be able to link current and future knowledge to their understanding of mathematics.

- identify and use the relationships among mathematical concepts as a basis for learning additional concepts (MLO 5.21, SFS 1.3)
- identify the relationships among graphical, numerical, physical, and algebraic mathematical models and concepts (MLO 5.22, SFS 1.32)
- identify mathematical concepts and processes as they apply to other content areas (MLO 5.23, SFS 1.3)
- *move beyond a particular problem by making general conclusions, summary statements and posing new, related questions and comments* (SFS 1.3)
- use mathematical concepts and processes to translate personal experiences into mathematical language (MLO 5.24)
- *identify the contributions of men and women of diverse cultures to the development, understanding, and application of mathematical concepts and processes*