Gateway School District
Curriculum Map

Middle Schools (5-8)
Moss Side Middle School (5-6)
9000 Gateway Campus Blvd.
Monroeville, PA 15146
412-373-5830

Gateway Middle School
4450 Old William Penn Highway
Monroeville, PA 15146
412-373-5780

# Curriculum Map: GMS - 8 Mathematics

Course: Math: 8

Grade(s): 8

## Unit 1: The Number System and Properties of Exponents

Subject: Mathematics

| Brief Summary of Unit |
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| Students begin extending the properties of exponents to integer exponents. They use the number line model to support their understanding of the rational numbers and the number system. The number system is revisited at the end of the year to develop the real number line through a detailed study of irrational numbers. |

**Stage One - Desired Results**

**Established Goals:**(Standards of Learning, content standards)

1. Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents). *Properties will be provided.*
2. Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of perfect squares (up to and including 122) and cube roots of perfect cubes (up to and including 53) without a calculator.
3. Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10 and express how many times larger or smaller one number is than another. Compare and/or order rational numbers.
4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in 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 (e.g., interpret 4.7EE9 displayed on a calculator as 4.7 × 109).
5. Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths).
6. Convert a terminating or repeating decimal to a rational number (limit repeating decimals to thousandths).
7. Distinguish between rational and irrational numbers using their properties.
8. Convert a terminating or repeating decimal into a rational number.

| **Understandings:** What will students | **Essential Questions:** What arguable, |
|---|---|

| understand (about what big ideas) as a result of the unit? "Students will understand that..." | recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
|---|---|
| 1. Mathematical relationships can be represented as expressions, equations, and inequalities in mathematical situations.<br>2. Numerical quantities, calculations, and measurements can be estimated or analyzed by using appropriate strategies and tools.<br>3. Data can be modeled and used to make inferences.<br>4. Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.<br>5. Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.<br>6. Mathematical relationships among numbers can be represented, com<br>pared, and communicated.<br>7. Measurement attributes can be quantified and estimated using customary and non-customary units of measure.<br>8. Patterns exhibit relationships that can be extended, described, and generalized. | 1. How are relationships represented mathematically?<br>2. How can expressions, equations, and inequalities be used to quantify, solve, model and/or analyze mathematical situations?<br>3. What does it mean to estimate or analyze numerical quantities?<br>4. When is it is appropriate to estimate versus calculate?<br>5. What makes a tool and/or strategy appropriate for a given task?<br>6. How does the type of data influence the choice of display?<br>7. How can probability and data analysis be used to make predictions?<br>8. How are spatial relationships, including shape and dimension, used to draw, construct, model, and represent real situations or solve problems?<br>9. How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?<br>10. How can geometric properties and theorems be used to describe, model, and analyze situations?<br>11. How can data be organized and represented to provide insight into the relationship between quantities?<br>12. How is mathematics used to quantify, compare, represent, and model numbers?<br>13. How can mathematics support effective communication?<br>14. Why does "what" we measure influence "how" we measure?<br>15. In what ways are the mathematical attributes of objects or processes measured, calculated, and/or interpreted?<br>16. How precise do measurements and calculations need to be?<br>17. How can patterns be used to describe relationships in mathematical situations?<br>18. How can recognizing repetition or regularity assist in solving problems more efficiently? |

**Stage Two - Assessment Evidence**

**Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met?

Solve each of the following. Show all your work. Circle your answers. 3 points each.

1. $x + 18 = 8$

2. $x - 21 = -10$

Solve each of the following. **Show all your work**. 3 points each.

1. $2x - 5 = 17$

2. $3x + 12 = -9$

Solve each of the following. Show all your work. Circle your answers. 3 points each. Remember, if you check your answer correctly, you will receive one bonus point for each problem.

1. $\frac{3x}{3} + 2x = 35$
2. $2(x - 5) = 24$
3. $5x - 8x = 36$
4. $7x - 6 = 6x + 11$
5. $4x - 2x + 1 = 7$
6. $-2y + 5 + 5y = 14$
7. $3x - 4x + 6 = -2$
8. $-3x + 8 + (-2x) = -1$
9. $3(x + 8) = 21$
10. $15 = -3(x - 1)$

**Other Evidence:**(quizzes, tests and so on)

## Stage Three - Learning Plan

# Unit 2: Congruence

Subject: Mathematics

| Brief Summary of Unit |
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| Students study congruence by experimenting with rotations, reflections, and translations of geometrical figures. Their study of congruence culminates with an introduction to the Pythagorean Theorem in which the teacher guides students through the proof of the theorem using the areas of squares built on each side of the right triangle. Students practice the theorem in real-world applications and mathematical problems throughout the year. (In the upcoming unit on Irrational Numbers using Geometry, students learn to prove the Pythagorean Theorem on their own and are assessed on that knowledge.) |

## Stage One - Desired Results

**Established Goals:**(Standards of Learning, content standards)

1. Identify and apply properties of rotations, reflections, and translations. Example: Angle measures are preserved in rotations, reflections, and translations.
2. Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them.
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures, using coordinates.
4. Apply the converse of the Pythagorean Theorem to show a triangle is a right triangle.
5. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
6. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
7. Use transformations to demonstrate congruence and similarity of geometric figures.
8. Use various tools to understand and apply geometric transformations to geometric figures.
9. Apply the Pythagorean Theorem and its converse to solve mathematical problems in two and three dimensions.

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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## Stage Two - Assessment Evidence

**Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met?

**Other Evidence:**(quizzes, tests and so on)

## Stage Three - Learning Plan

# Unit 3: Similarity

Subject: Mathematics

| Brief Summary of Unit |
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| Students study the more complex work of understanding the effects of dilations on geometrical figures in their study of similarity. They use similar triangles to solve unknown angle, side length and area problems. |

| Stage One - Desired Results |
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| **Established Goals:**(Standards of Learning, content standards)<br><br>1. Identify and apply properties of rotations, reflections, and translations. Example: Angle measures are preserved in rotations, reflections, and translations.<br>2. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures, using coordinates.<br>3. Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them.<br>4. Use transformations to demonstrate congruence and similarity of geometric figures.<br>5. Use various tools to understand and apply geometric transformations to geometric figures.<br>6. Apply the Pythagorean Theorem and its converse to solve mathematical problems in two and three dimensions. |

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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| Stage Two - Assessment Evidence |
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| **Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met? |
| **Other Evidence:**(quizzes, tests and so on) |

| Stage Three - Learning Plan |
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# Unit 4: Linear Equations

Subject: Mathematics

| Brief Summary of Unit |
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| Students use similar triangles learned in prior lessons to explain why the slope of a line is well-defined. Students learn the connection between proportional relationships, lines, and linear equations as they develop ways to represent a line by different equations ($y = mx + b$, $y - y1 = m(x - x1)$, etc.). They analyze and solve linear equations and pairs of simultaneous linear equations. The equation of a line provides a natural transition into the idea of a function explored in the next two modules. |

## Stage One - Desired Results

**Established Goals:**(Standards of Learning, content standards)

1. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
2. Use similar right triangles to show and explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane.
3. Derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
4. Write and identify linear equations in one variable with one solution, infinitely many solutions, or no solutions. 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).
5. Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
6. Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
7. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. Example: $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
8. Solve real-world and mathematical problems leading to two linear equations in two variables. 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.
9. Analyze and describe linear relationships between two variables, using slope.
10. Interpret solutions to a linear equation and systems of two linear equations.
11. Analyze, model and solve linear equations.
12. Analyze and solve pairs of simultaneous equations.

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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| Stage Two - Assessment Evidence |
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| **Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met? |
| **Other Evidence:**(quizzes, tests and so on) |
| **Stage Three - Learning Plan** |

# Unit 5: Functions from Geometry

Subject: Mathematics

| Brief Summary of Unit |
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| Students are introduced to functions in the context of linear equations and area/volume formulas. They define, evaluate, and compare functions using equations of lines as a source of linear functions and area and volume formulas as a source of non-linear functions. |

| Stage One - Desired Results |
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| **Established Goals:**(Standards of Learning, content standards)<br><br>1. Determine whether a relation is a function.<br>Compare properties of two functions each represented in a different way (i.e., algebraically, graphically,<br>2. numerically in tables, or by verbal descriptions).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.<br>3. Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear.<br>4. Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems. Formulas will be provided.<br>5. Define, interpret, and compare functions displayed algebraically, graphically, numerically in tables, or by verbal descriptions.<br>6. 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. |

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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| Stage Two - Assessment Evidence |
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| **Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met? |
| **Other Evidence:**(quizzes, tests and so on) |

| Stage Three - Learning Plan |
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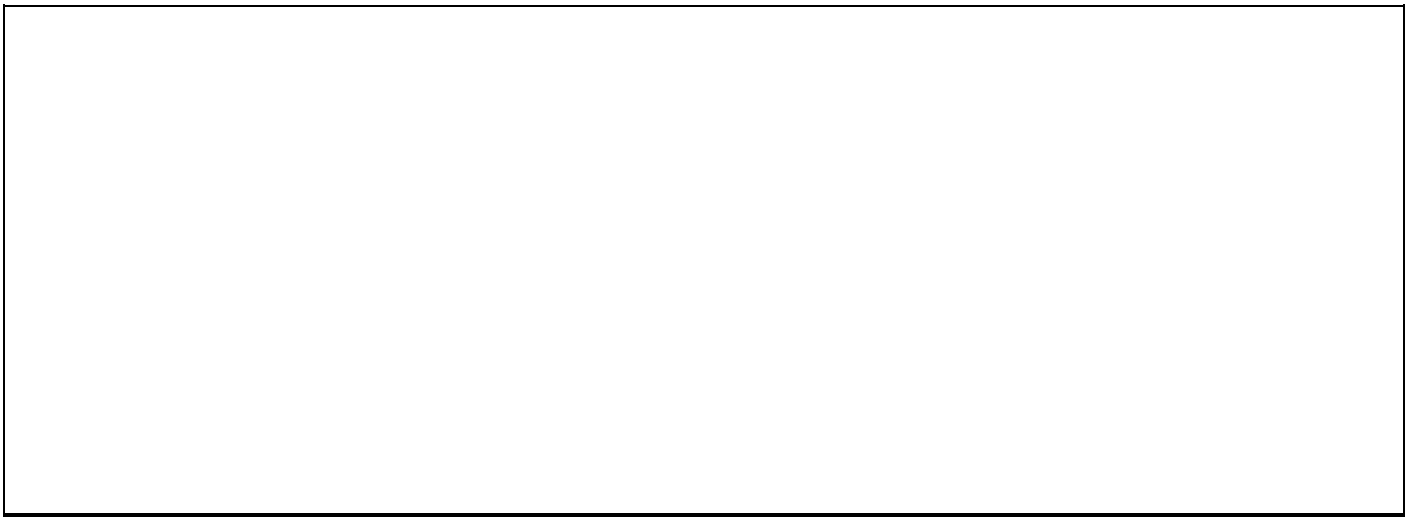

# Unit 6: Linear Functions

Subject: Mathematics

| Brief Summary of Unit |
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| Students return to linear functions in the context of statistics and probability as bivariate data provides support in the use of linear functions. |

## Stage One - Desired Results

**Established Goals:**(Standards of Learning, content standards)

1. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from 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.
2. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.
3. 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 correlation, linear association, and nonlinear association.
4. For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line.
5. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. 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.
6. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible associations between the two variables. Example: Given data on whether students have a curfew on school nights and whether they have assigned chores at home, is there evidence that those who have a curfew also tend to have chores?
7. Construct, analyze, and interpret bivariate data displayed in scatter plots.
8. Identify and use linear models to describe bivariate measurement data.
9. Use frequencies to analyze patterns of association seen in bivariate data.

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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## Stage Two - Assessment Evidence

**Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met?

**Other Evidence:**(quizzes, tests and so on)

## Stage Three - Learning Plan

# Unit 7: Irrational Numbers using Geometry

Subject: Mathematics

## Brief Summary of Unit

Students have been using the Pythagorean Theorem for several months. They are sufficiently prepared to learn and explain a proof of the theorem on their own. The Pythagorean Theorem is also used to motivate a discussion of irrational square roots (irrational cube roots are introduced via volume of a sphere). Thus, as the year began with looking at the number system, so it concludes with students understanding irrational numbers and ways to represent them (radicals, non-repeating decimal expansions) on the real number line.

## Stage One - Desired Results

**Established Goals:**(Standards of Learning, content standards)

1. Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144).Example: $\sqrt{5}$ is between 2 and 3 but closer to 2.
2. Use rational approximations of irrational numbers to compare and order irrational numbers.
3. Locate/identify rational and irrational numbers at their approximate locations on a number line.
4. Apply the converse of the Pythagorean Theorem to show a triangle is a right triangle.
5. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
6. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
7. Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems. **Formulas will be provided.**
8. Use rational approximations of irrational numbers to compare the size of irrational numbers.
9. Apply the Pythagorean Theorem and its converse to solve mathematical problems in two and three dimensions.

| **Understandings:** What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:** What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |
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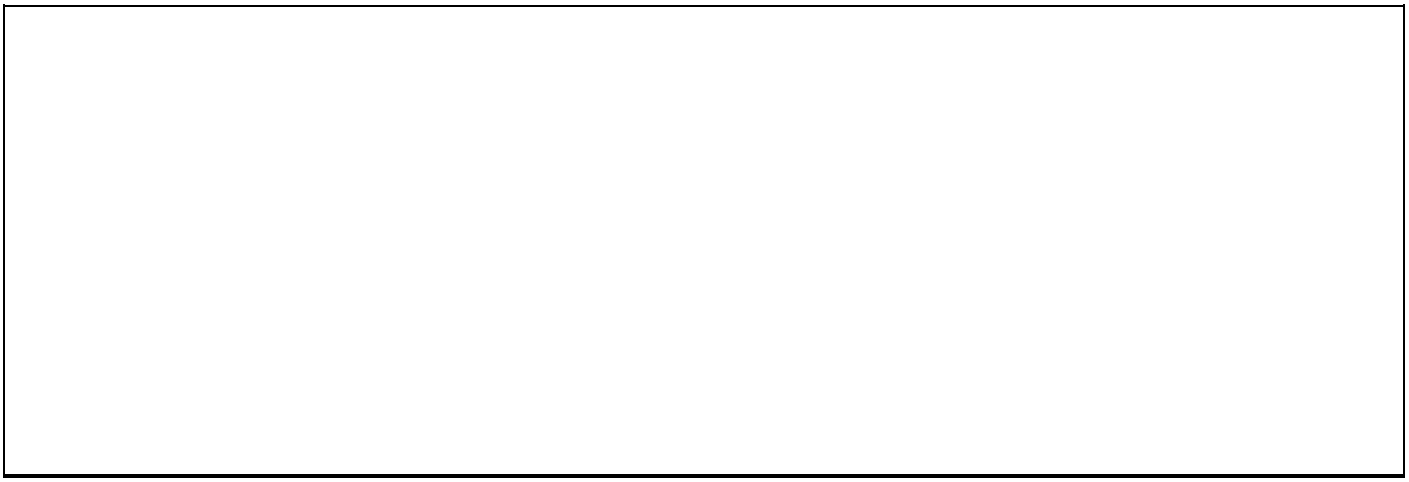
## Stage Two - Assessment Evidence

**Performance Tasks:** What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met?

**Other Evidence:**(quizzes, tests and so on)

## Stage Three - Learning Plan



# Unit Summary: Gr 8 - Standards for Mathematical Practice

Subject: Mathematics

| Brief Summary of Unit |
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| **Standards for Mathematical Practice**<br>Mathematical Practices resource page on SAS<br><br>Unit 1:<br>MP# 2. Reason abstractly and quantitatively<br>MP# 5. Use appropriate tools strategically<br>MP# 6. Attend to precision<br>MP# 7. Look for and make use of structure<br><br>Unit 3:<br>MP# 4. Model with mathematics<br>MP# 5. Use appropriate tools strategically<br>MP# 6. Attend to precision<br>MP# 7. Look for and make use of structure<br>MP# 8. Look for and express regularity in repeated reasoning<br><br>Unit 2, 4, 5, 6, 7:<br>MP# 1. Make sense of problems and persevere in solving them<br>MP# 2. Reason abstractly and quantitatively<br>MP# 3. Construct viable arguments and critique the reasoning of others<br>MP# 4. Model with mathematics<br>MP# 5. Use appropriate tools strategically<br>MP# 6. Attend to precision<br>MP# 7. Look for and make use of structure<br>MP# 8. Look for and express regularity in repeated reasoning |

| Stage One - Desired Results | |
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| **Established Goals:**(Standards of Learning, content standards) | |
| **Understandings:**What will students understand (about what big ideas) as a result of the unit? "Students will understand that..." | **Essential Questions:**What arguable, recurring, and thought-provoking questions will guide inquiry and point toward the big ideas of the unit? |

| Stage Two - Assessment Evidence |
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| **Performance Tasks:**What evidence will be collected to determine whether or not the understandings have been developed, the knowledge and skill attained, and the state standards met? |
| **Other Evidence:**(quizzes, tests and so on) |

| Stage Three - Learning Plan |
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| span style=font-family Tahoma, Verdana , Helvetica , sans-serif; font-size 10pt; font-weight bold; |

color Black; vertical-aligntop;Learning ExperiencesspanWhat sequence of learning activities and teaching will help students to engage with, develop, and demonstrate the desired understandings List the key teaching and learning activities in sequence. Code each activity with the appropriate initials of the WHERETO elements. The WHERETO elements are bWb - Where are we going Why What is expected bHb - How will we hook and hold student interest bEb - How will we equip students for expected performances bRb - How will we help students rethink and revise bE2b - How will students self-evaluate and reflect on their learning bTb - How will we tailor learning to varied needs, interests, learning styles bOb - How will we organize and sequence the learning Include at least one strategy included in the Marzano, Pickering, and Pollock (2001) text.br