

Fair Lawn

Public Schools

Fair Lawn, NJ

Pre-Algebra
Grade 8

Adopted August

2015

Revised August 2015
Developed August 2013

Grade 8 Pre-Algebra is a mathematics course that was developed by the Fair Lawn grade 8 Pre-Algebra Team and aligned to the Grade 8 Common Core State Standards Initiative and Common Core Anchor Standards for College and Career Readiness.

Pre-Algebra 8

Fair Lawn School District

Committee Credits Grade 8 Pre-Algebra Team

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Pre-Algebra 8

I. Course Synopsis

II.

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

II. Philosophy & Rationale

The purpose of Pre-Algebra is to introduce algebraic skills and terminology to students as well as to lay the foundation for the Algebra I course. Students will be given opportunities to apply critical thinking skills and algebraic skills to problem solving. Students will be introduced to the language of algebra and discover how to apply algebra to problem solving situations. Students will use mathematical tools and technology when appropriate. The grade 8 Pre-Algebra curriculum develops the foundational skills and knowledge necessary for algebra as defined by the Common Core State Standards for mathematics in grade 8.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

CCSS.MATH.PRACTICE.MP1 - Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information

they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

CCSS.MATH.PRACTICE.MP2 - Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

CCSS.MATH.PRACTICE.MP3 - Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

CCSS.MATH.PRACTICE.MP4 - Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high

school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

CCSS.MATH.PRACTICE.MP5 - Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

CCSS.MATH.PRACTICE.MP6 - Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

CCSS.MATH.PRACTICE.MP7 - Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an

existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x-y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y .

CCSS.MATH.PRACTICE.MP8 - Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through $(1, 2)$ with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

III. Scope & Sequence

Unit 1: The Number System (7 weeks)

- Rational and Irrational Numbers
- Perfect Squares 1-25
- Estimating Non-Perfect Square Roots to the Nearest Tenth
- Cube Roots
- Simplifying Expressions with Exponents
- Multiplication of Like Bases (Product Rule)
- Division of Like Bases (Quotient Rule)
- Power Rule of Exponents
- Zero Power Rule of Exponents
- Negative Exponents
- Writing Numbers in Scientific Notation
- Comparing and Ordering Numbers in Scientific Notation
- Multiplying in Scientific Notation
- Dividing in Scientific Notation

Unit 2: Expressions and Equations (4 weeks)

- Two-Step Equations
- Combining Like Terms
- Equations with Distributive Property
- Equations with Variables on Both Sides
- Clearing Fractions in Equations
- Equations with No Solution
- Equations with Infinite Solutions

Unit 3: Functions (6 weeks)

- Slope
- Linear vs. Nonlinear
- Writing Linear Equations in Slope-Intercept Form
- Graphing in Slope-Intercept Form
- Proportional Relationships
- Rate of Change/Unit Rates
- Comparing Unit Rates
- Function Notation
- Evaluating Functions

Classifying Functions & Relations from Tables and Graphs
Writing Function Rules from a Table or Graph

Unit 4: Systems of Linear Equations (4 weeks)

Solving Systems of Linear Equations by Graphing
Solving Systems of Linear Equations by Substitution
Solving Systems of Linear Equations by Elimination
Solving Systems of Linear Equations by Inspection (One, No, or Infinite Solutions)
Real World Applications of Two Equations with Two Variables

Unit 5: Geometry (5 weeks)

Translations
Reflections
Rotations
Dilations
Sequences of Transformations
Similarity/Congruence of Figures
Finding the Missing Side of a Right Triangle
Applications of the Pythagorean Theorem (2-D and 3-D)
Finding Distance Between Two Points on the Coordinate Plane
Volume of Cylinders, Cones, and Spheres
Using Formulas to Solve Real-World Volume Problems
Interior and Exterior Angles of a Triangle
Angles Formed by Parallel Lines Cut By a Transversal
Similarity of Triangles using Angle-Angle Criterion

Unit 6: Statistics (2 weeks)

Describe Patterns (Clustering, Outliers)
Positive and Negative Association
Linear and Nonlinear Association
Line of Best Fit
Slope and y-intercept
Patterns of Association in Two-Way Tables
Construction and Interpretation of Two-Way Tables

IV. Unit Descriptions

Unit 1: The Number System

Enduring Understanding

1. The use of exponents and scientific notation offer efficient ways of representing large numbers.
2. Some numbers are classified as rational numbers when they can be written in the form of a ratio, while other numbers are classified as irrational.
3. Rational approximations of irrational numbers can be used to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions.
4. Properties of integer exponents can be used to generate equivalent numerical expressions.

Essential Questions

1. How do we classify numbers as rational or irrational?
2. What happens to the exponents when multiplying or dividing like bases?
3. How does multiplying by a positive power of 10 affect a number?
4. How does multiplying by a negative power of 10 affect a number?
5. Where can scientific notation be used in the real world?
6. How is squaring a value and finding the square root of a value different?
7. Why do we approximate irrational numbers?
8. How do you approximate the square root of a number that is not a perfect square?
9. What are perfect squares and perfect cubes?

Learning Objectives

1. Students will be able to identify rational and irrational numbers.
2. Students will be able to change a repeating decimal to a fraction.
3. Students will be able to change a fraction to a repeating decimal.
4. Students will be able to memorize perfect squares up to 400 and perfect cubes to 125.
5. Students will be able to estimate non-perfect square roots to the nearest tenth.
6. Students will be able to simplify expressions with exponents.
7. Students will be able to use the product rule, quotient rule, and power rule.
8. Students will be able to use the zero power rule of exponents.
9. Students will be able to simplify expressions that include negative exponents.
10. Students will be able to write numbers in scientific notation.
11. Students will be able to write numbers in standard form.
12. Students will be able to multiply and divide numbers in scientific notation.

Common Core State Standards

- 8.NS.1. – Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
- 8.NS.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.
- 8.EE.1. – Know and apply the properties of integer exponents to generate equivalent numerical expressions.
- 8.EE.2. – 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 $\sqrt{2}$ is irrational.
- 8.EE.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 of the other.
- 8.EE.4. – 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.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
 - a. Do Now activities
 - b. Classwork
 - c. Homework
 - d. Use of white boards
 - e. Unit Test (extended time when needed)
 - f. Review Game
 - g. Project
 - h. Graphic Organizer
 - i. Calculator Use
 - j. Assistive Technology
 - k. Scavenger Hunt
 - l. PARCC Practice
2. English Language Learners.
 - a. Read written instructions.

- b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations
 - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
- a. Students may be provided with note organizers / study guides to reinforce key topics.
 - b. Extended time on assessments when needed.
 - c. Preferred seating to be determined by student and teacher.
 - d. Provide modified assessments when necessary.
 - e. Student may complete assessments in alternate setting when requested.
 - f. Establish a non-verbal cue to redirect student when not on task.
 - g. Maintain strong teacher / parent communication.
 - h. Repetition and practice
 - i. Pair Visual Prompts with Verbal Presentations
 - j. Provide Formulas
 - k. Check Use of Agenda
4. Gifted and Talented Students.
- a. Use of Higher Level Questioning Techniques
 - b. Extension/Challenge Questions
 - c. Provide Assessments at a Higher Level of Thinking
 - d. Exploration Problems/Proofs

New Jersey Core Curriculum Content Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers

Strand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters® and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
- 9.2.8.B.7 Evaluate the impact of online activities and social media on employer decisions.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Unit 2: Expressions and Equations

Enduring Understanding

1. Rules of arithmetic and algebra can be used together with (the concept of) equivalence to transform equations so solutions can be found to solve problems.
2. Algebra uses symbols to represent quantities that are unknown or that vary. Mathematical phrases and real-world relationships can be represented using symbols and operations.

Essential Question(s)

1. What are equations and expressions, and how do they differ?
2. How can both simple and multistep algebraic equations be written and solved to find unknown values?

3. Why do we use inverse operations to solve equations?

Learning Objectives

1. Students will be able to solve two-step equations.
2. Students will be able to solve multi-step equations by combining like terms.
3. Students will be able to solve multi-step equations using the distributive property.
4. Students will be able to solve multi-step equations with variables on both sides of the equal sign.
5. Students will be able to solve multi-step equations by clearing fractions.
6. Students will be able to determine if a linear equation has one, no, or an infinite number of solutions.

Common Core State Standards

- 8.EE.7. – Solve linear equations in one variable
- 8.EE.7.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 an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- 8.EE.7.b. – Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
 - a. Do Now activities
 - b. Classwork
 - c. Homework
 - d. Use of white boards
 - e. Unit Test (extended time when needed)
 - f. Review Game
 - g. Project
 - h. Assistive Technology
 - i. PARCC Practice
2. English Language Learners.
 - a. Read written instructions.

- b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations
 - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
- a. Students may be provided with note organizers / study guides to reinforce key topics.
 - b. Extended time on assessments when needed.
 - c. Preferred seating to be determined by student and teacher.
 - d. Provide modified assessments when necessary.
 - e. Student may complete assessments in alternate setting when requested.
 - f. Establish a non-verbal cue to redirect student when not on task.
 - g. Maintain strong teacher / parent communication.
 - h. Repetition and practice
 - i. Pair Visual Prompts with Verbal Presentations
 - j. Provide Formulas
 - k. Check Use of Agenda
4. Gifted and Talented Students.
- a. Use of Higher Level Questioning Techniques
 - b. Extension/Challenge Questions
 - c. Provide Assessments at a Higher Level of Thinking
 - d. Exploration Problems/Proofs

New Jersey Core Curriculum Content Standards - Technology

- *8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.*

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers
Strand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters® and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Unit 3: Functions

Enduring Understanding

1. Functions are a special type of relationship or rule that uniquely associates members of one set with members of another set.
2. Patterns and relationships can be represented graphically, numerically, and symbolically.
3. Real world situations can be represented symbolically and graphically.
4. Functional relationships can be expressed in real contexts, graphs, algebraic equations, tables, and words; each representation of a given function is simply a different way of expressing the same idea.
5. Slope and y-intercept are keys to solving real problems involving linear relationships.
6. Different representations (written descriptions, tables, graphs, and equations) of the relationships between varying quantities may have different strengths and weaknesses.

Essential Question(s)

1. How can the rate of change be found in various representations of linear data?
2. How can we illustrate a linear equation?
3. How do you write a function rule given a table or a graph?
4. How do graphs help us “visualize” solutions to problems?
5. What is slope, and how is it useful in both creating and reading graphs?
6. How can functions be used to model real-world situations?
7. How can I sketch a graph given a verbal description?
8. How can I find the initial value from a table, graph, equations, or verbal description?
9. What does the slope of the function line tell me about the unit rate?
10. How do you determine if relations are functions?
11. How are functions evaluated?
12. How can graphs and equations of functions help us to interpret real-world problems?

Learning Objectives

1. Students will be able to identify if an ordered pair is a solution to an equation.
2. Students will be able to solve for the missing coordinate of an ordered pair.
3. Students will be able to find the slope of a line by counting.
4. Students will be able to find the slope of a line using the slope formula.
5. Students will be able to graph linear equations from a table of values.
6. Students will be able to graph linear equations using the slope and y-intercept.
7. Students will be able to write the equation of a line in slope-intercept form.
8. Students will be able to interpret the unit rate as the slope of the graph.
9. Students will be able to compare proportional relationships represented in different ways.
10. Students will be able to identify if a table represents a function.
11. Students will be able to identify if a graph represents a function.
12. Students will be able to write function rules from a table or graph.
13. Students will be able to identify the rate of change and initial value from a table and a graph.
14. Students will be able to analyze a graph and determine where it is increasing, decreasing, constant, linear, and non-linear.
15. Students will be able to sketch a qualitative graph given verbal directions.

Common Core State Standards

- 8.EE.5. – Graph proportional relationships, interpreting the unit rates as the slope of the graph. Compare two different proportional relationships represented in different ways.

- specific content standards
- 8.EE.6. – 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 $y = mx + b$ for a line intercepting the vertical axis at b .
- 8.F.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. (Function notation is not required in Grade 8.)
- 8.F.2. – Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- 8.F.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.
- 8.F.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.
- 8.F.5. – 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.

Suggested Activities/Modifications

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 - c. Homework
 - d. Use of white boards
 - e. Unit Test (extended time when needed)
 - f. Review Game
 - g. Project
 - h. Calculator Graphing Activity
 - i. Assistive Technology
 - j. PARCC Practice
 - k. Stained Glass Activity
 - l. Happy Hearts Activity

2. English Language Learners.
 - a. Read written instructions.
 - b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations
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- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers

Strand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters[®] and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Unit 4: Systems of Linear Equations

Enduring Understanding

1. There are situations that require two or more equations to be satisfied simultaneously.
2. There are several methods for solving systems of linear equations which will result in the same solution.
3. Solutions to systems of equations are ordered pairs and can therefore be interpreted algebraically, geometrically, or in relation to its context.

Essential Question(s)

1. What is a system of linear equations?

2. What are real life applications of systems of equations and how are they used to model these situations?
3. What does the solution to a system of equations mean?
4. How do you know how many solutions a system of equations will have?
5. How can we interpret the solution to a system of linear equations given its real world context?
6. How can we use technology to solve systems of linear equations?
7. What is the best way to solve a particular system of linear equations?
8. What does it mean for a system of linear equations to have no solution?
9. What does it mean for a system of linear equations to have infinite solutions?
10. What does it mean for a system of linear equations to have one solution?

Learning Objectives

1. Students will be able to manipulate equations to slope-intercept form.
2. Students will be able to understand that the solution to a system of equations is the point of intersection of their graphs.
3. Students will be able to solve a system of equations by graphing.
4. Students will be able to solve a system of equations by substitution.
5. Students will be able to solve a system of equations by elimination.
6. Students will be able to identify if a system has one, no, or an infinite number of solutions.
7. Students will be able to solve real-world and mathematical problems.

Common Core State Standards

- 8.EE.8. – Analyze and solve pairs of simultaneous linear equations.
- 8.EE.8.a. – Understand the 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.
- 8.EE.8.b. – Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
- 8.EE.8.c. – Solve real-world and mathematical problems leading to two linear equations in two variables.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
 - a. Do Now activities

- b. Classwork
 - c. Homework
 - d. Use of white boards
 - e. Unit Test
 - f. Review Game (extended time when needed)
 - g. Project
 - h. Calculator Graphing Activity
 - i. Assistive Technology
 - j. Hybrid Car Project
 - k. PARCC Practice
2. English Language Learners.
- a. Read written instructions.
 - b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations
 - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
- a. Students may be provided with note organizers / study guides to reinforce key topics.
 - b. Extended time on assessments when needed.
 - c. Preferred seating to be determined by student and teacher.
 - d. Provide modified assessments when necessary.
 - e. Student may complete assessments in alternate setting when requested.
 - f. Establish a non-verbal cue to redirect student when not on task.
 - g. Maintain strong teacher / parent communication.
 - h. Repetition and practice
 - i. Pair Visual Prompts with Verbal Presentations
 - j. Provide Formulas
 - k. Check Use of Agenda
4. Gifted and Talented Students.
- a. Use of Higher Level Questioning Techniques
 - b. Extension/Challenge Questions
 - c. Provide Assessments at a Higher Level of Thinking
 - d. Exploration Problems/Proofs

New Jersey Core Curriculum Content Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers

Strand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters® and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Unit 5: GeometryEnduring Understanding

1. One or two congruent figures on a coordinate plane can be mapped onto the other by a series of reflections, translations, or rotations.
2. Transformations and symmetry are used to analyze real-world situations.
3. All right triangles share common characteristics and have a special relationship among their side lengths.
4. Intersecting lines create special relationships among the angles that are formed by their intersection.
5. Volume represents the amount of space that is taken up by a three-dimensional solid.

Essential Question(s)

1. How can you change a figure's position without changing its size and shape?
2. How can you change a figure's size without changing its shape?
3. How can you represent a transformation in the coordinate plane?
4. Does the order of a sequence of transformations matter or will the resulting image be the same?
5. Which transformations or sequences of transformations produce congruent images?
6. Which transformations or sequences of transformations result in similar figures?
7. When can the Pythagorean Theorem be applied to real life situations?
8. How are the parts of a right triangle related?
9. What are the applications of the Pythagorean Theorem and its converse?
10. How do I calculate the volume of a given polyhedron?
11. What is a transversal and how does it impact the angles created by intersecting parallel lines?

Learning Objectives

1. Students will be able to recall and apply the Pythagorean Theorem to solve for a missing side of a right triangle.
2. Students will be able to identify the legs and hypotenuse of a right triangle.
3. Students will be able to apply the converse to the Pythagorean Theorem to determine if a given triangle is a right triangle.
4. Students will be able to apply the Pythagorean Theorem to classify triangles as right, acute, or obtuse.
5. Students will be able to explain a proof of the Pythagorean Theorem.
6. Students will be able to use the Pythagorean Theorem to calculate the distance between two points in the coordinate plane.

7. Students will be able to calculate the length of a missing side or diagonal in a three-dimensional figure by applying the Pythagorean Theorem.
8. Students will be able to recall the formulas to calculate the volume of spheres, cylinders, and cones.
9. Students will be able to recognize three-dimensional polyhedrons in real-world situations.
10. Students will be able to name and categorize three-dimensional polyhedrons.
11. Students will be able to calculate the volume of cones, cylinders, and include appropriate units of measurement.
12. Students will be able to use formulas to calculate the volume of real-world polyhedrons.
13. Students will be able to identify interior and exterior angles of a triangle.
14. Students will be able to recall and apply the formula for calculating the interior angle sum of a polygon.
15. Students will be able to recognize parallel lines and transversals.
16. Students will be able to identify special angles, including vertical angles, alternate interior angles, alternate exterior angles, corresponding angles, and same-side interior angles.
17. Students will be able to define and find complementary and supplementary angles of a given angle measurement.
18. Students will be able to prove triangles' similarity based upon Angle-Angle criterion.

Common Core State Standards

- 8.G.A.1 – Verify experimentally the properties of rotations, reflections, and translations:
 - 8.G.A.1.A – Lines are taken to lines, and line segments to line segments of the same length.
 - 8.G.A.1.B – Angles are taken to angles of the same measure.
 - 8.G.A.1.C – Parallel lines are taken to parallel lines.
- 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.B.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.
- 8.G.B.6. – Explain a proof of the Pythagorean Theorem and its converse.
- 8.G.B.7. – Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- 8.G.B.8. – Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
- 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.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
 - a. Do Now activities
 - b. Classwork
 - c. Homework
 - d. Use of white boards
 - e. Unit Test (extended time when needed)
 - f. Review Game
 - g. Project
 - h. Calculator Graphing Activity
 - i. Transformation Activity
 - j. Formula Sheet
 - k. Assistive Technology
 - l. Play-Doh Activity – Cross Sections
 - m. PARCC Practice
 - n. Popcorn Lab -- Volume
2. English Language Learners.
 - a. Read written instructions.
 - b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations

- h. Highlight Key Words & Formulas
3. Special Education/504 Students.
 - a. Students may be provided with note organizers / study guides to reinforce key topics.
 - b. Extended time on assessments when needed.
 - c. Preferred seating to be determined by student and teacher.
 - d. Provide modified assessments when necessary.
 - e. Student may complete assessments in alternate setting when requested.
 - f. Establish a non-verbal cue to redirect student when not on task.
 - g. Maintain strong teacher / parent communication.
 - h. Repetition and practice
 - i. Pair Visual Prompts with Verbal Presentations
 - j. Provide Formulas
 - k. Check Use of Agenda
 4. Gifted and Talented Students.
 - a. Use of Higher Level Questioning Techniques
 - b. Extension/Challenge Questions
 - c. Provide Assessments at a Higher Level of Thinking
 - d. Exploration Problems/Proofs

New Jersey Core Curriculum Content Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers

Strand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters® and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Unit 6: Statistics

Enduring Understanding

1. Logical patterns exist and are a regular occurrence in mathematics and the world around us.
2. Algebraic representation can be used to generalize patterns and relationships.
3. The type of data and the quantity of data collected affect the type of graph used to display it.

Essential Question(s)

1. What is a scatter plot?
2. When is making a scatter plot useful in the real world?
3. What types of relationships among data create positive associations?
4. What types of relationships among data create negative associations?
5. What does it mean for a bivariate set of data to have no association?
6. Why is drawing a line of best fit helpful to interpret data from a scatter plot?
7. How do we approximate data not included within the data set using a line of best fit?
8. Where are two-way tables found in the real world?
9. How do we analyze multiple sets of data within a two-way table?

Learning Objectives

1. Students will be able to interpret scatter plots by recognizing positive and negative associations, linear and nonlinear associations, and analyzing patterns.
2. Students will be able to identify outliers in a scatter plot.
3. Students will be able to determine if a scatter plot contains data that is clustered.
4. Students will be able to draw a line of best fit for data in a scatter plot.
5. Students will be able to determine if a given line is the line of best fit.
6. Students will be able to find the slope and y-intercept of the line of best fit, and interpret their findings.
7. Students will be able to interpolate and extrapolate information from a scatter plot and a line of best fit.
8. Students will be able to read two-way tables and gather data for analysis.
9. Students will be able to plot data from a two-way table in a scatter plot.
10. Students will be able to analyze patterns from two-way tables, including positive and negative associations and linear and nonlinear associations.
11. Students will be able to construct two-way tables to summarize bivariate data.

Common Core State Standards

- 8.SP.1. – Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8.SP.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.
- 8.SP.3. – Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
- 8.SP.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.

Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities

- a. Do Now activities
 - b. Classwork
 - c. Homework
 - d. Use of white boards
 - e. Unit Test (extended time when needed)
 - f. Review Game
 - g. Project
 - h. Calculator Graphing Activity
 - i. Assistive Technology
 - j. Task Cards
 - k. Stock Market Project/Game
 - l. Conduct Surveys to Create Two-Way Tables and Scatter Plots
2. English Language Learners.
 - a. Read written instructions.
 - b. Students may be provided with note organizers / study guides to reinforce key topics.
 - c. Model and provide examples
 - d. Extended time on assessments when needed.
 - e. Establish a non-verbal cue to redirect student when not on task.
 - f. Students may use a bilingual dictionary.
 - g. Pair Visual Prompts with Verbal Presentations
 - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
 - a. Students may be provided with note organizers / study guides to reinforce key topics.
 - b. Extended time on assessments when needed.
 - c. Preferred seating to be determined by student and teacher.
 - d. Provide modified assessments when necessary.
 - e. Student may complete assessments in alternate setting when requested.
 - f. Establish a non-verbal cue to redirect student when not on task.
 - g. Maintain strong teacher / parent communication.
 - h. Repetition and practice
 - i. Pair Visual Prompts with Verbal Presentations
 - j. Provide Formulas
 - k. Check Use of Agenda
4. Gifted and Talented Students.
 - a. Use of Higher Level Questioning Techniques
 - b. Extension/Challenge Questions
 - c. Provide Assessments at a Higher Level of Thinking
 - d. Exploration Problems/Proofs

New Jersey Core Curriculum Content Standards - Technology

- 8.1.8.A.4 - Generate a spreadsheet to calculate, graph, and present information.
- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.

Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
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- CRP4. Communicate clearly and effectively and with reason.
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- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and CareersStrand C: Career Preparation

- 9.2.8.B.1 Research careers within the 16 Career Clusters® and determine attributes of career success.
- 9.2.8.B.2 Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
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Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

V. Course Materials (included, but not limited to)

- Textbook – Mathematics Course 3, Publisher: Prentice Hall, Copyright: 2008
- Triumph Learning Performance Coach, grade 8
- Power Up for the PARCC Assessment, Course 3
- Calculator – TI-Nspire
- Rulers
- Graph Paper
- Computer Programs: Online Textbook, Math Circus
- Interactive Student Response Software

VI. Assessments (included, but not limited to)

1. Do Now Problems
2. Quizzes
3. Unit Tests
4. Projects
5. Classwork
6. Homework
7. Individual White Boards
8. Exit Tickets
9. Final Exam
10. PARCC Practice
11. PARCC Assessment
12. Review Games
13. Scavenger Hunts
14. Interactive Student Response Software

VII. Cross Curricular Aspects

1. Scientific Notation (Science)
2. Pythagorean Theorem Projects (Art, History)
3. City Design Project (Art)