Watson Chapel Jr. High School

8th Grade Curriculum Map

2019-2020

8th Grade Math Course Description

Description: This course will focus on three critical areas: (1) Formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) Grasping the concept of a function and using functions to describe quantitative relationships; (3) Analyzing two and three dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. The curriculum for this course aligns with the Arkansas Standards which may be viewed on the Arkansas Department of Education website.

http://www.arkansased.gov/divisions/learning-services/curriculum-support/stem-sciences-technologies-engineering-and-mathematics/mathematics/mathematics-standards-and-courses

8th Grade Honors Math Course Description

Description: This course is designed for an eight grade student with exceptional mathematical ability, who demonstrates mathematical understanding, problem solving, and reasoning skills; can grasp mathematics concepts quickly, but is not ready for **Algebra 1**. This course will be taught more rigorous than the regular eight grade math course. Student expectations are higher. Students will be given more enrichment and challenging types of problem solving.

This course will focus on three critical areas: (1) Formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) Grasping the concept of a function and using functions to describe quantitative relationships; (3) Analyzing two and three dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. The curriculum for this course aligns with the Arkansas Standards which may be viewed on the Arkansas Department of Education website.

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Watson Chapel Jr. High School
8th Grade/Honors Math at a Glance
2019- 2020

Months	Topics	Standards	Days of Instruction
August/September	Real Numbers	8.NS.A.1 8.NS.A.2 8.EE.A.1 8.EE.A.2 8.EE.A.3 8.EE.A.4	19 days
September/October	Analyze and Solve Linear Equations	8.EE.B.5 8.EE.B.6 8.EE.C.7 8.EE.C.8	16 days
Unit 1 Common Assessment- October 11, 2019			
October/November	Use Functions to Model Relationships	8.F.A.1 8.F.A.2 8.F.A.3 8.F.A.4 8.F.A.5	14 days
November/December	Investigate Bivariate Data	8.F.A.4 8.F.A.5 8.EE.A.1 8.EE.A.2	18 days
Unit 2 Common Assessment-December 12, 2019 (Include all 4 topics)			
End of the 1st Semester- December 20, 2019			

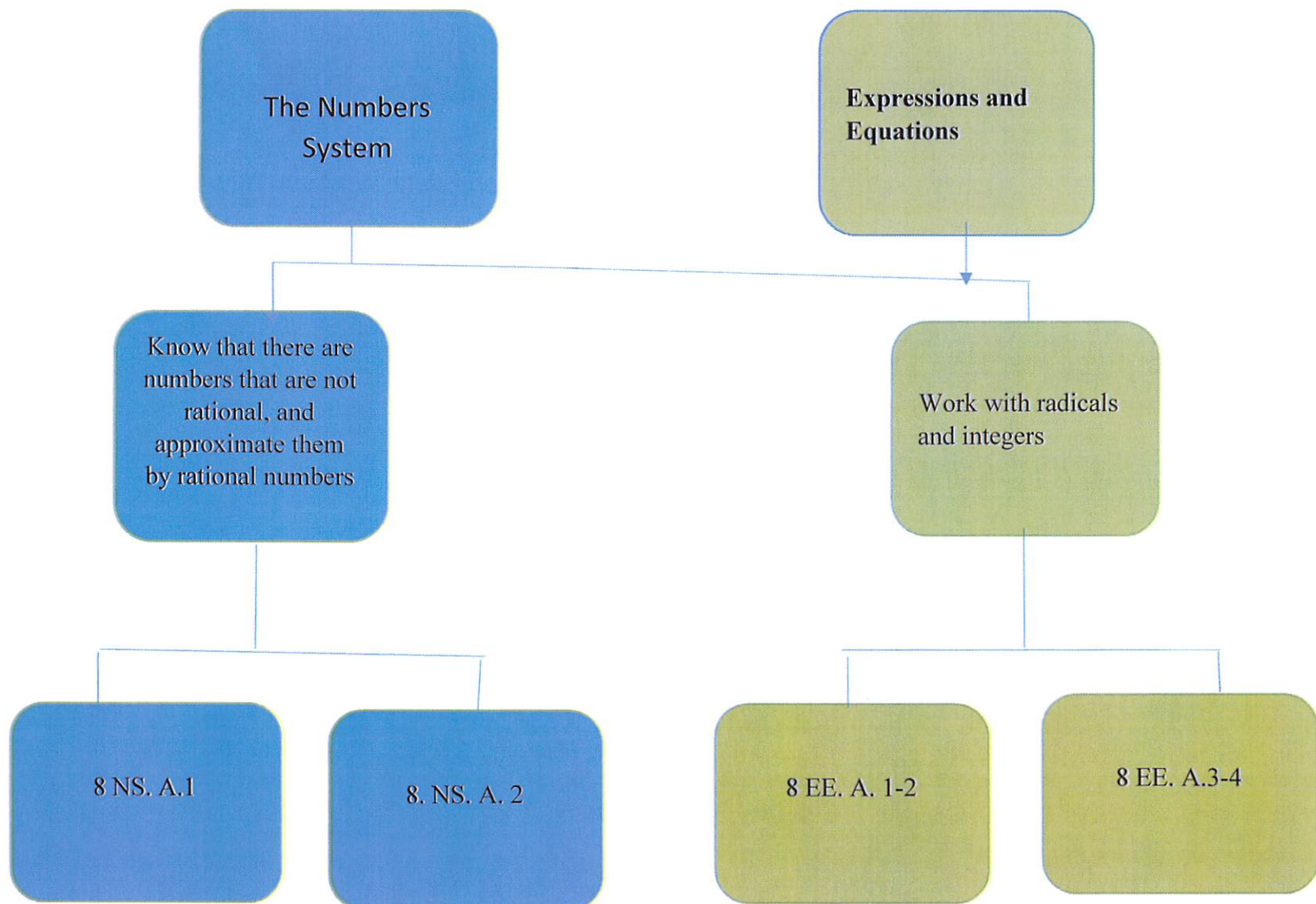# Watson Chapel Jr. High School
8th Grade/Honors Math at a Glance
2019- 2020

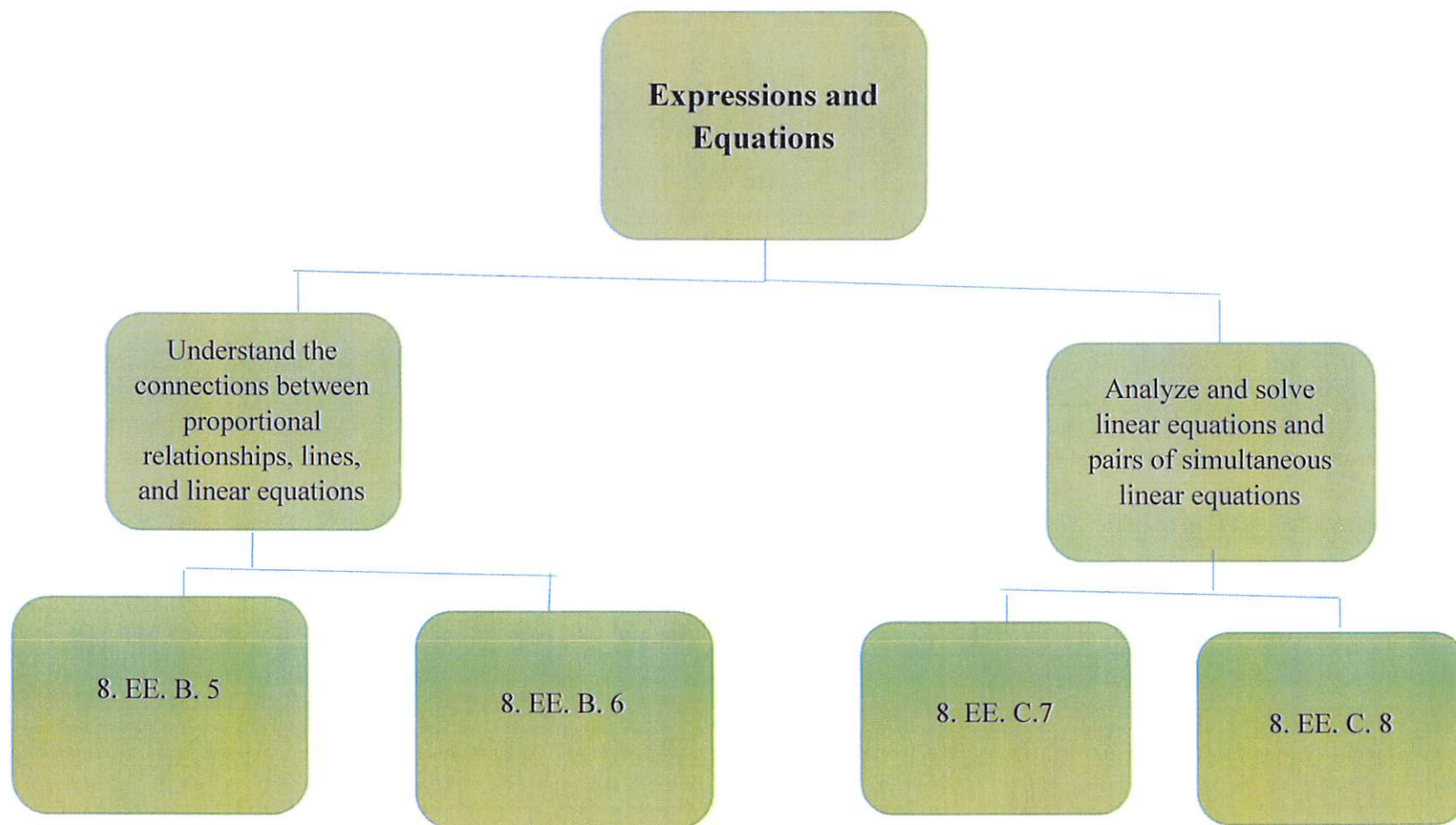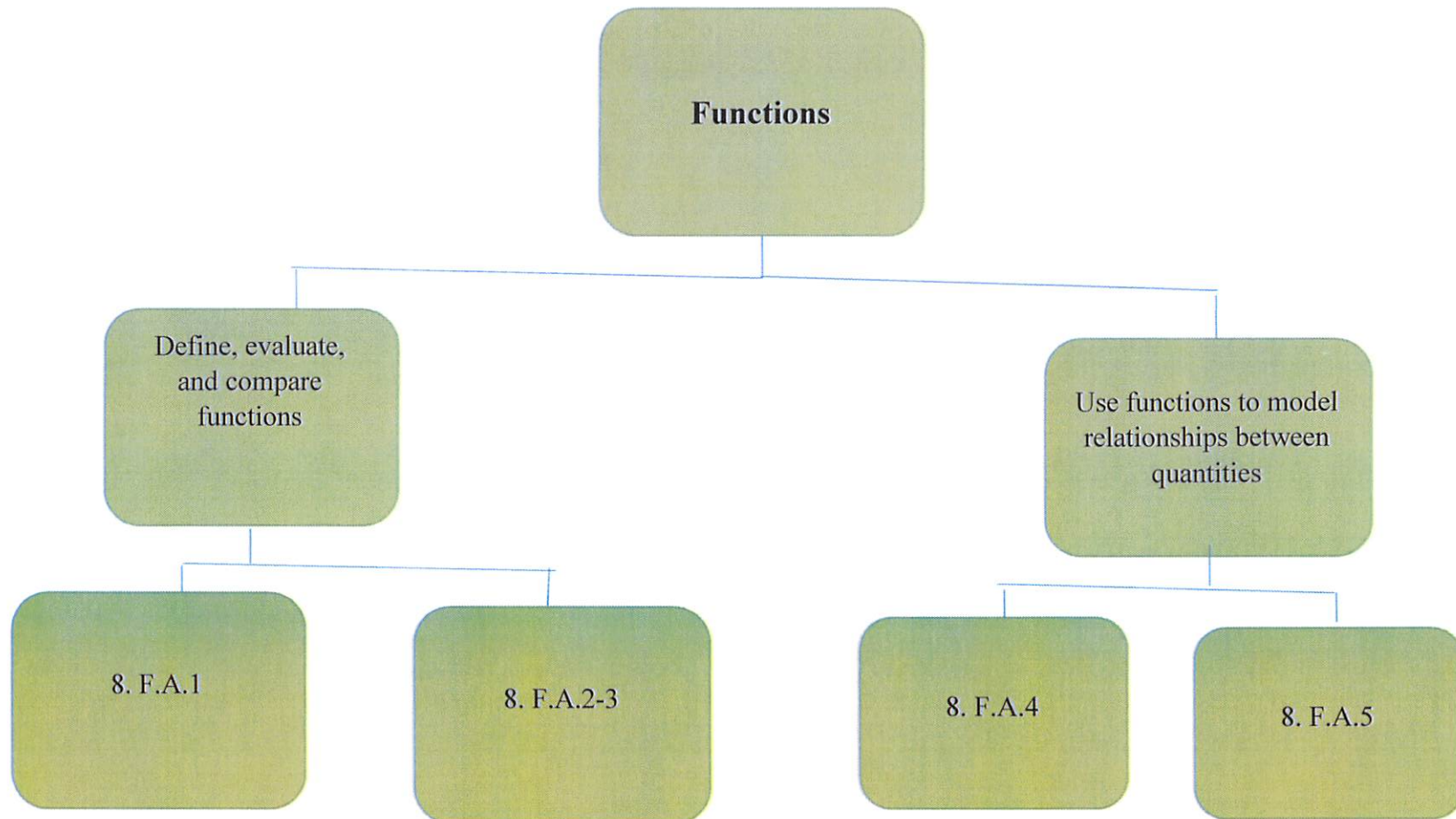| Months	Topics	Standards	Days of Instruction
January	Analyze and Solve Systems of Linear Equations	8.EE.C.8b 8.EE.C.8c	12 days
February	Congruence and Similarity	8.G.A.1 8.G.A.2 8.G.A.3 8.G.A.4 8.G.A.5	20 days
Unit 3 Common Assessment- March 2, 2020			
March	Understand and Apply the Pythagorean Theorem	8.G.B.6 8.G.B.7 8.G.B.8	12 days
March/April	Solve Problems Involving Surface Area and Volume	8.G.C.9	12 days
Unit 4 Common Assessment-April 17, 2020 (Include all 4 topics)			
End of 2nd Semester- June 1, 2020			

8th Grade Math/Honors Math

Pacing Guide (YAG)
Unit 1- Real Numbers

The Numbers System

Expressions and Equations

Know that there are numbers that are not rational, and approximate them by rational numbers

Work with radicals and integers

8 NS. A.1

8. NS. A. 2

8 EE. A. 1-2

8 EE. A.3-4

8th Grade Math/Honors Math

Pacing Guide (YAG)
Unit 2-Analyze and Solve Linear Equations

Expressions and Equations

Understand the connections between proportional relationships, lines, and linear equations

Analyze and solve linear equations and pairs of simultaneous linear equations

8. EE. B. 5

8. EE. B. 6

8. EE. C.7

8. EE. C. 8

8th Grade Math/Honors Math

Pacing Guide (YAG)
Unit 3-Use Functions to Model Relationships

Functions

Define, evaluate, and compare functions

Use functions to model relationships between quantities

8. F.A.1

8. F.A.2-3

8. F.A.4

8. F.A.5

8th Grade Math/Honors Math

Pacing Guide (YAG)

Unit 4- Investigate Bivariate Data
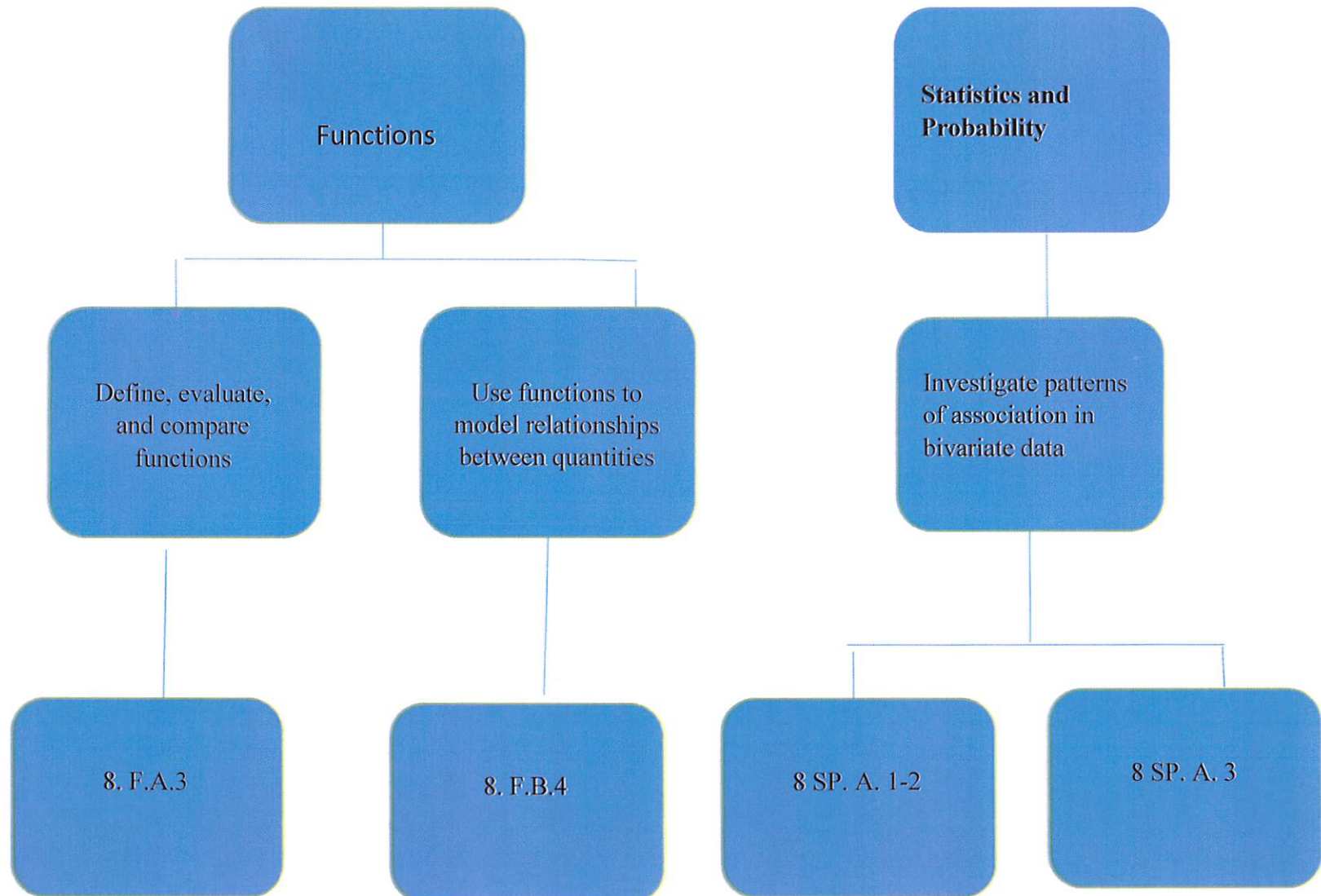
Functions

Statistics and Probability

Define, evaluate, and compare functions

Use functions to model relationships between quantities

Investigate patterns of association in bivariate data

8. F.A.3

8. F.B.4

8 SP. A. 1-2

8 SP. A. 3

Expressions and Equations

Analyze and solve linear equations and pairs of simultaneous linear equations

8. EE.C.8b

8. EE.C.8c

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software

8. G.A.1-3

8. G. A.4-5
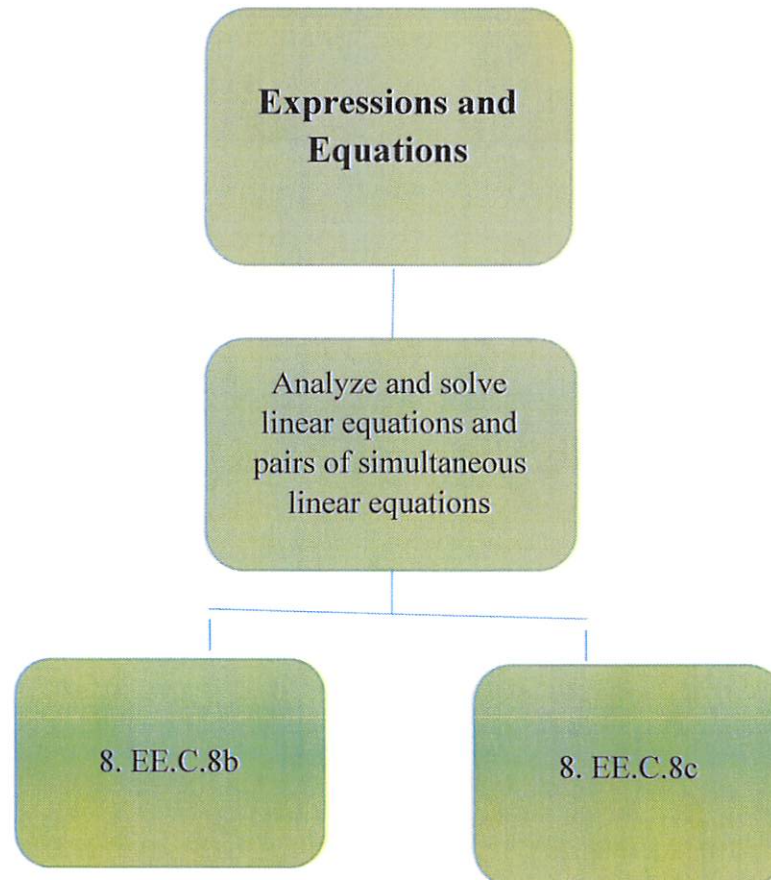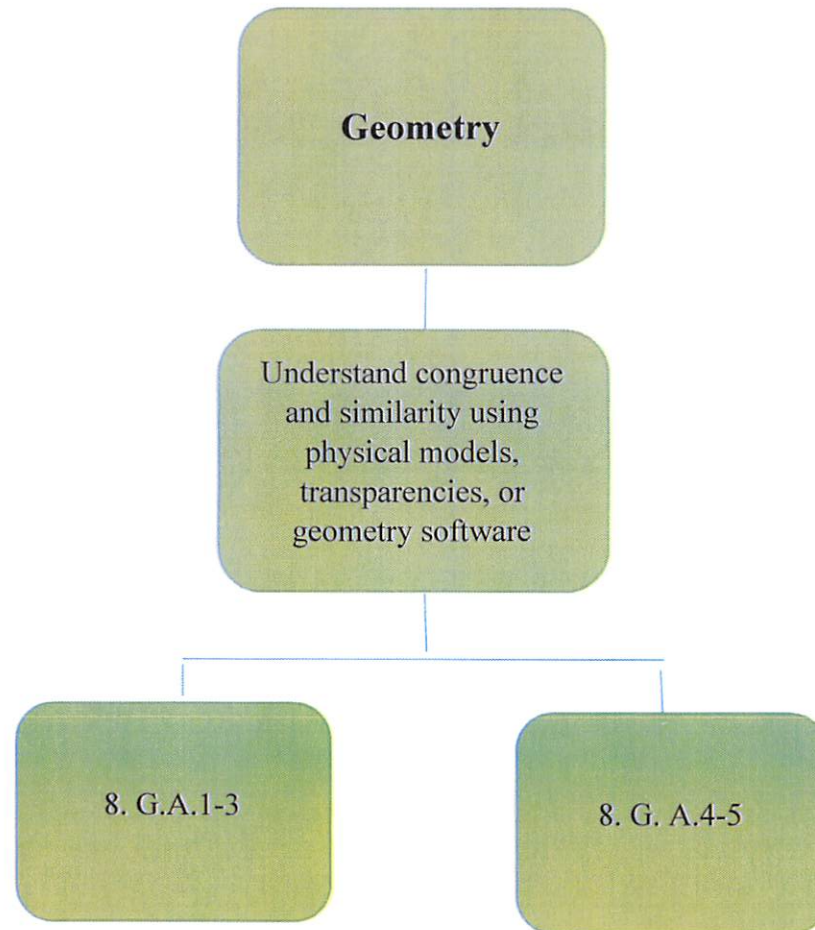
8th Grade Math/Honors
Pacing Guide (YAG)
Unit 7: Understand and Apply the Pythagorean Theorem

Geometry

Understand and Apply the Pythagorean Theorem

8. G. B. 8

8. G.B.6-7
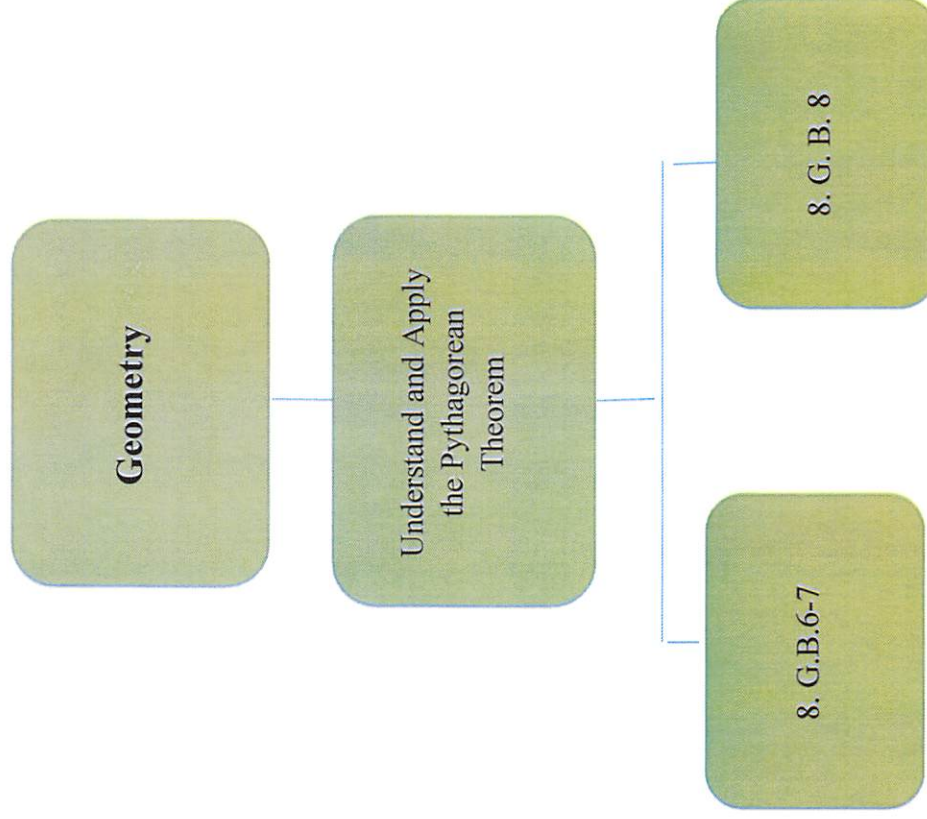
8th Grade Math/Honors

Pacing Guide (YAG)
Unit 8: Solve Problems Involving Surface Area and Volume

Geometry

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

8. G.C.9

Green: Major Content
Blue: Supporting Content
Gold: Additional Content

Unit: 1 Real Numbers

Pacing: 17-19 days (Month of September)

From the previous year, students should have mastered:
• Solving equations by adding, subtracting, multiplying and dividing Integers as well as how to apply their knowledge of rational numbers when solving equations.

Enduring Understandings	Essential Questions
• Students will develop an understanding of real numbers • Apply their knowledge when solving problems containing real numbers.	• What are real numbers? • How are real numbers used to solve problems?

By the end of this unit, students should be able to:
• Locate repeating decimals on a number line and write the repeating decimals as fractions. • Classify, compare and order rational and irrational numbers. • Understand the concepts of square roots and perfect squares as well as evaluate square roots and cube roots while solving problems. • Multiply and divide expressions with integer exponents and find the power of a power. • Simplify exponential expressions using the Zero Exponent Property and the Negative Exponent Property. • Estimate, compare and write very small and very large numbers using the powers of 10 and in scientific notation. • Convert scientific notation into standard form. • Use mathematical modeling to represent a problem situation and to propose a solution. Test and verify these models. • Add, subtract, multiply and divide numbers in scientific notation.

Learning Standards
8.NS.A.1 – 8.NS.A.2 - 8.EE.A.1 - 8.EE.A.2 - 8.EE.A.3 - 8.EE.4 MP.2 Reason abstractly and quantitatively and MP.7 Look for and make use of structure.

Vocabulary		Resources	Assessment
cube root irrational number perfect cube Negative Exponent Property Power of Powers Property Power of Products Property Product of Powers Property Quotient of Powers Property	Zero Exponent Property square root perfect square scientific notation	enVision math 2.0 – Volume 1 - Topic 1 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Lesson quizzes Mid – Topic Assessment Topic Assessment

Unit 2: Analyze and Solve Linear Equations

From the previous year, students should have mastered:
- Writing expressions by using variables to represent unknown quantities to solve problems.   - Analyze and write equivalent expressions to solve multi-step equations using the distributive property.   - Apply proportional reasoning to solve problems.   - Compare ratios and compute unit rates to determine whether two quantities have a proportional relationship.

Enduring Understandings	Essential Questions
- Analyzing linear equations by combining like terms. - Solving for variables on both sides. - Solving multi-step equations.	How can we analyze connections between linear equations, and use them to solve problems?

By the end of this unit, students should be able to:
- Combine like terms that are on one side of an equation,   - Solve linear equations that has variable terms on both sides of the equation and then isolate the variable.   - Solve problems using the distributive properties as a tool for simplifying and combining like terms.   - Classify equations with one variable that has zero, one or infinitely many solutions.   - Analyze equations, linear graphs and tables to find unit rates and compare proportional relationships.   - Find the slope of a line and interpret the slope in context and relate its steepness on a graph.   - Write and graph a linear equation in the form y=mx+b (when the slope is and is not given) from an equation or graph.   - Analyze graphs in context to determine and explain the concept of the y-intercept.

·   Learning Standards
8.EE.B.5 - 8.EE.B.6 - 8.EE.C.7a and 8.EE.C.7b. MP.4 Model with Mathematics and MP.7 Look for and make use of structure.

Vocabulary	Resources	Assessment
slope of a line slope-intercept form y-intercept	enVision math 2.0 – Volume 1 - Topic 2 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM Project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Mid – Topic Assessment Topic Assessment Cumulative/Benchmark Assessment Topics 1 and 2

Unit 3: Using Functions to Model Relationship

Pacing: 12-14 Days (Month of November)

From the previous year, students should have mastered:
• How to reason about proportional relationships and identify the constant of proportionality when using the equation *y=kx* (where k is the constant of proportionality). • Solving multistep problems involving simple interest, discounts commissions, makeups and markdowns.

Enduring Understandings	Essential Questions
• Identifying different types of functions, • Comparing linear and nonlinear functions and testing and verifying through mathematical modeling how to construct a linear function using the slope formula.	• How can you use functions to model linear relationships?

By the end of this unit, students should be able to:
• Identify and interrupt a function in different representations: equations, tables and graphs. • Identify linear and nonlinear functions and compare their properties. • Test, verify and use mathematical modeling to represent a problem situation and propose a solution. • Construct a linear function using the slope formula (y=mx+b). • Describe qualitatively the behavior of a function by analyzing a graph. • Draw a qualitative graph of a function based on a verbal description and analyze one that has already been drawn or sketched.

Learning Standards
8.F.A.1 – 8.F.A.2 – 8.F.A.3- 8.F.B.4 – 8.F.A.2 – 8.F.B.5 MP.2: Reason abstractly and quantitatively and MP.4: Model with Mathematics

Vocabulary	Resources	Assessment
constant rate of change function initial value interval linear function nonlinear function qualitative graph relation	enVision math 2.0 – Volume 1 - Topic 3 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM Project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Lesson quizzes Mid – Topic Assessment Topic Assessment

8th Grade Math Curriculum Map

Unit 4: Investigative Bivariate Data   Pacing: _ Days (Month of December)

From the previous year, students should have mastered:
• To collect data by randomly sampling a population in order to obtain a representative sample. • Extend their understanding and abilities to construct: dot plots, bar graphs and box-and-whisker plots. • Compute measures of center and variability and used these measures to informally compare two populations.

Enduring Understandings	Essential Questions
• Using paired data that is represented on a graph. • Analyzing and interpreting the data as being linear, nonlinear, having no association, being positive or negative, strong or weak. • Making predictions on an equation or when no equation is given by writing or graphing the equation.	• How can you present the relationship between paired data and use the representation to make a prediction?

By the end of this unit, students should be able to:
• Construct a scatter plot to model paired data and utilize the scatter plot to identify and interrupt the relationship between the data. • Recognize if the paired data is one of the following: linear association, nonlinear association or has no association at all. • Draw a line to determine if the linear association is positive or negative, strong or weak. • Use the slope and y-intercept of a trend to make a prediction or make the predictions when no line is given by drawing the line or writing the equation. • Organize pared data into a two-way frequency table and then compare and make conjectures about the data that was displayed. • Use mathematical modeling to represent a problem situation and to propose a solution. Test and verify these models. • Explain why the results from their mathematical models may not align actually with the problem situation.

.   .Learning Standards
8.SP.A.1 – 8.SP.A.2 – 8.F.A.3 – 8. F.B.4 – 8.SP.A.3 – 8.SP.A.4 MP.1: Make sense of problems and persevere in solving them and MP. 7: Look for and make use of structure.

Vocabulary		Resources	Assessment
outlier	categorical data	enVision math 2.0 – Volume 1 - Topic 4	Review that you know – Topic Readiness
measurement data	scatter plot	Math modeling	Assessment
negative association	cluster	Vocabulary support	Formative assessments (admit and exit tickets)
positive association	trend line	Formative assessments (admit and exit	Mid – Topic Assessment
relation frequency table	gap	tickets)	Lesson quizzes
		Reteach and build understandings	Topic Assessment Cumulative/Benchmark
		Lesson quiz	Assessment Topics 1-4
		STEM Project	

Unit 5: Analyze and Solve systems of Linear Equations

From the previous year, students should have mastered:
Writing expressions that represent situations and how to solve one-step and two step equations.

Enduring Understandings	Essential Questions
- Writing and solving linear equations. - Determining if the equation has one solution, no solution or indefinite solutions. - Analyzing the slope and y-intercepts of these solutions.	What does it mean to solve a system of linear equations?

By the end of this unit, students should be able to:
- Examine graphs of linear equations to determine the number of solutions, based on the number of intersection points.   - Compare equations in a linear system to look for a relationship between the number of solutions and slopes and y-intercepts of the equations   - Create and examine graphs of linear equations to determine the solution.   - Understand how substitution can be used to solve a linear system of equations and apply this understanding to solve a system of linear equations with one solution, no solutions or infinitely many solutions.   - Understand how the process of elimination can be used to solve a system of linear equations with one solution, no solutions or infinitely many solutions and apply this understanding to solve mathematical and real world problems.   - Use mathematical modeling to represent a problem situation and propose a solution.   - Test and verify the appropriateness of their math models and explain why the results from their mathematical models may align exactly to the problem solution.

Learning Standards
8.EE.C.8 - 8.EE.C.8b - 8.EE.C.8c – 8.F.B.4 - 8.SP.A.3   Revision: 8.EE.C.8b: edited to identify "elimination and substitution" as strategies for solving systems of equations in grade 8.   MP.2: Reason abstractly and quantitatively and MP.7: Look for and make use of structure.

Vocabulary	Resources	Assessment
system of linear equations solution of a system of linear equations	enVision math 2.0 – Volume 2 - Topic 5 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson Quiz and Stem Project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Lesson Quiz Mid – Topic Assessment Performance Assessment

Unit 6: Congruence and Similarity

From the previous year, students should have mastered:
- Represent polygons on the coordinate plane.   - Draw, construct and describe geometrical figures and the relationships between them.   - Solve real-life and mathematical problems involving angle measure, area, surface area and volume.

Enduring Understandings	Essential Questions
- Showing that two figures are congruent or similar by performing the following transformations: translations, reflections, rotations, and dilations. - Applying their knowledge of relationships formed by parallel lines and a transversal and the relationship of interior angles of a triangle to also prove congruency or similarity.	How can you show that two figures are either congruent or similar to one another?

By the end of this unit, students should be able to:
- Identify, describe and understand translations, reflections, transformations, congruent figures, rotations, dilations, similarity, similar figures, relationships formed by parallel lines and a transversal and the relationship of interior angles of a triangle.   - Translate a figure on a coordinate plane.   - Reflect two-dimensional figures.   - Determine how a rotation affects a two-dimensional figure.   - Describe and perform a sequence of transformations.   - Use mathematical modeling to represent a problem situation and to propose a solution.   - Understand congruent figures using a series of transformations.   - Dilate to enlarge or reduce a figure in a coordinate plane.   - Complete a similarity transformation.   - Find unknown angle measurements.   - Determine whether triangles are similar.   - Solve problems involving similar triangles.

Learning Standards
8.G.A.1 - 8.G.A.1a - 8.G.A.1b - 8.G.A.1c - 8.G.A MP.2: Reason abstractly and quantitatively and MP.3: Construct viable arguments and critique the reasoning of others.

Vocabulary		Resources	Assessment
transformation translation image reflection	enlargement reduction similar transversal	enVision math 2.0 – Volume 2 - Topic 6 Math modeling Vocabulary support	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets)

line of reflection rotation angle of rotation center of rotation congruent dilation	corresponding angles alternate interior angles same-side interior angles remote interior angles exterior angle of a triangle scale factor	Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM Project	Mid – Topic Assessment Lesson quizzes Topic Assessment Cumulative/Benchmark Assessment Topics 1-6

Unit 7: Understand and Apply the Pythagorean Theorem

From the previous year, students should have mastered:
• The ability to construct triangles from three given side or angle measures. • Write equations that represent problem situations and how to approach these situations when solving two-step equations.

Enduring Understandings	Essential Questions
• Applying their knowledge of the Pythagorean Theorem when it can be used to prove that a triangle is a right triangle. • Finding the missing side length of a triangle using the formula $a^2+b^2=c^2$. • Applying this formula to solve real life situations using a map or constructing a figure from points on a coordinate plane.	• How can you use the Pythagorean Theorem to solve problems?

By the end of this unit, students should be able to:
• Use mathematical modeling to represent a problem situation and propose a solution. • Test and verify the appropriateness of their math models and explain why double the base and the height of a triangle, the area is more than double. • Understand the Pythagorean Theorem. • Given two side lengths of a right triangle, use the Pythagorean Theorem to find the length of the third side. • Explain why the Converse of the Pythagorean Theorem is true. • Use the Converse of the Pythagorean Theorem to analyze two-dimensional shapes. • Apply the Pythagorean Theorem and its converse to solve real-world problems. • Apply the Pythagorean Theorem to solve problems that involve three dimensions. • Apply the Pythagorean Theorem to find the distance between two points on a map or coordinate plane. • Find the perimeter of a figure on a coordinate plane. • Identify the coordinates of the third vertex of a triangle on the coordinate plane.

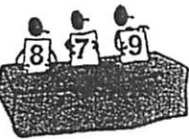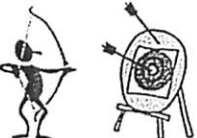| Learning Standards |
|---|
| 8.G.B.6 - 8.G.B.7 - 8.G.B.8
    • **8.G.B.6:** edited to clarify student expectations for understanding and explaining the Pythagorean Theorem in grade 8 and to maintain the mathematical rigor of the standard. Proving theorems is introduced in high school mathematics. In grade 8 students will demonstrate their understanding of the Pythagorean Theorem by analyzing and justifying the relation among the sides of a right triangle and applying the Pythagorean Theorem to solve problems in a variety of contexts

MP.3: Construct viable arguments and critique reasoning and MP.7: Look for and make use of structures. |

Vocabulary	Resources	Assessment
Hypotenuse leg Pythagorean Theorem a^2+b^2=c^2 proof Converse of the Pythagorean Theorem	enVision math 2.0 – Volume 2 - Topic 7 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM Project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Lesson quizzes Mid – Topic Assessment Topic Assessment

Unit 8: Solving Problems Involving Surface Area and Volume

Pacing: 10-12 Days (April)

From the previous year, students should have mastered:
- Their understanding of three-dimensional figures.   - How to represent solid figures by creating and analyzing nets and the expansion of their knowledge and understanding of solid figures to include determining the surface area of prisms and pyramids in order to solve real-world problems.   - The application of their knowledge of volume by solving real-world problems involving cubes and right prisms.

Enduring Understandings	Essential Questions
- Using formulas for finding the areas of polygons (rectangles, squares, triangles and circles) - Using formulas for finding the surface areas of cones, cylinders and sphere as long as the correct formula is applied. - Using formulas for finding the volume of different composite figures as long as the correct formula is used.	How are the formulas for volume of a cylinder, cone, and sphere related to one another?

By the end of this unit, students should be able to:
- Find the surface area of a cylinder: $SA = 2\pi r^2 + 2\pi rh$ - Find the surface area of a cone: $SA = \pi r^2 + \pi rl$ - Find the surface area of a sphere: $SA = 4\pi r^2$ - Recognize the relationship between the volume of a rectangular prism and the volume of a cylinder.   - Solve real-world problems involving the volume of a cylinder.   - Use the formula for the volume of a cylinder to find an unknown measure.   - Recognize the relationship between the volume of a cylinder and the volume of a cone.   - Use the Pythagorean Theorem when solving volume problems.   - Find the volume of a cone given the circumference of the base.   - Recognize the relationship between the volume of a cone and the volume of a sphere.   - Find the volume of a sphere given the surface area.   - Find the volume of a composite figure.   - Use mathematical modeling to represent a problem situation and propose a solution.   - Test and verify the appropriateness of their math models.   - Explain why their results from their mathematical models may not align to the problem solution.

Learning Standards
8.G.C.9
MP.2: Reason abstractly and quantitatively and MP.7: Look for and make use of structure.

Vocabulary	Resources	Assessment
cone - SA = πr^2 + πrl cylinder - SA = 2πr^2 + 2πrh sphere - SA = 4πr^2 composite figure	enVision math 2.0 – Volume 2 - Topic 8 Math modeling Vocabulary support Formative assessments (admit and exit tickets) Reteach and build understandings Lesson quiz STEM Project	Review that you know – Topic Readiness Assessment Formative assessments (admit and exit tickets) Mid – Topic Assessment Lesson quizzes Topic Assessment/Performance Assessment End of the Year Assessment

Standard for Mathematical Practice	Student Friendly Language
1. Make sense of problems and persevere in solving them.	• I can try many times to understand and solve a math problem.
2. Reason abstractly and quantitatively.	• I can think about the math problem in my head, first.
3. Construct viable arguments and critique the reasoning of others.	• I can make a plan, called a strategy, to solve the problem and discuss other students' strategies too.
4. Model with mathematics.	• I can use math symbols and numbers to solve the problem.
5. Use appropriate tools strategically.	• I can use math tools, pictures, drawings, and objects to solve the problem.
6. Attend to precision.	• I can check to see if my strategy and calculations are correct.
7. Look for and make use of structure	• I can use what I already know about math to solve the problem.
8. Look for and express regularity in repeated reasoning.	• I can use a strategy that I used to solve another math problem.

Engaging in the Mathematical Practices (Look-fors)

Mathematics Practices	Students:	Teachers:
productive math thinker — 1. **Make sense of problems and persevere in solving them**	☐ Understand the meaning of the problem and look for entry points to its solution ☐ Analyze information (givens, constrains, relationships, goals) ☐ Make conjectures and plan a solution pathway ☐ Monitor and evaluate the progress and change course as necessary ☐ Check answers to problems and ask, "Does this make sense?" Comments:	☐ Involve students in rich problem-based tasks that encourage them to persevere in order to reach a solution ☐ Provide opportunities for students to solve problems that have multiple solutions ☐ Encourage students to represent their thinking while problem solving Comments:
6. **Attend to precision**	☐ Communicate precisely using clear definitions ☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels ☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision ☐ Provide carefully formulated explanations ☐ Label accurately when measuring and graphing Comments:	☐ Emphasize the importance of precise communication by encouraging students to focus on clarity of the definitions, notation, and vocabulary used to convey their reasoning ☐ Encourage accuracy and efficiency in computation and problem-based solutions, expressing numerical answers, data, and/or measurements with a degree of precision appropriate for the context of the problem Comments:
2. **Reason abstractly and quantitatively**	☐ Make sense of quantities and relationships in problem situations ☐ Represent abstract situations symbolically and understand the meaning of quantities ☐ Create a coherent representation of the problem at hand ☐ Consider the units involved ☐ Flexibly use properties of operations Comments:	☐ Facilitate opportunities for students to discuss or use representations to make sense of quantities and their relationships ☐ Encourage the flexible use of properties of operations, objects, and solution strategies when solving problems ☐ Provide opportunities for students to decontextualize (abstract a situation) and/or contextualize (identify referents for symbols involved) the mathematics they are learning Comments:
3. **Construct viable arguments and critique the reasoning of others**	☐ Use definitions and previously established causes/effects (results) in constructing arguments ☐ Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions ☐ Listen to or read the arguments of others ☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments Comments:	☐ Provide and orchestrate opportunities for students to listen to the solution strategies of others, discuss alternative solutions, and defend their ideas ☐ Ask higher-order questions which encourage students to defend their ideas ☐ Provide prompts that encourage students to think critically about the mathematics they are learning Comments:

* All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

Mathematics Practices	Students:	Teacher(s):
4. **Model with mathematics**	☐ Apply prior knowledge to solve real world problems ☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas ☐ Use assumptions and approximations to make a problem simpler ☐ Check to see if an answer makes sense within the context of a situation and change a model when necessary Comments:	☐ Use mathematical models appropriate for the focus of the lesson ☐ Encourage student use of developmentally and content-appropriate mathematical models (e.g., variables, equations, coordinate grids) ☐ Remind students that a mathematical model used to represent a problem's solution is 'a work in progress,' and may be revised as needed Comments:
5. **Use appropriate tools strategically**	☐ Make sound decisions about the use of specific tools (Examples might include: calculator, concrete models, digital technologies, pencil/paper, ruler, compass, protractor) ☐ Use technological tools to visualize the results of assumptions, explore consequences, and compare predications with data ☐ Identify relevant external math resources (digital content on a website) and use them to pose or solve problems ☐ Use technological tools to explore and deepen understanding of concepts Comments:	☐ Use appropriate physical and/or digital tools to represent, explore and deepen student understanding ☐ Help students make sound decisions concerning the use of specific tools appropriate for the grade level and content focus of the lesson ☐ Provide access to materials, models, tools and/or technology-based resources that assist students in making conjectures necessary for solving problems Comments:
7. **Look for and make use of structure**	☐ Look for patterns or structure, recognizing that quantities can be represented in different ways ☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems ☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems Comments:	☐ Engage students in discussions emphasizing relationships between particular topics within a content domain or across content domains ☐ Recognize that they quantitative relationships modeled by operations and their properties remain important regardless of the operational focus of a lesson ☐ Provide activities in which students demonstrate their flexibility in representing mathematics in a number of ways e.g., $76 = (7 \times 10) + 6$; discussing types of quadrilaterals, etc. Comments:
8. **Look for and express regularity in repeated reasoning**	☐ Notice repeated calculations and look for general methods and shortcuts ☐ Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings Comments:	☐ Engage students in discussion related to repeated reasoning that may occur in a problem's solution ☐ Draw attention to the prerequisite steps necessary to consider when solving a problem ☐ Urge students to continually evaluate the reasonableness of their results Comments:

ARKANSAS ACADEMIC STANDARDS

Arkansas Mathematics Standards

Arkansas Mathematics Standards
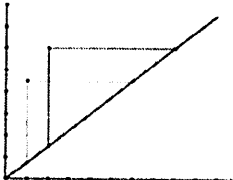## Grades 6-8
2016

Grade 8 - Arkansas Mathematics Standards

The Number System	Know that there are numbers that are not rational, and approximate them by rational numbers
AR.Math.Content.8.NS.A.1	Know that numbers that are not rational are called irrational: • Understand that every number has a decimal expansion For example: 2=2.00... • Write a fraction a/b as a repeating decimal • Write a repeating decimal as a fraction
AR.Math.Content.8.NS.A.2	Use rational approximations of *irrational numbers* to compare the size of *irrational numbers*, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2) For example: By truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

Grade 8 - Arkansas Mathematics Standards

Expressions and Equations	Work with radicals and integer exponents
AR.Math.Content.8.EE.A.1	Know and apply the properties of *integer exponents* to generate equivalent numerical *expressions* using product, quotient, power to a power, or expanded form
AR.Math.Content.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations: • Use square root symbols to represent solutions to equations of the form $x^2 = p$, where p is a positive rational number Evaluate square roots of small perfect squares. • Use cube root symbols to represent solutions to equations of the form $x^3 = p$, where p is a rational number. Evaluate square roots and cube roots of small perfect cubes
AR.Math.Content.8.EE.A.3	Use numbers expressed in the form of a single digit times an *integer* power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other For example: Estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.
AR.Math.Content.8.EE.A.4	• Perform operations with numbers expressed in scientific notation, including problems where both standard form and scientific notation are used • Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading) • Interpret scientific notation that has been generated by technology

Expressions and Equations	Understand the connections between proportional relationships, lines, and linear equations
AR.Math.Content.8.EE.B.5	• Graph proportional relationships, interpreting the unit rate as the slope of the graph. • Compare two different proportional relationships represented in different ways (graphs, tables, equations) For example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

AR.Math.Content.8.EE.B.6	- Using a non-vertical or non-horizontal line, show why the slope m is the same between any two distinct points by creating similar triangles - Write the equation $y=mx + b$ for a line through the origin - Be able to write the equation $y = mx + b$ for a line intercepting the vertical axis at b

Expressions and Equations	**Analyze and solve linear equations and pairs of simultaneous linear equations**
AR.Math.Content.8.EE.C.7	Solve linear equations in one variable: - Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions Note: Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers) - Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms Note: Students should solve equations with variables on both sides.
AR.Math.Content.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations: - Find solutions to a system of two linear equations in two variables so they correspond to points of intersection of their graphs - Solve systems of equations in two variables algebraically using simple substitution and by inspection (e.g., 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6) - Solve real-world mathematical problems by utilizing and creating two linear equations in two variables. For example: Given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Grade 8 - Arkansas Mathematics Standards

Functions	Define, evaluate, and compare functions
AR.Math.Content.8.F.A.1	• Understand that a *function* is a rule that assigns to each input exactly one output • The graph of a *function* is the set of ordered pairs consisting of an input and the corresponding output Note: An informal discussion of *function notation* is needed; however, student assessment is not required.
AR.Math.Content.8.F.A.2	Compare properties (e.g., y-intercept/initial value, slope/rate of change) of two *functions* each represented in a different way (e.g., algebraically, graphically, numerically in tables, or by verbal descriptions) For example: Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
AR.Math.Content.8.F.A.3	Identify the unique characteristics of *functions* (e.g., linear, quadratic, and exponential) by comparing their graphs, equations, and input/output tables

Functions	Use functions to model relationships between quantities

AR.Math.Content.8.F.B.4	Construct a *function* to model a linear relationship between two quantities:
	• Determine the rate of change and initial value of the *function* from:
	    o a verbal description of a relationship
	    o two (*x, y*) values
	    o a table
	    o a graph
	
	• Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values

AR.Math.Content.8.F.B.5	• Describe the functional relationship between two quantities by analyzing a graph (e.g., where the *function* is increasing or decreasing, linear or nonlinear) • Sketch a graph that exhibits the features of a *function* that has been described verbally

Grade 8 - Arkansas Mathematics Standards

Geometry	Understand congruence and similarity using physical models, transparencies, or geometry software
AR.Math.Content.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations: • Lines are taken to lines, and line segments to line segments of the same length • Angles are taken to angles of the same measure • Parallel lines are taken to parallel lines
AR.Math.Content.8.G.A.2	• Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations • Given two congruent figures, describe a sequence that exhibits the congruence between them
AR.Math.Content.8.G.A.3	Given a two-dimensional figure on a *coordinate plane*, identify and describe the effect (rule or new coordinates) of a transformation (dilation, translation, rotation, and reflection): • Image to pre-image • Pre-image to image
AR.Math.Content.8.G.A.4	• Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations • Given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them
AR.Math.Content.8.G.A.5	Use informal arguments to establish facts about: • The angle sum and exterior angle of triangles For example: Arrange three copies of the same triangle so that the sum of the three angles appears to form a line. • The angles created when parallel lines are cut by a transversal For example: Give an argument in terms of translations about the angle relationships. • The angle-angle criterion for similarity of triangles

Grade 8 - Arkansas Mathematics Standards

Geometry	Understand and apply the Pythagorean Theorem
AR.Math.Content.8.G.B.6	Model or explain an informal proof of the Pythagorean Theorem and its converse
AR.Math.Content.8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions
AR.Math.Content.8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system

Geometry	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres
AR.Math.Content.8.G.C.9	Develop and know the formulas for the volumes and surface areas of cones, cylinders, and spheres and use them to solve real- world and mathematical problems

Grade 8 - Arkansas Mathematics Standards

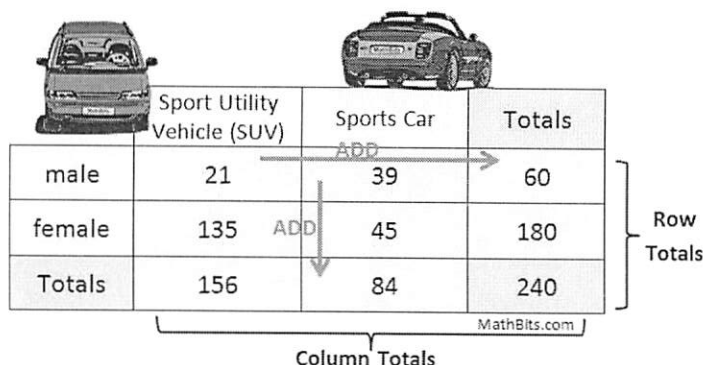| Statistics and Probability	Investigate patterns of association in bivariate data
AR.Math.Content.8.SP.A.1	• Construct and interpret scatter plots for *bivariate* measurement data to investigate patterns of association between two quantities • Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
AR.Math.Content.8.SP.A.2	• Know that straight lines are widely used to model relationships between two quantitative variables • For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line For example: Identify weak, strong, or no correlation.
AR.Math.Content.8.SP.A.3	Use the equation of a linear model to solve problems in the context of *bivariate* measurement data, interpreting the slope and intercepts For example: In a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

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AR.Math.Content.8.SP.A.4	• Understand that patterns of association can also be seen in *bivariate* categorical data by displaying frequencies and relative frequencies in a two-way table • Construct and interpret a two-way table on two categorical variables collected from the same subjects • Use relative frequencies calculated for rows or columns to describe possible association between the two variables

Example: Two-Way Frequency Table
http://mathbitsnotebook.com/Algebra1/StatisticsReg/ST2TwoWayTable.html

	Sport Utility Vehicle (SUV)	Sports Car	Totals
male	21	39	60
female	135	45	180
Totals	156	84	240

Column Totals

Row Totals

MathBits.com

Example: Two-Way Relative Frequency Table

Whole Table Relative Frequencies - Divide all cells by 240.

MathBits.com	Sport Utility Vehicle (SUV)	Sports Car	Totals
male	$\frac{21}{240} = 0.09$	$\frac{39}{240} = 0.16$	$\frac{60}{240} = 0.25$
female	$\frac{135}{240} = 0.56$	$\frac{45}{240} = 0.19$	$\frac{180}{240} = 0.75$
Totals	$\frac{156}{240} = 0.65$	$\frac{84}{240} = 0.35$	$\frac{240}{240} = 1.00$

For example: Students might be asked to interpret from the tables above, if they saw an SUV in the parking lot, would it be more likely to belong to a male or female?

Note: Suggested connections for instruction: Standard 8.NS.1. On the Two-Way Relative Frequency Table, it is not required to include the fractional representation for each value, this is simply provided as an example.