

# Pequannock Township School District

## Curriculum Syllabus

### Introduction to Algebra / Grade 8

#### Course Description:

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.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ( $y/x = m$  or  $y = mx$ ) as special linear equations ( $y = mx + b$ ), understanding that the constant of proportionality ( $m$ ) is the slope, and the graphs are lines through the origin. They understand that the slope ( $m$ ) of a line is a constant rate of change, so that if the input or  $x$ -coordinate changes by an amount  $A$ , the output or  $y$ -coordinate changes by the amount  $m \cdot A$ . Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and  $y$ -intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. 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.

Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

## **Course Standards:**

The following is a list of proficiencies that describe what students are expected to know and be able to do as a result of successfully completing this course. The following proficiencies are the basis of the assessment of student achievement. The learner will demonstrate mastery of:

### **The Number System**

1. Know that there are numbers that are not rational, and approximate them by rational numbers.  
*8.NS.A.1, 8.NS.A.2*

### **Expressions and Equations**

2. Work with radicals and integer exponents.  
*8.EE.A.1, 8.EE.A.2, 8.EE.A.3, 8.EE.A.4*
3. Understand the connections between proportional relationships, lines, and linear equations.  
*8.EE.B.5, 8.EE.B.6*
4. Analyze and solve linear equations and pairs of simultaneous linear equations.  
*8.EE.C.7a-b, 8.EE.C.8a-c*

### **Functions**

5. Define, evaluate, and compare functions.  
*8.F.A.1, 8.F.A.2, 8.F.A.3*
6. Use functions to model relationships between quantities.  
*8.F.B.4, 8.F.B.5*

### **Statistics**

7. Investigate patterns of association in bivariate data.  
*8.SP.A.1, 8.SP.A.2, 8.SP.A.3, 8.SP.A.4*

## Geometry

8. Understand congruence and similarity using physical models, transparencies, or geometry software.  
*8.G.A.1, 8.G.A.2, 8.G.A.3, 8.G.A.4, 8.G.A.5*
9. Understand and apply the Pythagorean Theorem.  
*8.G.B.6, 8.G.B.7, 8.G.B.8*
10. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.  
*8.G.C.9*

## Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them. *SMP1*
2. Reason abstractly and quantitatively. *SMP2*
3. Construct viable arguments and critique the reasoning of others. *SMP3*
4. Model with mathematics. *SMP4*
5. Use appropriate tools strategically. *SMP5*
6. Attend to precision. *SMP6*
7. Look for and make use of structure. *SMP7*
8. Look for and express regularity in repeated reasoning. *SMP8*

## Scope and Sequence

### **Unit 1: The Number System (Trimester 1)**

Students will be able to compare, approximate, locate, and identify rational and irrational numbers. Students will be able to evaluate expressions with integer exponents and use scientific notation to write very large or very small numbers. Students will be able to perform operations expressed in scientific notation. Students will be able to choose appropriate size measurements for quantities in real-world problem solving situations.

Students in 8<sup>th</sup> grade need to be able to communicate clearly and accurately about real numbers. Students will use definitions, terminology, symbols, and properties associated with real numbers to identify and locate rational and irrational numbers on a number line, use exponential notation to generate equivalent numerical expressions, and use square root and cube roots symbols to evaluate expressions. Students in 8<sup>th</sup> grade will use scientific notation in problem solving by learning how to represent real-world situations using scientific notation, computing with very small and very large measurements and quantities, and by applying scientific notation in real-world and mathematical contexts. Students in 8<sup>th</sup> grade need to understand these properties in order to be prepared for Algebra 1 and Geometry.

### **Unit 2: Equations, Slope, and Functions (Trimesters 1 and 2)**

Students will be able to establish proportion relationships and interpret unit rates. Students will be able to identify the slope or rate of change and graph and interpret the relationship between two variables. Students will be able to identify the parts of the slope-intercept formula and graph the linear equation. From this graph students will be able to use similar triangles to explain how slope is similar between two points of a non-vertical line. Students will be able to evaluate these linear equations with rational number coefficients that may require expressions using the distributive property and/or combining like terms yielding one solution, infinite solutions, or no solution.

Students will be able to identify and define linear functions through graphs and function rules. Students will be able to compare functions represented in different ways and utilize tables, graphs, and equations to classify linear and non-linear functions. Students will be able to model real life problems involving slope and intercept of a linear equation.

Students in 8<sup>th</sup> grade need to be able to solve problems by reasoning about algebraic linear equations. Students will make sense of quantities and relationships by using properties, such as the distributive property, to solve linear equations. Students will also identify the number of solutions to an equation and use tables and multi-variable equations to represent relationships. Students will be able to understand that direct proportional relationships are really linear relationships. Students are expected to extend the models and processes associated with ratios and rates to transform linear equations to slope-intercept form ( $y = mx + b$ ) to determine intercepts and find the slope of a line. Students will use slope and intercepts to graph linear equations and explain the slopes and y-intercept in the context of real-world problems.

Students in 8<sup>th</sup> grade need to be able to use a visual-symbolic-algebraic progression that fosters understanding that a function is a rule that assigns to each input exactly one output. Students should look for patterns in various representations of functions in order to describe, analyze, and compare functions.

Students in 8<sup>th</sup> grade need to understand these properties in order to be prepared for Algebra 1 and Geometry.

### **Unit 3: Bivariate Data and Systems of Equations (Trimester 2)**

Students will be able to interpret and construct scatter plots and describe possible associations between two variables.

Students will be able to solve systems of equations containing two variables by inspection, algebraically, and/or graphically. Students will be able to construct a function to model linear relationships between two variables to examine the rate of change and initial value of the real world data. Students will be able to graph a function from a qualitative description and give a qualitative description of a graph of a function.

Students will model and investigate patterns of association in bivariate data. Students will organize data into scatter plots and frequency tables by clustering outliers, positive or negative association, possible lines of best fit, and nonlinear association. Students will employ a visual, symbolic, and algebraic progression that allows students to connect symbolic and graphical representations for systems of linear equations. Students will interpret and solve real-world problems leading to systems of equations through these multiple representations of tables, verbal descriptions, coordinate graphs, numerical and algebraic expressions, comparison bar models, systems of equations, technology through

graphing calculators, and coordinate graphs. Students will model and investigate patterns of association in bivariate data.

#### **Unit 4: Congruence and Similarity (Trimesters 2 and 3)**

Students build comprehension of transformation in the coordinate plane through dilations, translations, rotations, and reflections. Students will also be able to recognize the proportionality of objects and establish if angles and side lengths of polygons are congruent or similar. Students will also understand the relationship between corresponding angles. Students in 8<sup>th</sup> grade need to be able to select appropriate geometric tools to establish facts about geometric transformations on two-dimensional figures. Students in 8<sup>th</sup> grade are expected to understand and model geometric transformations by using coordinates to describe the effect of dilations, translations, rotations, and reflections and drawing images of two-dimensional figures after geometric transformations. Students in 8<sup>th</sup> grade will complete this unit so they can reason inductively and communicate conclusions about congruence, similarity, and transformations. Students in 8<sup>th</sup> grade need to understand these properties in order to be prepared for Algebra 1 and Geometry.

#### **Unit 5: Pythagorean Theorem and Volume (Trimester 3)**

Students will work on understanding the Pythagorean theorem and its' converse. Students will apply the Pythagorean theorem in real-life situations. Students will also explore the distance formula in reference to the coordinate plane. Students will recognize that the distance formula or Pythagorean theorem will be able to be used to find the distance between two ordered pairs on the coordinate plane. Students in 8<sup>th</sup> grade need to be able to extend properties and formulas associated with two- and three-dimensional geometric figures. Students are expected to develop the Pythagorean Theorem and the distance formula, explain the proof of the Pythagorean Theorem and its converse, and use the Pythagorean Theorem to solve real-world problems in two or three dimensions. Students will also be able to find the volume of common three-dimensional figures such as cones, cylinders, and spheres. Students in 8<sup>th</sup> grade need to understand these properties in order to be prepared for Algebra 1 and Geometry.

## **Assessments**

Evaluation of student achievement in this course will be based on the following:

- a. Observational data collected by teachers as students are learning
- b. Formative assessments given by teachers to gauge progress toward each standard

## **Curriculum Resources**

**Instructional Resources:**

*enVision Math Grade 8 Common Core*

**Additional Technology Resources:**

Illustrative Mathematics: [www.illustrativemathematics.org](http://www.illustrativemathematics.org)

Open-Up Resources: <https://im.openupresources.org/8/teachers/index.html>

NC Lessons for Learning: <http://tools4ncteachers.com/eighth-grade/>

Georgia Lessons for Grade 8: <https://www.georgiastandards.org/Georgia-Standards/Pages/Math-6-8.aspx>

## Home and School Connection

The following are suggestions and/or resources that will help parents support their children:

- Tutorials
  - <https://www.khanacademy.org/>
- Learn Zillion
  - <https://learnzillion.com/resources/75114-math/>
- IXL Math
  - <https://www.ixl.com/math/grade-8>
- EnVision Math series
  - [www.pearsonrealize.com](http://www.pearsonrealize.com)
    - Educational games
    - Online tutorials for each lesson (Virtual Nerd videos)