Pre-Algebra – 8
Mathematics Curriculum

Francis Howell School District

HOME SCHOOL COMMUNITY

LEARNING TOGETHER

Board Approved: July 17, 2014

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Francis Howell School District

Mission Statement

Francis Howell School District is a learning community where all students reach their full potential.

Vision Statement

Francis Howell School District is an educational leader that builds excellence through a collaborative culture that values students, parents, employees, and the community as partners in learning.

Values

Francis Howell School District is committed to:

- Providing a consistent and comprehensive education that fosters high levels of academic achievement for all
- Operating safe and well-maintained schools

- Promoting parent, community, student, and business involvement in support of the school district
- Ensuring fiscal responsibility
- Developing character and leadership

Francis Howell School District Graduate Goals

Upon completion of their academic study in the Francis Howell School District, students will be able to:

1. Gather, analyze and apply information and ideas.
2. Communicate effectively within and beyond the classroom.
3. Recognize and solve problems.
4. Make decisions and act as responsible members of society.

Mathematics Graduate Goals

Upon completion of their mathematics study in the Francis Howell School District, students will be able to:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Course Rationale

In order to be effective citizens in the 21st century, students need to understand mathematics. Students often encounter problem situations that require reasoning, computation, and communication. We regularly study the most efficient methods for reaching solutions, but also realize that examining different solution methods help develop more flexible solving skills. The instruction and assessment is focused on instilling students with enduring understandings of mathematics. Pre-Algebra – 8 seeks to help students develop a strong foundation for future algebra courses and conceptual understanding in real-life problem solving.

Course Description for Pre-Algebra - 8

This course is designed to provide students with a strong foundation for future algebra courses and conceptual understanding in real-life problem solving. The focus is 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.

Francis Howell School District
Pre-Algebra – 8 Curriculum Map

Unit	Standard	Description	Textbook Reference
SEMESTER 1			
Real Numbers & Exponents	8.NS.A.1	Know that numbers are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert decimal expansion which repeats eventually into a rational number.	3.10/6.3
	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.	3.10
	8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.	2.6/2.7/2.8
	8.EE.A.2	Use square roots and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$ when p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect squares. Know that the $\sqrt{2}$ is irrational.	3.8/3.9/3.10 Cubes Pg. 154-55
	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 that the other.	2.9 7.2 Algebra
	8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Used scientific notation and choose units of appropriate size for measurements of very large or very small quantities.	2.9 7.2 Algebra
	Are you ready?	Evaluating Expressions/Order of Operations Distributive Property	1.6 and supplement

Equations	Are you ready?	One and two step equations Equations with integers and rational numbers	
	8.EE.C.7a	Solve linear equations in one variable. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which 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	10.1 10.2 10.3
	8.EE.C.7b	Solve linear equations in one variable. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	10.1 10.2 10.3
Functions	Are you ready?	Proportions Similarity Units/Ratios	7.1/7.2 7.4/7.6
	8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of a graph. Compare two different proportional relationships represented in different ways.	11.1/11.2
	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.	12.4
	8.EE.B.6	Use similar triangles to explain why the some m is the same between any two distinct points on a non-vertical line in the coordinate plane, derive the equation y=mx+b for a line through the origin and the equation y=mx+b for a line intercepting the vertical axis as b.	11.3
	8.F.A.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)	11.1/11.2/11.3
	8.F.A.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.	11.1/11.2/11.3
	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 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.	12.4/12.5 Refer to 12.6/12.7
	8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	12.4/12.5 Refer to 12.6/12.7

Systems of Equations	8.EE.C.8a	Analyze and solve pairs of simultaneous linear equations - Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	10.6 6.1-6.4 from Algebra
	8.EE.C.8b	Analyze and solve pairs of simultaneous linear equations - Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations.	10.6 6.1-6.4 from Algebra
SEMESTER 2			
Systems of Equations	8.EE.C.8c	Analyze and solve pairs of simultaneous linear equations - Solve real-world and mathematical problems leading to two linear equations in two variables.	10.6 6.1-6.4 from Algebra
Pythagorean Theorem	8.G.B.6	Explain the proof of the Pythagorean Theorem and its converse.	6.3
	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 dimensional.	6.3
	8.G.B.8	Apply Pythagorean Theorem to find the distance between two points in a coordinate system.	6.3
Geometry	8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	5.2/5.3
	8.G.A.1a	Verify experimentally the properties of rotations, reflections, and translations. Lines are taken to lines, and line segments to line segments of the same length	5.7
	8.G.A.1b	Verify experimentally the properties of rotations, reflections, and translations. -Angels are taken to angles of the same measure.	5.7
	8.G.A.1c	Verify experimentally the properties of rotations, reflections, and translations. -Parallel lines are taken to parallel lines.	5.7
	8.G.A.2	Understanding 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.	5.7
	8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	5.7/7.5
	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	5.7/7.5

		dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	
	8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	
Statistics and Probability	8.SP.A1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.	4.7 SP
	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.	4.7 SP 11.7 Line of Best Fit
	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 intercept.	11.3/4.7/11.7
	Supple-ment as needed	Measures of Center	4.3
	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 summarizing data 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.	Skills bank Page 785 Supplement
	8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	12.4/12.5 Refer to 12.6/12.7
	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.	5.7/7.5

Content Area: Math	Course: Pre-Algebra - 8	UNIT 1: Real Numbers & Exponents
Unit Description: Beginning with familiar number sense topics helps students transition into the Grade 8 content. Turning decimal expansions into fractions and deepening understanding of the meaning of decimal expansions sets a firm foundation for understanding irrational numbers. Students will learn that the square roots of perfect squares are rational numbers, and that the square roots of non-perfect squares, such as $\sqrt{2}$ or $\sqrt{7}$, are examples of irrational numbers. Students will understand the value of square roots and cube roots and use this understanding to solve equations involving perfect squares and cubes. Further work with exponents, including scientific notation, naturally flow from the understanding of squares and cubes.		**Unit Timeline:** 5 weeks

DESIRED RESULTS
<u>Transfer Goal</u> - *Students will be able to independently use their learning to…* ● Make sense of problems and persevere in solving them ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision

- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Decimals that "terminate" actually repeat the digit zero. *(*$2.5 = 2.500000...$*) (8.NS.1)*
2. Numbers that repeat in their decimal form are called rational. (8.NS.1)
3. Numbers that do not repeat in their decimal form are called irrational. (8.NS.1)
4. The number $\sqrt{2}$ is irrational. (8.EE.2)
5. The square root of the area of a square represents the side length of the square. (8.EE.2)
6. Exponent operation properties. (8.EE.1)

Essential Questions: *Students will keep considering…*

- Why do you convert a rational number into a decimal?
- How do you use a number line to compare the size of two irrational numbers?
- How do you evaluate a numerical expression with integer exponents?
- What are the numbers that are perfect squares and non-perfect squares?
- How do you use scientific notation?
- What are the laws of exponents?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Perform operations with rational numbers including negative rational numbers. (7.NS) ● Rewrite expressions in different forms. (7.EE.A.2) **Skills**: *Students will be able to…* ● Distinguish between rational and irrational numbers. (8.NS.A.1) ● Convert a decimal expansion which repeats eventually into a rational number. (8.NS.A.1) ● Find rational approximations of irrational numbers. (8.NS.A.2) ● Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions.(8.NS.A.2) ● Evaluate square roots of small perfect squares and cube roots of small perfect cubes. (8.EE.A.2) ● Use square root and cube root symbols to solve and represent solutions of equations. (8.EE.A.2) ● Apply the properties of integer exponents to generate equivalent numerical expressions. (8.EE.A.1) ● Estimate very large or very small quantities using a single digit times a power of ten. (8.EE.A.3) ● Express how much larger one number expressed as a single digit times a power of ten is than another in the context of the situation. (8.EE.A.3) ● Express numbers in scientific notation. (8.EE.A.4) ● Perform operations with numbers expressed in scientific notation and a mix of scientific notation and decimal notation. (8.EE.A.4) ● Choose appropriate units of measurements for a given number in scientific notation. (8.EE.A.4)		**<u>Mathematical Practices</u>** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **<u>Grade Level Standards</u>** **Know that there are numbers that are not rational, and approximate them by rational numbers.** Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. 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., π2). For example, by truncating the decimal expansion of √2,	 MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 **8.NS.A** 8.NS.A.1 8.NS.A.2

• Interpret scientific notation that has been generated by technology. (8.EE.A.4)		show that √2 is *between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* **Work with radicals and integer exponents.** Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.* Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. 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 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.* Perform operations with numbers expressed in scientific notation, including problems where both decimal 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.	**8.EE.A** 8.EE.A.1 8.EE.A.2 8.EE.A.3 8.EE.A.4

EVIDENCE of LEARNING			
Understanding # 6	Standards MP3 MP4 MP7 8.EE.A.1	**Unit Performance Assessment**: **Description of Assessment Performance Task:** ***Unit Performance Assessment: Real Numbers and Exponents*** (See Appendix 1.A) This performance task is meant to assess the understanding around the meaning of negative integer exponents. While it may be unfamiliar to some students, it is good for them to learn the convention that negative time is simply any time before t = 0. Students will complete a table and answer questions surrounding an experiment where bacteria population is known to double every hour. **Teacher will assess:** 1. Student ability to generate a table from a given pattern 2. Student ability to work with both positive and negative integer exponents 3. Student ability to substitute values in an equation to find the correct equation **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** 1. Students can accurately work with both positive and negative integer exponents 2. Formulate answers from given patterns and justify all steps. **Scoring Guide:** See Appendix 1.B	R/R Quadrant **D**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
# 2, #3, #4	MP5 MP7 8.NS.A.1 8.NS.A.2	1. Activity: **Estimating with Irrational Numbers and Placement on the Number Line** This can be completed individually or with a partner* ● Objective: Part 1 The first part of this learning activity can be used to either build or assess initial understandings related to rational approximations or irrational numbers. Students are comparing the size of irrational numbers. Part 2 The second part of this activity the students will plot irrational numbers on a number line. They will need to understand the idea of where they fit into a number system that includes the more familiar integer and rational numbers. ● Appendix Document: Appendix 1.C – Estimating with Irrational Numbers and Placement on the Number Line Appendix 1.D – Learning Activities Scoring Guide	● Cooperative Learning* ● Similarities and Differences	**B**
#1, #2, #3, #4	MP6 8.NS.A.2	2. Activity: **Real Number Race** ● Objective: This is a cooperative learning activity in which the student outcomes are as follows: ● Write a decimal approximation for an irrational number to a given decimal place ● Convert either repeating or terminal decimals into a fraction ● Explain the difference between a rational and an irrational number Materials: ● One copy of the real number hexagon per team ● Spinner or cube ● Two different colors of pencils for each student	● Cooperative Learning ● Similarities and Differences	**B**

		Directions: 1. S/he chooses one of their colors for rational and one for irrational 2. On each player's first turn, s/he will spin the spinner and get a real number, irrational number, rational number or lose a turn. 3. S/he colors a number on the hexagon that fits the category that they spun. If S/he spins a real number they can color either rational or irrational. 4. Students take turns with the spinner and marking their numbers. 5. The winner is the first player to get four in a diagonal row of one color. If a player colors an incorrect circle, the opponents should challenge her/him; a wrong move has the penalty of losing a spin and the color should be erased. ● Appendix Document: Appendix 1.E – Real Number Race Appendix 1.D – Learning Activities Scoring Guide		
# 6	MP1 MP2 MP3 MP4 MP5 8.EE.A.3 8.EE.A.4 ISTE-S.4	3. Activity: **Planets Activity** This activity uses information about the planets for comparisons using scientific notation and planet diameters. It is includes an argument piece where students can cast their vote as to whether Pluto should still be considered a planet. http://heasarc.nasa.gov/docs/cosmic/planets.html ● Objective: ● Students will be able to perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. ● Students will be able to 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). ● Students will be able to interpret scientific notation that has been generated by technology. ● Appendix Documents: Appendix 1.F – Planets Activity Appendix 1.G – Planets Activity Scoring Guide	● Cooperative Learning ● Technology research tools ● Similarities and Differences	**D**

# 6	MP1 MP2 MP3 MP4 8.EE.A.3 8.EE.A.4	4. Activity: **Fish Tank "Fun Facts"** This activity combines using precision with scientific notation and conversion within units. Students are using the capacity of fish tanks and the volume of the oceans in the world. Students are also asked to create a "fun fact" about their own task that they have designed. This can be completed individually or with a partner* ● Objective: ● Students will be able to perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. ● Students will be able to 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). ● Appendix Documents: Appendix 1.H – Fish Tank Fun Fact Appendix 1.I – Fish Tank Fun Fact Scoring Guide	● Cooperative Learning* ● Similarities and Differences	**C**

UNIT RESOURCES

Teacher Resources:

- http://heasarc.nasa.gov/docs/cosmic/planets.html (Website with planet information)
- http://www.nctm.org/resources
- Illustrative Mathematics: http://www.illustrativemathematics.org/
- Learnzillion: http://learnzillion.com/

Student Resources:

- http://heasarc.nasa.gov/docs/cosmic/planets.html (Website with planet information)
- Thinking Blocks: http://www.mathplayground.com/thinkingblocks.html
- Learnzillion: http://learnzillion.com/

Vocabulary:

- Exponent - An exponent is a number or a variable in an expression that represents how many times another number is used in repeated multiplication.
- Scientific notation – A form of writing numbers as the product of a power of 10 and a decimal number greater than or equal to one. Scientific notation makes it easier to work with very large and very small numbers.
- Irrational number – A number that cannot be written as a quotient of two integers.
- Rational number – Any number that can be written as a quotient of two integers or in the form of $\frac{a}{b}$
- Square root - The square root of x is the number that, when multiplied by itself, gives the number, x.
- Radical Sign – The radical sign is a symbol used in expressions when a root is to be taken. $\sqrt{36}$ means the square root of 36.
- Perfect square – A perfect square is the product of an integer and itself. Perfect squares are non-negative and can be written as x^2 when x is an integer.
- Cube root - A number that when cubed (taken to the power of 3) gives the original number.

Content Area: Math	Course: Pre-Algebra - 8	UNIT 2 : Equations
Unit Description: Students solve linear equations in one-variable using the distributive property and combining like terms.		**Unit Timeline:** 4 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Students will solve linear equations using the distributive property and by combining like terms, including equations with variables on both sides.
2. Students will simplify linear equations in one variable into the form of x=a, a=a, or a=b (where a and b are different numbers).
3. Students will write linear equations in one variable for a given number of solutions.

Essential Questions: ***Students will keep considering…***

- How can you find the value of an unknown quantity?
- What are the possible solutions for a linear equation with one variable?
- How can you write an equation to represent a real world problem?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Simplify linear expressions utilizing the distributive property and collecting like terms. ● Create a multi-step linear equation to represent a real-life situation. ● Solve equations with linear expressions on either or both sides including equations with one solution, infinitely many solutions, and no solutions. **Skills**: *Students will be able to…* ● Solve linear equations in one variable. Give examples of 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 equivalent equation of the form x= a, a=a, or a=b results (where a and b are different numbers). (8.EE.C.7a) ● Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. (8.EE.C.7b)		**Mathematical Practices** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **Grade Level Standards** Solve linear equations in one variable. a. Give examples of 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 equivalent equation of the form x= a, a=a, or a=b results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 8.EE.C.7 8.EE.C.7a 8.EE.C.7b

EVIDENCE of LEARNING			
Understanding # 1, #2, #3	Standards MP1 MP3 MP4 8.EE.C.7	**Unit Performance Assessment**: **Description of Assessment Performance Task:** ***Unit Performance Assessment: Equations*** (See Appendix 2.A) Students will generate linear equations and solve equations in one variable. Students will create equations to help them decide which method will earn the most money to purchase equipment for the school. The students also find equivalent expressions and finally decide on the amount of solutions equations have. **Teacher will assess:** 1. Student ability to show correct work. 2. Student understanding of equivalent expressions 3. Student ability to recognize the amount of solutions to an equation **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** Clearly explain their math reasoning as to why they chose the fundraiser method for the school. **Scoring Guide:** See Appendix 2.B	R/R Quadrant **D**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
#1, #2	MP1 MP2 MP5 MP6 MP7 8.EE.C.7b	1. Activity: **Simplifying Expressions** ● Objective: Part 1: Simplifying Expressions In this lesson, students use properties to combine like terms and simplify expressions. Appendix 2.C – Simplifying Expressions Appendix 2.D – Simplifying Expressions Teacher Notes Part 2: Algebraic Expressions In this lesson, students make predictions and then solve the expressions using substitution to check for equality. Students write rules that explain how the sets of expressions maintain equivalence while changing from one form to another. At the end of the lesson, students are asked to write a reflection where they give examples of the equivalence of equations given their properties. Appendix 2.E – Paired Algebraic Expressions Appendix 2.F – Paired Algebraic Expressions Teacher Notes Part 3: Art Class Project The art class has been asked to help decorate the new children's floor at the hospital. Each art student will decorate one wall tile. The decorated tiles will be bordered by plain tiles. Students will write an expression that will help him calculate the number of plain tiles he will need based on the number of decorated tiles. Appendix 2.G – Art Class Project Instructions Appendix 2.H – Art Class Project Appendix 2.I – Art Class Project Teacher Notes	● Cooperative Learning – Think Pair Share ● Similarities and Differences ● Summarizing and Note Taking ● Generating and Testing Hypotheses	**C**

#1, #2	MP 1 MP3 MP4 MP8 8.EE.C.7b	2. Activity: **Solving One-Step Equations** ● Objective: In this lesson students use properties of equality to solve one-step equations. Teacher begins by using a magic number trick to introduce inverse operations. Students then model the property of equality by creating a human scale to show the balance of an equation. The students practice the equations by using a cooperative learning strategy, Monkey See, Monkey Do. At the end of the lesson the teachers can informally evaluate the students using the activity, Order Please. ● Appendix Documents: Appendix 2.J – Solving One-Step Equations Instructions Appendix 2.K – Solving One-Step Equations Practice Problems Appendix 2.L – Solving One-Step Equations Order Please	● Homework and Practice ● Nonlinguistic Representations ● Cooperative learning ● Cues, Questions, and Advance Organizers	**C**
#1, #2	MP 1 MP2 MP4 8.EE.C.7b	3. Activity: **Multi-Step Equations – Relay Race** ● Objective: In this lesson students work with groups to solve multi-step problems that include distribution property and variables on both side. Put students in groups of 4 and assign them a number 1-4. Place the worksheet on person #1's desk to start. They solve problem #1 and hand the paper to Person #2. Person #2 plugs in the answer from Person #1 and solves their equation. This continues through Person #4.. ● Appendix Documents: Appendix 2.M – Multi-Step Equations Relay Race	● Homework and Practice ● Cooperative learning	**B**
#3	MP1 MP2 MP3 MP4 MP5	4. Activity: **Movie Rentals and Candles** ● Objective: <u>Part 1: Movie Rentals</u> In this lesson, students will decide on a fair price for membership and rental fees. Based on that information, students will have to determine when the membership is a better deal and when being a non-member is a better deal.	● Homework and Practice ● Generating and Testing Hypotheses	**C**

	8.EE.C.7a	<u>Part 2: Candles</u> In the second half of this activity, students will determine based on multiple representations at what time two candles of different heights will burn to the same height. ● Appendix Documents: Appendix 2.N – Movie Rentals and Candles		
#2	MP1 MP2 MP3 MP4 8.EE.C.7b	5. Activity: **Conversion between Celsius and Fahrenheit** ● Objective: Students learn a real-world application of linear equations with respect to the conversion of temperatures from Celsius to Fahrenheit and Fahrenheit to Celsius. Through class discussion or group work, students will discover and generate the equation for converting Celsius to Fahrenheit. They will graph their equations to confirm their findings. Included is an Exit Ticket at the end of the lesson. ● Appendix Documents: Appendix 2.O – Conversion between Celsius and Fahrenheit	● Homework and Practice ● Generating and Testing Hypotheses	**C**
#2, #3	MP2 MP6 MP8 8.EE.C.7a	6. Activity: **Identifying Solutions** ● Objective: Given different expressions, students will decide the solutions for each. Also, students are asked to create an equation that does not have a solution ● Appendix Documents: Appendix 2.P – Identifying Solutions	● Homework and Practice ● Generating and Testing Hypotheses	**C**
#1, #3	MP1	7. Activity: **Balance Scales and Cell Phone Plans**		**B**

	MP4 MP5 8.EE.C.7a	● Objective: In this Performance Task, students will continue to develop their ability to solve linear equations by determining the best cell phone plan based upon their personal use. They will consider the cost of the phone and the monthly service fee. ● Appendix Documents: Appendix 2.Q – Cell Phone Plans	● Homework and Practice ● Nonlinguistic representation ● Generating and Testing Hypothesis	

UNIT RESOURCES

Teacher Resources:

- Illustrative Mathematics: http://www.illustrativemathematics.org/
- Learnzillion: http://learnzillion.com/
- Simplifying Expressions: http://wveis.k12.wv.us/teach21/public/Uplans/LPview.cfm?page=1&tsele1=2&tsele2=116&upidU=570&UPid=576
- Solving one –step equations: http://wveis.k12.wv.us/teach21/public/Uplans/LPview.cfm?page=1&tsele1=2&tsele2=116&upidU=570&UPid=577
- Problem solving: http://www.insidemathematics.org/pdfs/problems-of-the-month/pom-wheelshop.pdf?phpMyAdmin=NqJS1x3gaJqDM-1-8LXtX3WJ4e8
- Identifying Solutions: http://www.engageny.org/sites/default/files/resource/attachments/math-g8-m4-student-materials.pdf

Extra Practice:

- http://kutasoftware.com/FreeWorksheets/Alg1Worksheets/Systems%20of%20Equations%20Graphing.pdf
- http://middlemathccss.files.wordpress.com/2011/04/systems-of-equation-no-solution.pdf

Videos:

- http://goanimate4schools.com/public_movie/0bKHL40jy8bc

Student Resources:

- Thinking Blocks: http://www.mathplayground.com/thinkingblocks.html
- Learnzillion: http://learnzillion.com/

Vocabulary:

- Simplify – to solve a given problem and reduce to its simplest term.

- Distributive property – property indicating a special way in which multiplication is applied to addition of two or more numbers in which each term inside a set of parentheses can be multiplied by a factor outside the parentheses, such as $a(b + c) = ab + ac$

- Like terms – terms whose variables (and their exponents such as the 2 in x2) are the same
- Solution – means of solving a problem; an answer
- Inverse operations – the operation that reverses the effect of another operation
- Variable – a symbol for an unknown value
- Slope – a number that describes the "steepness" or "slant" of a line. It is the constant rate of change.

Content Area: Math	**Course: Pre-Algebra - 8**	**UNIT 3: Functions**
Unit Description: Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.		**Unit Timeline:** 6 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Functions describe relationships and will be able to compare and construct a function
2. The equation $y = mx + b$ will be interpreted as a straight line, where m and b are constants.
3. How to recognize linearity in a table or graph by a constant rate of change
4. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
5. Patterns are sequences and sequences are functions with a domain consisting of whole numbers.

6. Non-linear data can be modeled with linear graph models to make predictions
7. They can use similar triangles to identify the slope of a line.

Essential Questions: *Students will keep considering…*

- What defines a function and how can it be represented?
- What makes a function linear?
- How can linear relationships be modeled and used in real-life situations?
- How do you solve a linear equation algebraically with one solution or no solution?
- How do you use functions to model relationships between quantities?
- How do you define, evaluate, and compare functions?

Students Will Know…	Standard	Students Will Be Able to …	Standard

Prerequisite Skills/Concepts: *Students should already be able to…* ● Determine unit rate. ● Apply proportional relationships. ● Solve equations with numeric and graphical representations of solutions. ● Calculate slope/rate of change. **Skills**: *Students will be able to…* ● Determine whether a relationship is linear.	8.EE.C.8	**<u>Mathematical Practices</u>** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically.	MP1 MP2 MP3 MP4 MP5
● Compare graphs, tables, and equations of proportional relationships.	8.EE.B.5	Attend to precision.	MP6
● Graph proportional relationships and interpret the unit rate as the slope.	8.EE.B.5	Look for and make use of structure. Look for and express regularity in repeated reasoning.	MP7 MP8
● Estimate solutions by graphing equations.	8.EE.C.8	**<u>Grade Level Standards</u>**	
● Identify and write Function Rules	8.F.A.1	**Understand the connections between proportional relationships, lines, and linear equations.** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = x$ for a line through the origin and the equation $y = mx+b$ for a line intercepting the vertical axis at .	**8.EE.B** 8.EE.B.6
		Define, evaluate, and compare functions. 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.	**8.F.A** 8.F.A.1

		Compare properties of two functions each represented in a different way (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.*	8.F.A.2
		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. *For example, the function $a=s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points* (1,1)*,* (2,4) *and* (3,9)*, which are not on a straight line.*	8.F.A.3
		Use functions to model relationships between quantities.	**8.F.B**
		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.	8.F.B.4
		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 a graph that exhibits the qualitative features of a function that has been described verbally.	8.F.B.5

<table>
<tr><th colspan="4">EVIDENCE of LEARNING</th></tr>
<tr>
<td>Understanding

#1, #2, #3, #4, #5, #6, #7</td>
<td>Standards

MP1
MP2
MP3
MP4
MP5
MP6
MP7
MP8
8.F.A.1
8.F.A.2
8.F.A.3</td>
<td><u>Unit Performance Assessment</u>:
Description of Assessment Performance Task(s):

Unit Performance Assessment: Functions (See Appendix 3.A)
This performance assessment has the students analyzing the weight of the White Deer population. Students will interpret a table, identify x and y-intercepts and graph the results. Students will construct a line of best fit and the associated equation.

Teacher will assess:
1. Student ability to find rate of change and y-intercept from a table, graph, two coordinate points, or an equation
2. Student ability to identify linear vs. non-linear functions
3. Student ability to make predictions based on a linear equation

<u>Performance:</u>
Mastery: Students will show mastery when they can successfully do the following:
Clearly explain their math reasoning using algebraic steps to find slope and y-intercept from two points, tables, graphs, or story problems.

Scoring Guide: See Appendix 3.B</td>
<td>R/R Quadrant

D</td>
</tr>
</table>

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
# 3, #4, #6, #7	MP1 MP2 MP3 MP4 8.EE.B.6 8.F.B.4 8.F.B.5 ISTE-S.2 ISTE-S.3 ISTE-S.4	*1.* Activity: **Wasting Water Lab** ● Objective: In this lesson, students complete the Wasting Water Experiment, research the cost of water per gallon for 2 local water companies and create a proposal for which water company they would choose based on the cost of water per gallon. ● Students will be able to model non-linear data with a linear graph model (Line of best fit). ● Students will be able to use the line of best-fit to extrapolate predictions for future events. ● Students will be able to use technology to research and collaborate on a graph model (Google Drawings, Excel or other graphing tool capable of drawing a line of best-fit) for the cost of water throughout the local area. ● Students will be able to form an opinion and communicate reasoning of which water company is a better choice. ● Appendix Documents: Appendix 3.C – Wasting Water Lab	● Cooperative Learning ● Technology Integration: Graphing tools, Internet Research tools ● Similarities and Differences	**D**
# 1, #2, #3, #4	MP1 MP6 8.F.B.4 8.F.A.3	2. Activity: **Sandy's Candy Corporations** ● Objective: In this lesson, students will analyze table and graphs to determine the best price increase option for her candy by crating equations, tables and graphs. ● Students will be able to create a function to model a linear relationship. ● Students will be able to determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, a table or a graph ● Students will be able to interpret the rate of change and initial value in the context of the situation in models. ● Students will be able to determine whether a function is linear or not.	● Similarities and Differences	**C**

		● Appendix Document: Appendix 3.D – Sandy's Candy Corporations		
# 1, #2, #3, #4	MP1 MP2 MP3 MP4 8.EE.B.5 8.F.A.2 8.F.A.3 8.F.B.4 8.F.B.5	*3.* Activity: **Cell Phone Plans** ● Objective In this lesson, students 1) complete a table, graph, and function for two cell phone companies, 2) compare the two companies, determine which company is a better buy and 3) form an opinion and communicate reasoning about which company they should choose. ● Appendix Document: Appendix 3.E – Logging On (Cell Phone Activity)	● Similarities and Differences ● Nonlinguistic Representations	**B**
# 1, #4, #5, #6	MP2 MP4 MP7 MP8 8.F.A.1 8.F.B.4 8.F.B.5	*4.* Activity: **Increasing and Decreasing Functions** ● Objective: In this lesson, students sketch a functional relationship given a verbal description and interpret the meaning of "flat rate". ● Students will be able to sketch a functional relationship based on verbal descriptions ● Students will be able to interpret negative changes and positive changes in rate and make generalizations about how these changes influence a graph ● Students will be able to interpret the rate of change and initial value in the context of the situation in models. ● Appendix Document: Appendix 3.F – Increasing and Decreasing Functions Appendix 3.G – Increasing and Decreasing Functions Teacher Notes	● Cooperative Learning ● Nonlinguistic Representations	**C**

UNIT RESOURCES
Teacher Resources: ● Illustrative Mathematics: http://www.illustrativemathematics.org/ ● Learnzillion: http://learnzillion.com/ ● Google Drawings: Must have Google account and access GoogleDrive
Student Resources: ● Thinking Blocks: http://www.mathplayground.com/thinkingblocks.html ● Learnzillion: http://learnzillion.com/ ● Google Drawings: Must have Google account and access GoogleDrive
Vocabulary: ● Slope- A measure to find the steepness of a line. If (x1y1) and (x2 y2) are any two points on the line, the slope of a line is known as m, is represented by the equation m=(y2-y1)/(x2-x1) ● Y-intercept- The second number in an ordered pair, which indicates the vertical distance of a point from the origin on the coordinate plane. ● Coordinate Grid- A plane that is divided into four regions by a horizontal line called the x-axis and a vertical line called the y-axis. ● Independent Variable- The input of a function. ● Dependent Variable- The output of a function ● X-intercept- the first number in an ordered pair, which indicates the horizontal distance of a point from the origin on the coordinate plane ● Slope-Intercept Form – y = mx+b when m is the slope and b is the y-intercept ● Unit rate- A rate in which the second quantity in the comparison is one unit

- Linear – A relationship where a constant rate of change exists between two variables.
- Rate of change- A ratio that compares the amount of change in a dependent variable to the amount of change in an independent variable
- Origin- the intersection point (0,0) of the x-axis and the y-axis

Content Area: Math	Course: Pre-Algebra - 8	UNIT 4: Systems of Equations
Unit Description: In this unit, students will solve systems of linear equations graphically and algebraically. They analyze linear system solutions and use relationships in data to make decisions about real world problems.		**Unit Timeline:** 4 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. The solution to a system of two linear equations in two variables is an ordered pair that satisfies both equations
2. Some systems of equations have no solutions (parallel lines)
3. Some systems of equations have infinite solutions (same line)

Essential Questions: *Students will keep considering…*

- How do you find the value of an unknown quantity?
- What does the intersection point of the graph of two linear functions represent?
- How do you decide whether to solve a system of linear equations graphically or algebraically?
- How does being able to solve systems of equations help you to make decisions in real-world situations?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Students will solve linear equations using the distributive property and by combining like terms, including equations with variables on both sides (8.EE.C.7b) ● Students will simplify linear equations in one variable into the form of x=a, a=a, or a=b (where a and b are different numbers). (8.EE.C.7a) ● Students will write linear equations in one variable for a given number of solutions. (8.EE.C.7a) **Skills**: *Students will be able to …* ● Estimate solutions by graphing equations. (8.EE.C.8) ● Solve systems by graphing, substitution, or elimination (combination). (8.EE.C.8) ● Determine if a system has one solution, no solutions, or many solutions. (8.EE.C.8) ● Interpret the solution to a system of equations in context. (8.EE.C.8)		**<u>Mathematical Practices</u>** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **<u>Grade Level Standards</u>** Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x +2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*	 MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 8.EE.C.8 8.EE.C.8a 8.EE.C.8b

		c. Solve real-world and mathematical problems leading to 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.*	8.EE.C.8c

EVIDENCE of LEARNING			
Understanding # 1	Standards MP1 MP3 MP4 MP8 8.EE.C.8c	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):** ***Unit Performance Assessment: Systems of Equations*** (See Appendix 4.A) Students will solve a real-world mathematical problem using two linear equations in two variables. They will be generating equations based upon salary and savings, completing tables using repeated reasoning, graphing the system to observe any intersecting points, and finally, communicating their reasoning for given answers. **Teacher will assess:** 1. Student completion of table from a given pattern 2. Student ability to generate equations based upon the situation 3. Student accurate depiction of the situation on graph 4. Student ability to offer reasonable solution to questions asked **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** 1. Students can accurately complete a table through repeating reasoning 2. Students can accurately graph a pair of linear equations on the same axes 3. Students can effectively communicate reasoning to support their findings **Scoring Guide:** See Appendix 4.B	R/R Quadrant **D**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
#1	MP1 MP2 MP4 MP7 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c ISTE-S.3	1. Activity: **The Chickens and Pigs Problem** ● Objective In this lesson, students use trial and error to figure the solution to the chickens and pigs problem. In the process, they deal with the ideas for two equations. First, they combine numbers which add to be the number of heads. Then they try combinations of numbers which work for the chicken and pig legs. From this experience, they create a table and a graph and then write two equations to enter into the calculator or computer. They then explain the equations and graphs. Materials: Calculators and/or Computers Directions: Use the chickens and pigs problem as the introduction to systems of equations. Have students divide into small groups and solve the problem using trial and error. Once they have arrived at a solution, have them share the way they came up with the solution. Then write the equations. Students may need assistance writing the equations. Coach them by asking what they did—they usually come up with combinations of numbers which add to 60—or pigs + chickens = 60. It's an easy jump from here to an equation for legs. The teacher will need to demonstrate to students how to find enter equations into the calculator or computer and then find the trace to the solution. Students can now graph the equations by plotting points, using a graphing calculator or graphing software such as TI Interactive. ● Appendix Document: Appendix 4.C – Chickens and Pigs	● Cooperative Learning ● Similarities and Differences ● Nonlinguistic Representations ● Technology Integration	**C**

#1	MP1 MP2 MP4 MP7 MP8 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c	2. Activity: **Skate Park Comparison** ● Objective In this activity, students write and graph a system of equations to find the solution. They will use this information to make reasonable conclusions as to the cost effectiveness when deciding on different skate parks. ● Appendix Document: Appendix 4.D – Skate Park Comparison	● Nonlinguistic Representations ● Homework and Practice ● Similarities and Differences	**C**
#1	MP2 MP3 MP6 MP7 8.EE.C.8b	3. Activity: **Buying Chips and Candy** ● Objective In this activity, students write a system of equations and solve to figure out the cost of one bag of potato chips and one candy bar. This activity is more guided than most and could be used as an introduction to the elimination method of solving a system of equations. ● Appendix Document: Appendix 4.E – Buying Chips and Candy Appendix 4.F – Buying Chips and Candy Scoring Rubric	● Homework and Practice ● Similarities and Differences	**B**
#2, #3	MP1 MP2 MP3 MP6 MP7 MP8 8.EE.C.7a 8.EE.C.7b	4. Activity: **Solution Sort!** ● Objective In this activity, students analyze, sort and reflect on whether equations have one solution, no solution, or infinitely many solutions. Materials: For each group – ● 1 Copy of Instructional Activity 10_solving multi-step equations for each group with problems 1-16 cut out to make sets of cards for each group ● 1 Copy of Instructional Activity 10_solution sort	● Cooperative Learning ● Summarizing and Note Taking ● Similarities and Differences	**C**

		Directions: 1. Explain to students that sometimes equations will have one solution, no solution, or infinitely many solutions. Give groups the 16 problem cards and have them sort them into three solution categories. 2. Have them write an explanation of why they decided to sort the equations the way they did. Have groups share how they decided to sort the equations and provide their reasoning. 3. Now have students solve the equations and have them resort them again. Have them write down their thoughts about what they have discovered about the different forms of the equations. Again, have the groups share with the class their reasoning for their sorts. 4. Students should have been able to discover the forms x = a, a = a, and a = b (where a and b are different numbers). Go through problem #18 on "solving multi-step equations" with the class and then challenge the groups to complete question 19 together. Have the groups share and explain the equations they have created for the given number of solutions. 5. Have students reflect on the three forms of a linear equation in one-variable and how they can determine the number of solutions that the equation has. ● Appendix Document: Appendix 4.G – Solving Multi-Step Equations Appendix 4.H – Solution Sort		

UNIT RESOURCES

Teacher Resources:

- Illustrative Mathematics: http://www.illustrativemathematics.org/
- Learnzillion: http://learnzillion.com/

Additional Resources:

- A lesson plan with activities and materials, *Math Island*, can be found at: http://wveis.k12.wv.us/teach21/public/Uplans/LPview.cfm?page=1&tsele1=2&tsele2=116&upidU=566&UPid=1079

  Use the examples provided in the "investigate/explore" section of the lesson instructions to provide direct instruction on how to solve systems of equations using the substitution method. Make sure students take notes and copy down the examples. Give students the "Island of Math" worksheet found here: http://wveis.k12.wv.us/Teach21/CSO/Upload/LP1079WS2.doc?tsele1=2&tsele2=116&tsele3i=1079
  Have students work with a partner to figure out where the treasure is buried on the Island of Math. Assign practice problems for practice.

  Materials:
  - Island of Math Worksheets for pairs of students
  - Island of Math Solutions
  - Practice Problems and Solutions

- Journal Reflection: Have students explain the process of solving a system of equations using substitution. Have them provide an example. Have them explain how they can tell if a system of equations has a common solution by using the substitution method.

Miscellaneous Resources

- Problem Solving: http://www.insidemathematics.org/problems-of-the-month/pom-thewheelshop.pdf
- Extra Practice:
  - http://www.kutasoftware.com/free.html
  - http://middlemathccss.wordpress.com/
- Videos
  - Spring Break Word Problem: http://goanimate4schools.com/public_movie/0bKHL40jy8bc

Student Resources:

- Thinking Blocks: http://www.mathplayground.com/thinkingblocks.html

- Learnzillion: http://learnzillion.com/

Vocabulary:

- System of linear equations – a set of two or more linear equations containing two or more variables.
- Solution of a system of linear equations with two variables – an ordered pair that satisfies each equation in the system. So, if an ordered pair is a solution, it will make both equations true.

Special systems of linear equations:

- Consistent – when lines intersect in at least one point
- Inconsistent – when lines never cross and gives us no solution
- Independent System – has exactly one solution
- Dependent System – has infinitely many solutions

Content Area: Math	Course: Pre-Algebra - 8	UNIT 5: Pythagorean Theorem
Unit Description: This course is designed to provide students with a strong foundation and conceptual understanding in real-life problem solving. This course will include, but are not limited to the real number systems, expressions, exponents, equations, functions, systems of linear equations, the Pythagorean Theorem and plane geometry.		**Unit Timeline:** 2 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Right triangles have a special relationship among the side lengths which can be represented by a model and a formula
2. The Pythagorean Theorem can be used to find the missing side lengths in a coordinate plane and real-world situations.
3. The Pythagorean Theorem and its converse can be proven.

Essential Questions: *Students will keep considering…*

An Essential Question is meant to:

- Why is the Pythagorean Theorem relevant in everyday life?
- How are triangular relationships important in everyday use?
- Why does the Pythagorean Theorem apply only to right triangles?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Evaluate expressions and equations with exponents ● Solve equations in the form of $x^2 = p$ ● Classify triangles **Skills**: *Students will be able to …* ● Explain a proof of the Pythagorean Theorem ● Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. ● Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	8.G.B.6 8.G.B.7 8.G.B.8	**Mathematical Practices** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **Grade Level Standards** Explain a proof of the Pythagorean Theorem Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system	 MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 8.G.B.6 8.G.B.7 8.G.B.8

EVIDENCE of LEARNING			
Understanding # 1 , #3	Standards MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 8.G.B.7	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):** ***Unit Performance Assessment: Functions*** (See Appendix 5.A) Students will solve real-world application problems that require the Pythagorean Theorem to solve. The students will complete three performance tasks on the formative assessment. The first requires students to examine a bridge structure and use the Pythagorean theorem to find how long a brace should be to make the bridge secure. The second PT will have students using the Pythagorean theorem to help find the amount of tassel necessary to surround an isosceles triangular rug. This is an unfamiliar problem because students are used to using the Pythagorean theorem with right triangles and not isosceles. The third PT will have students use the converse of the Pythagorean Theorem. Students will be using a real world problem involving volume of water in a glass. **Teacher will assess:** 1. Student ability to use the Pythagorean theorem to find a missing side length 2. Student ability use the converse of the Pythagorean Theorem to find the missing leg of a right triangle 3. Student ability to use Pythagorean theorem to find distance between two points on a coordinate grid **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** Accurately use the Pythagorean theorem and its converse appropriately. **Scoring Guide:** See Appendix 5.B	R/R Quadrant **C**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
# 1, 2, 3	MP1 MP4 MP5 MP6 MP7 8.G.B.8 ISTE-S.3	1. Activity: **Rectangle in the Coordinate Plane** In this lesson, students 1) use the Pythagorean theorem to find different segment lengths, 2) use the coordinate grid to create right triangles, 3) use the converse of the Pythagorean theorem to find missing sides of a quadrilateral on a coordinate grid, and 4) use a web-based graphing program to create a graph such as http://nces.ed.gov/NCESKIDS/createagraph ● Objective ● Students will be able to prove the distance between two points using the Pythagorean theorem and its converse. ● Students will be able to decide appropriate scales, intervals, labels and windows to graph on a coordinate grid ● Students will be able to answer and defend their response to the question "Is this a rectangle?" ● Appendix Document: Appendix 5.C – Rectangle in the Coordinate Plane	● Identifying Similarities and Differences ● Technology integration: http://nces.ed.gov/NCESKIDS/createagraph	**B**
# 2, 3	MP1 MP2 MP6 8.G.B.7 8.G.B.8	2. Activity: **The Bird and Dog Race** In this lesson, students will analyze and predict who will win a race by reading a given map. ● Objective: ● Students will be able to use the Pythagorean Theorem as a problem solving tool to calculate between two points on a grid ● Students will be able to articulate and interpret information based on running/flying time for each contestant ● Students will be able to pay attention to units and precision. ● Appendix Document: Appendix 5.D – The Bird and Dog Race	● Identifying Similarities and Differences	**C**

# 1	MP2 MP3 MP4 MP7 MP8 8.G.B.6	3. Activity: **Proofs of the Pythagorean Theorem** In this lesson, students will analyze three proofs of the Pythagorean theorem, critique and justify the various proofs, and form an opinion as to which is the best proof. ● Objective: ● Students will be able to determine which proof best proves the Pythagorean Theorem and communicate reasoning ● Appendix Document: Appendix 5.E – Proofs of the Pythagorean Theorem	● Setting Objectives and Providing Feedback	**C**
# 1, #2	MP1 MP2 MP4 8.G.B.7	4. Activity: **Aspect Ratio with TV** In this lesson, students will use the Pythagorean theorem to determine the dimensions of a TV, decide whether the TV will fit onto an existing table, and justify their reasoning with a viable argument. ● Objective: ● Students will be able to determine which proof best proves the Pythagorean Theorem and communicate reasoning ● Appendix Document: Appendix 5.F – Aspect Ratio with TV	● Homework and Practice	**B**

UNIT RESOURCES
Teacher Resources: ● Illustrative Mathematics: http://www.illustrativemathematics.org/ ● Learnzillion: http://learnzillion.com/ ● Graphing tool: http://nces.ed.gov/NCESKIDS/createagraph
Student Resources: ● Thinking Blocks: http://www.mathplayground.com/thinkingblocks.html ● Learnzillion: http://learnzillion.com/ ● Graphing tool: http://nces.ed.gov/NCESKIDS/createagraph
Vocabulary: ● **Altitude of a Triangle:** The perpendicular distance between a vertex of a triangle and the side opposite that vertex. Sometimes called the height of a triangle. Also, sometimes the line segment itself is referred to as the altitude. ● **Coordinate Plane:** A two-dimensional surface on which points are plotted and located by their x and y coordinates. ● **Coordinate Point of a Plane:** A pair of numbers defining the position of a point on a two-dimensional plane. ● **Converse of Pythagorean Theorem:** If the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the other two sides, the triangle is a right triangle. ● **Distance Formula:** An application of the Pythagorean Theorem based on the distance between two points. ● **Geometric Solid:** The collective term of all bounded three dimensional geometric figures. ● **Height of Solids:** The vertical height (or altitude) which is the perpendicular distance from the top down to the base. ● **Hypotenuse:** The hypotenuse is the side of a right triangle that is directly across from the right angle ● **Irrational**: A real number whose decimal form is non-terminating and non-repeating that cannot be written as the ratio of two integers. ● **Leg of a Triangle**: Either of the two shorter sides of a right triangle. These two sides together form the right angle in the right triangle.

- **Perfect Squares**: The product of a rational number multiplied by itself.
- **Pythagorean Theorem:** A theorem that states that in a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.
- **Pythagorean Triples:** A set of positive integers, a, b, and c that fit the rule $a^2 + b^2 = c^3$
- **Square Root:** The square root of a number is a special value that, when multiplied by itself, gives the number.
- **Radical**: A symbol that is used to indicate square roots.
- **Rational Number**: A number expressible in the form a/b or – a/b for some fraction a/b. The rational numbers include the integers.
- **Right Triangle**: A triangle with exactly one right angle.

Content Area: Math	Course: Pre-Algebra - 8	UNIT 6: Geometry (Transformations)
Unit Description: Geometric sense allows students to comprehend space and shape. Students analyze the characteristics and relationships of shapes and structures, engage in logical reasoning, and use tools and techniques to determine measurement. Students learn that geometry and measurement are useful in representing and solving problems in the real world as well as in mathematics.		**Unit Timeline:** 9 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Reflections, translations, and rotations are actions that produce congruent geometric objects.
2. A dilation is a transformation that changes the size of a figure but not the shape.
3. If the scale factor of a dilation is greater than 1, the image resulting from the dilation is an enlargement, and if the scale factor is less than 1, the image is a reduction.
4. A two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of transformations.
5. Two shapes are similar if the lengths of all the corresponding sides are proportional and all the corresponding angles are congruent.

6. Two similar figures are related by a scale factor, which is the ratio of the lengths of corresponding sides.
7. Congruent figures have the same size and shape. If the scale factor of a dilation is equal to 1, the image resulting from the dilation is congruent to the original figure.
8. When parallel lines are cut by a transversal, corresponding angles, alternate interior angles, alternate exterior angles, and vertical angles are congruent.
9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Essential Questions: ***Students will keep considering…***

- What are transformations and what effect do they have on an object?
- What does the scale factor of a dilation convey?
- How can transformations be used to determine congruency or similarity?
- What angle relationships are formed by a transversal?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Draw, construct, and describe geometrical figures and describe the relationships between them. (7.G.A.1-3) ● Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. (7.G.B.4-6) **Skills**: *Students will be able to …* ● Describe a series of transformations that exhibits congruence between two congruent figures. (8.G.A.2) ● Describe transformations (dilations, translations, rotations, and reflections) with words and with coordinates. (8.G.A.3) ● Describe a series of transformations that exhibits similarity between two similar figures. (8.G.A.4) ● Find the measures of angles using transversals, the sum of angles in a triangle, the exterior angles of triangles. (8.G.A.5) ● Determine if triangles are similar using the angle-angle criterion. (8.G.A.5) ● Justify congruence or similarity of figures using a series of transformations. (8.G.A.2 and 8.G.A.4)		**<u>Mathematical Practices</u>** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **<u>Grade Level Standards</u>** **Understand congruence and similarity using physical models, transparencies, or geometry software.** Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.	MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 **8.G.A** 8.G.A.1 8.G.A.1a 8.G.A.1b 8.G.A.1c 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.	8.G.A.3
		Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	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.	8.G.A.5
		Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*	**8.G.C**
		Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.	8.G.C.9
		Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	

EVIDENCE of LEARNING			
Understanding # 1, #2, #3, #4, #5, #6	Standards MP1 MP4 MP5 MP6 8.G.A.4 8.G.A.5	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):** ***Unit Performance Assessment: Geometry*** (See Appendix 6.A) Students will perform a dilation on the coordinate plane and use similar triangles to explain the relationship among the image and its copy. Students will find missing side lengths and explain angle measures. **Teacher will assess:** 1. Student ability to accurately graph the dilation 2. Student ability to identify coordinates of the dilated copy 3. Student explanation including mathematical language **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** 1. Dilate an object on the coordinate plan 2. Explain relationships using similar triangles 3. Students can effectively communicate reasoning to support their findings **Scoring Guide:** See Appendix 6.B	R/R Quadrant **C**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
# 2, #6, #7	MP2 MP3 MP5* 8.G.A.3 8.G.A.4 ISTE-S.3 * ISTE-S.4 *	1. Activity: **Transformation Introduction and Effects of Dilations** ● Objective The focus of this segment is to get an overview and solid conceptual understanding of dilations. Students use their conceptual understanding of dilations to building procedural fluency in performing dilations on the coordinate plan. *For any of these activities, you may use the Geometer's Sketchpad to allow students to explore technology. http://www.keycurriculum.com/sketchpad-resources ● Appendix Documents: (Lessons include teacher notes/reflections) Appendix 6.C – Transformation Matching Appendix 6.D – Discovering the Center of Dilation Appendix 6.E – Performing Dilations Appendix 6.F – Dilation Practice	● Nonlinguistic Representations ● Homework and Practice ● Similarities and Differences ● Technology integration with Geometer's Sketchpad	**D**
#1, #3, #4	MP2 MP4 MP6 MP5* 8.G.A.1 8.G.A.2 8.G.A.3 8.G.A.4 ISTE-S.3 * ISTE-S.4 *	2. Activity: **Symmetry and Reflections** ● Objective In this activity, students analyze symmetry and reflections through the analysis of facial symmetry. Materials: ● You may use your own test picture or pictures through the online program: http://www.symmeter.com/symfacer.htm ● *You may use the Geometer's Sketchpad to allow students to explore technology. http://www.keycurriculum.com/sketchpad-resources Directions:	● Nonlinguistic Representations ● Homework and Practice ● Similarities and Differences ● Technology integration with Geometer's Sketchpad	**D**

		1. Ask students if they knew that one measure of attractiveness in the animal kingdom (including humans) is facial symmetry. In other words, if one side of the face is a mirror image of the other, it can be considered more attractive. 2. You may use your own test picture or pictures through the online program: http://www.symmeter.com/symfacer.htm Students should see first of all that the orientation of the picture is important. If the head is tilted at all, it will produce a distorted picture. Introduce students to the term "line of reflection" when placing the line through which you produce the facial symmetry. 3. Ask students how a computer program is able to produce these pictures from the original. They should get to the fact that it is just a mirror image of each half. They might say it's like folding along the line of reflection. 4. Reflections: Break students into partners. Give each partnership one picture to be reflected (Shrek, the Frog, or Space Shuttle) Ask them to reflect the image across the listed line of reflection. Students may do this using the images on paper, on whiteboards, or on the computer through a program such as Geometer's Sketchpad. 5. Reflection Practice: Students will perform a series of reflections that also include dilation practice. ● Appendix Documents: Appendix 6.G – Basic Reflections Appendix 6.H – Reflection Practice		
#1, #2, #3	MP2 MP4 8.G.A.1 8.G.A.2 8.G.A.3	3. Activity: **Additional Practice** ● Objective This lesson is designed to give students independent practice on rotations and translations. Have students complete the Rotation Practice worksheet and Translations Practice worksheet. This includes more examples of completing series of transformations. Make sure that students have the answer key available so they can use this as a self-assessment as well. ● Appendix Documents: (Lessons include teacher notes/reflections) Appendix 6.I – Rotation Practice Appendix 6.J – Translation Practice	● Nonlinguistic Representations ● Homework and Practice	**B**

#5, #6	MP2 MP4 8.G.A.4	4. Activity: **Fundamental Theorem of Similarity (FTS)** ● Objective This lesson includes a teacher guided lesson/discussion on the FTS as well as an Exit Ticket for students upon conclusion of the lesson. The lesson explains that when two similar figures are related by scale factor, the ratio of the lengths of corresponding sides is also the scale factor. ● Appendix Documents: Appendix 6.K – Fundamental Theorem of Similarity (FTS)	● Nonlinguistic Representations ● Homework and Practice	**B**
#5, #6, #8	MP2 MP4 MP6 MP5* 8.G.A.1 8.G.A.4 8.G.A.5 ISTE-S.3* ISTE-S.4*	**5.** Activity: **Informal Proofs of Properties of Dilations** ● Objective This lesson explores why dilations are degree-preserving transformations. Specifically, proof on when parallel lines are cut by a transversal – corresponding angles are congruent. Lesson includes teacher-student guided discussion and Exit Ticket. *For exploring angle measurement, you may use the Geometer's Sketchpad to allow students to discover congruency using technology. http://www.keycurriculum.com/sketchpad-resources ● Appendix Documents: Appendix 6.L – Informal Proofs of Properties of Dilations	● Nonlinguistic Representations ● Homework and Practice ● Technology integration with Geometer's Sketchpad	**D**

#9	MP1 MP2 MP4 MP6 8.G.C.9	6. Activity: **Volumes of Familiar Solids – Cones and Cylinders** ● Objective In this activity, students gain knowledge about the volume formulas for cones and cylinders and apply them to real-world and mathematical problems. This includes a teacher guided lesson/discussion as well as an Exit Ticket for students upon conclusion of the lesson. Materials: ● For the demonstrations in this lesson you will need a stack of the same-sized note cards, a stack of the same-sized round disks, a cylinder and cone of the same dimensions, and something to fill the cone with (e.g., rice, sand, water). Directions: 1. Demonstrate to students that the volume of a rectangular prism is like finding the sum of the areas of congruent rectangles, stacked one on top of the next. 2. A similar demonstration will be useful for the volume of a cylinder. 3. To demonstrate that the volume of a cone is one-third that of the volume of a cylinder with the same dimension, you will need to fill a cone with something like rice, sand, or water and show students that it takes exactly three cones to equal the volume of the cylinder. ● Appendix Documents: Appendix 6.M – Volumes of Familiar Solids – Cones and Cylinders	● Nonlinguistic Representations ● Homework and Practice ● Similarities and Differences	**C**

UNIT RESOURCES

Teacher Resources:

- The Geometer's Sketchpad: http://www.keycurriculum.com/sketchpad-resources
- Illustrative Mathematics: http://www.illustrativemathematics.org/
- Learnzillion: http://learnzillion.com/

Additional Resources for Scaffolding Practice:

- Volume Practice: http://www.engageny.org/resource/grade-8-mathematics-module-5
- Similarity Practice: http://www.engageny.org/resource/grade-8-mathematics-module-3

Student Resources:

- Learnzillion: http://learnzillion.com/
- The Geometer's Sketchpad: http://www.keycurriculum.com/sketchpad-resources

Vocabulary:

- Transformations – a general term for four specific ways to manipulate the shape of a point, a line, or shape.
- Translation – moving in the same distance and direction
- Rotation – turning around a center
- Reflection – an image of a shape as it would be seen in a mirror
- Line of reflection – another name for reflection symmetry. One half is the reflection of the other half.
- Dilations – to resize something
- Transversal – a line that cuts through at least 2 other lines
- Exterior angles – the angle between any side of a shape, and a line extended from the next side.
- Interior angles – an angle inside a shape
- Angle of rotation – the measure of degrees that a figure is rotated about a fixed point.

Content Area: Math	Course: Pre-Algebra - 8	UNIT 7: Statistics and Probability
Unit Description: Students will apply experience with coordinate planes and linear functions in the study of association between two variables related to a question of interest. They will analyze bivariate measurements on a scatter plot describing shape, center, and spread. The shape is a description of the cloud of points on a plane, the center is the line of best fit, and the spread is how far data points are from the line.		**Unit Timeline:** 6 weeks

DESIRED RESULTS

Transfer Goal - ***Students will be able to independently use their learning to…***

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Understandings – ***Students will understand that… (Big Ideas)***

1. Written descriptions, tables, graphs, and equations are useful in representing and investigating relationships between varying quantities.
2. Different representations (written descriptions, tables, graphs, and equations) of the relationships between varying quantities may have different strengths and weaknesses.
3. Linear functions may be used to represent and generalize real situations.
4. Slope and y-intercept are keys to solving real problems involving linear relationship models of data.
5. Some data may be misleading based on representation.

Essential Questions: *Students will keep considering…*

- What relationships can be seen in bivariate data?
- What conclusions can be drawn from data displayed on a graph?
- What do the slope and y-intercept of a line of best fit signify on a graph?

- How can graphs, tables, or equations be used to predict data?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Prerequisite Skills/Concepts: *Students should already be able to…* ● Use the coordinate plane **Skills**: *Students will be able to …* ● Construct and interpret scatter plots and two-way tables for patterns such as positive or negative association, linearity or curvature, and outliers. (8.SP.A.1) ● Generate an approximate line of best fit. (8.SP.A.2) ● Use the equation of a linear model to solve problems in the context of bivariate measurement data. (8.SP.A.3) ● Interpret the slope and y-intercept of the line of best fit in context. (8.SP.A.3) ● Show that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. (8.SP.A.4) ● Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. (8.SP.A.4) ● Use relative frequencies calculated for rows or columns to describe possible association between the two variables. (8.SP.A.4)		**<u>Mathematical Practices</u>** Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning. **<u>Grade Level Standards</u>** **Investigate patterns of association in bivariate data.** 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. 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.	MP1 MP2 MP3 MP4 MP5 MP6 MP7 MP8 **8.SP.A** 8.SP.A.1 8.SP.A.2

		Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *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.*	8.SP.A.3
		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 summarizing data 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. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	8.SP.A.4

EVIDENCE of LEARNING			
Understanding # 1, #2, #5	Standards MP1 MP2 MP3 MP7 8.SP.A.1	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):** ***Unit Performance Assessment: Statistics and Probability*** (See Appendix 7.A) Students will interpret a data table and construct a scatter plot using bivariate data to investigate patterns of association between two quantities. Students will make observations using this data and communicate their reasoning for assumptions made from this data. **Teacher will assess:** 1. Student accuracy within the scatter plot 2. Student ability to generate equations based upon the situation 3. Student accurate depiction of the situation on graph 4. Student ability to offer reasonable solution to questions asked **Performance:** **Mastery: Students will show mastery when they can successfully do the following:** 1. Students can interpret the meaning of the data from a table 2. Students can accurately complete a scatter plot using reasonable choices for axes 3. Students can effectively communicate reasoning to support their findings **Scoring Guide:** See Appendix 7.B	R/R Quadrant **D**

SAMPLE LEARNING PLAN				
Pre-assessment: District Benchmark assessment				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
#1	MP1 MP2 MP4 8.SP.A.1	1. Activity: **Birds' Eggs** ● Objective In this lesson, students are asked to interpret a scatterplot and use the data to answer specific questions. In addition to these questions, students are asked to make predictions for a similar situation. The last part of this activity has students comparing ratios based upon the data in the graph. ● Appendix Document: Appendix 7.C – Birds' Eggs (student exemplar included)	● Similarities and Differences ● Nonlinguistic Representations	**B**
#1, #2, #3, #4	MP1 MP4 MP7 MP8 8.SP.A.1 MP2 MP4 MP5 MP7 8.SP.A.2 ISTE-S.3	2. Activity: **Line of Best Fit** – Technology embedded Appendix 7.D – Line of Best Fit Instructions <u>Part 1:</u> In this activity, students construct a scatterplot based upon given data. They are then to construct a linear model and generate an equation. Students must explain the linear model. Prior Understanding: Students must be able to find the equation of a line using slope and y-intercept. Appendix 7.E – Line of Best Fit #2A <u>Part 2:</u> Students are generating a line of best fit using the graphing calculator. Students may work alone or in pairs on this activity. Five sets of data are provided. Prior Understanding: Students need to know how to find the equation of a line given two points on the line. Students also need to know how to enter data into LISTS function of the graphing calculator.	● Similarities and Differences ● Nonlinguistic Representations ● Homework and Practice	**C**

	MP2 MP4 MP5 MP7 8.SP.A.3 ISTE-S.6	Appendix 7.F – Line of Best Fit #2B <u>Part 3:</u> Students will be creating scatterplots using on-line tools: http://nces.ed.gov/nceskids/createagraph/default.aspx Based upon graph and data given from a table, students are to find the equation of a line of best fit and make predictions based upon this model. There are four data sets to help students practice. Appendix 7.G – Line of Best Fit #2C		
#1	MP2 MP3 MP4 MP8 8.SP.A.4	3. Activity: **Two-Way Tables** ● Objective In this lesson, students use bivariate categorical data to read, interpret and create two-way frequency tables. Students can use a Rally-Coach cooperative learning structure to works in pairs to complete this activity. ● Appendix Document: Appendix 7.H – Two-Way Tables	● Cooperative Learning ● Similarities and Differences	**B**
#1, #2	MP1 MP2 MP3 MP4 MP6 MP7 8.SP.A.1 8.SP.A.2	4. Activity: **Exit Ticket** ● Objective This exit card can be given to reinforce the idea of correlation of a scatter plot. Students are to plot the data, construct a line of best fit, and describe the relationship of the data ● Appendix Document: Appendix 7.I – Exit Ticket	● Homework and Practice ● Nonlinguistic Representations	**B**
#1, #2, #3, #4, #5	MP1 MP2 MP3 MP4	5. Activity: **Performance Task - Oil Changes and Engine Repairs** ● Objective Students are asked to construct a scatterplot based on data received about the relationship between repair costs on a vehicle and number of oil changes. They need to draw a Line	● Homework and Practice	**D**

	MP6 MP7 8.SP.A.1 8.SP.A.2 8.SP.A.3 8.SP.A.4	of Best Fit and to generate an equation for this line. Students are also asked to determine what the x and y intercepts mean. The final portion of this task is to write a letter explaining the benefits of getting regular oil changes as it applies to repair costs. ● Appendix Document: Appendix 7.J – Performance Task - Oil Changes and Engine Repairs	● Nonlinguistic Representations	

UNIT RESOURCES

Teacher Resources:

- Illustrative Mathematics: http://www.illustrativemathematics.org/
- Learnzillion: http://learnzillion.com/
- Videos: http://khanacademy.org

Additional Resources:

- Additional examples can be found in the Arizona Mathematics Standards Articulated by Grade Level, page 29-30, http://www.azed.gov/wpcontent/uploads/PDF/MathGr8.pdf

- Practice Lessons may be downloaded at http://www.regentsprep.org/Regents/math/ALGEBRA/AD4/indexAD4.htm
  - Lesson 1 – Scatter Plots and Correlation
  - Lesson 2 – Line of Best Fit and Prediction (without a graphing calculator)
  - Lesson 3 – Line of Best Fit and Prediction (with a graphing calculator)
  - Lesson 4 – Practice with Scatter Plots and More
  - Lesson 5 – More Advanced Scatter Plots (without a calculator)

- A lesson plan with activities, *Exploring Linear Data*, can be found at http://illuminations.nctm.org/LessonDetail.aspx?id=L298 Students will be instructed to model linear data in a variety of settings that range from car repair costs to sports to medicine. Students work to construct scatterplots, interpret data points and trends, and investigate the notion of line of best fit.

Student Resources:

- Learnzillion: http://learnzillion.com/
- Videos: http://khanacademy.org

Vocabulary:

- Bivariate data – Data that has two variables. The quantities from these two variables are often displayed using a scatterplot.

- Scatter plot – A scatterplot is a type of graph that plots points to show a relationship between two variables.
- Line of best fit – A straight line that best represents that data on a scatterplot
- Outlier – Numbers in a set of data that lie outside the pattern of the data are called outliers.
- Positive/negative association – (Correlation) – Describes the strength of a relationship between two variables.