Wayne, New Jersey

**Middle School Mathematics Department
Eighth Grade Mathematics Curriculum Guide
July 2022
Revised**

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This curriculum may be modified through varying techniques, strategies, and materials
as per an individual student's Individualized Educational Plan (IEP)

Approved by the Wayne Township Board of Education at the regular meeting held on
September 8, 2022

Wayne Township Public Schools - Mathematics - Grade 8 - Pacing Guide

Month	Sept				Oct				Nov				Dec				Jan				Feb/March				March/April				April/May				June		
Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Unit 1: Number System	Launch	X	X	X	X	X	X	X	Flex																										
Unit 2: Linear Relationships and Functions											X	X	X	X	X	X	X	X	X	X	X	X	Flex												
Unit 3: Geometry																								X	X	X	X	X	X	X	X	X			
Unit 4: Statistics and Probability																																	X	X	Flex
Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Month	Sept				Oct				Nov				Dec				Jan				Feb/March				March/April				April/May				June		

Content Area/ Grade Level/ Course:	**Mathematics/Grade 8**
Unit Plan Title:	**Unit 1 – The Number System**
Time Frame	**7 Weeks (see pacing guide)**

Anchor Standards/Domain*

Anchor Standards for Mathematics
- 8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.
- 8.EE.A Work with radicals and integer exponents.

New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills
9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- Multiple solutions often exist to solve a problem.
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

Technology Literacy
- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.

WIDA Standards
- ELD Standard 1: Social and Instructional Language
- ELD Standard 3: The Language of Mathematics

Unit Summary

In previous grades, students described lengths using only whole numbers and fractions. In this Unit, students explore lengths that cannot be described using whole numbers or fractions. They discover irrational numbers and approximate their magnitudes using rational numbers. They discover properties of exponents that will allow them to transform expressions. These properties also help students to express very large and very small quantities using powers. Students work with square and cube root symbols to prepare for working with rational exponents in high school.

Standard Numbers

8.NS.A.1 - 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.

8.NS.A.2 – Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

8.EE.A.1 - Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 × 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.*

8.EE.A.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.A.3 – Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as $3 × 10^8$ and the population of the world as $7 × 10^9$, and determine that the world population is more than 20 times larger.*

8.EE.A.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 (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Mathematical Practices 1-8:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

New Jersey Student Learning Standards for Career Readiness, Life Literacy, and Key Skills
9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- 9.4.8.CT.2 Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
- 9.4.8.CT.3 Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Technology Literacy
- 9.4.8.TL.2 Gather data and digitally represent information to communicate a real-world problem.

Essential Questions
- In what ways can rational numbers be useful?
- How does one locate irrational numbers on a number line?
- How does one determine whether a number is rational or irrational?
- How can one estimate the decimal value of an irrational number?
- Why does one need to write numbers in scientific notation?
- What is the advantage of performing operations on numbers expressed in scientific notation rather than numbers in standard form?

Enduring Understandings
- All numbers, rational and irrational, have a location on a number line.
- Every number has a decimal expansion.

- Every rational number has a decimal expansion that terminates or eventually repeats.
- A number in the form a/b means a is divided by b.
- Every irrational square root can be estimated by its location between two rational square roots.
- Numbers can be written in many equivalent forms.
- Perfect cube numbers are whole numbers each raised to the third power.
- Very large or very small quantities can be estimated using numbers expressed in scientific notation.
- Compare magnitudes of numbers when expressed in scientific notation.
- Operations can be performed with numbers expressed in scientific notation.

Interdisciplinary Connections

- Topic "STEM Project"
- Topic "3 ACT Math"
- MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. Understanding of very small and very large quantities and ability to express how many times as much one is than the other will allow students to be successful in this science standard.
- MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
  Understanding of properties of integer exponents and square roots and cube roots will allow students to be successful in this science standard.

In this unit plan, the following 21st Century themes and skills are addressed.

	Check all that apply. 21st Century Themes			Check all that apply 21st Century Skills
x	Global Awareness		x	Creativity and Innovation
	Environmental Literacy		x	Critical Thinking and Problem Solving
x	Health Literacy		x	Communication
	Civic Literacy		x	Collaboration
x	Financial, Economic, Business, and Entrepreneurial Literacy			

Student Learning Targets/Objectives (Students will know/Students will understand)

- How to write rational numbers as quotients of integers.
- How to distinguish between rational and irrational numbers.
- Perfect square numbers. If not memorized, students should know how to find the perfect square numbers by multiplying each whole number by itself.
- That the decimal expansion of a rational number terminates or repeats.
- How to convert a decimal expansion which repeats eventually into a rational number.
- How to find rational approximations of irrational numbers.
- How to compare the size of approximations of irrational numbers.
- How to locate approximations of irrational numbers on a number line.
- How to estimate the value of expressions of irrational numbers. *E.g.,* π^2
- How to apply properties of integer exponents to generate equivalent numerical expressions.
- How to evaluate square roots of small perfect squares and cube roots of small perfect cubes.
- Conversion of numbers between standard form and scientific notation.
- How to express how many times as much one number in scientific notation is than another.
- How to interpret scientific notation that has been generated by technology.

Assessments (Pre, Formative, Summative, Other)	*Denote required common assessments with an **

Assessments (some can be in more than one category):
- *Pre-Assessment:* Beginning-of-the-Year Assessment, Topic Readiness Assessments, "Review What You Know" activities at the beginning of a new topic, classroom warm-up activities
- *Formative*: "Try It!," "Convince Me!," "Do You Understand?," and "Do You Know How?" activities throughout a topic, lesson quizzes, Mid-Topic Checkpoints, informal student questioning, communicator activities, homework, class participation, exit cards/tickets, use of digital assessment tools through, Chromebooks, smart phones, or other devices, Edulastic
- *Summative*: Topic 1 Assessment
- *Benchmark*: *District mid-year benchmark assessment
- *Alternative* (available for individual students as needed): Topic Performance Tasks, Student Self-Assessment Tool (Teacher's Resource Masters, Volume 2), evaluate student work using the Cognitive Rigor Matrix for Mathematics (Assessment Book), portfolio assessment of student work

Teaching and Learning Activities	
Activities	- Lessons 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, Topic 1 Review "3-Act Math" activities - STEM projects "Solve & Discuss It"/""Explore It!"/"Explain It!" activities at the beginning of each lesson - students should be encouraged to: - Work productively in teams - Communicate clearly and effectively and with reason - Demonstrate creativity and innovation - Utilize critical thinking to make sense of problems and persevere in solving them - Use digital tools to enhance their group response - Utilize digital tools to present their work to the class, where appropriate - Ongoing use of NJSLA online tools, NJSLA online calculator, and reference sheet to gain comfort and familiarity

	● Classifying Rational and Irrational Numbers Lesson from the Mathematics Assessment Project: https://www.map.mathshell.org/download.php?fileid=1710 & Mathshell slides classifying rational and irrational numbers ● Desmos: Circles (Whole Number Exponents)
Differentiation Strategies	● Expand work with integer exponents to include variable bases ● Estimate roots to different place values based on ability ● Use of extra skill practice/calculators ● enVision Differentiated Intervention: Reteach to Build Understanding, Additional Vocabulary Support, Build Mathematical Literacy, Enrichment, Math Tools and Games ● Online enVision resources: (Today's Challenge, accessible student edition of text, Another Look activities and videos, reteaching activities) ● Online enVision resources for student assistance/differentiation: digital tools, extra practice, interactive eText, glossary, games ● Math Diagnosis and Intervention System ● English Language Learners Toolkit ● Differentiation Strategies for Special Education Students ● Differentiation Strategies for Gifted and Talented Students ● Differentiation Strategies for ELL Students ● Differentiation Strategies for At Risk Students ● Differentiation Strategies for Students with a 504

Resources

- enVision 2.0 Math Topic 1
- Communicators, graph boards, calculators
- Graph paper, colored pencils, rulers, 3-D manipulatives
- Projection System, Document Camera, Chromebooks, other student devices
- Reference Sheets:
  - Rational vs. Irrational Numbers
  - How to Approximate Irrational Numbers Template
  - Scientific Notation Reference Sheet
- Websites:
  - http://nlvm.usu.edu/en/nav/vlibrary.html
  - http://illuminations.nctm.org/
  - http://map.mathshell.org/materials/index.php
  - http://www.ixl.com
  - http://insidemathematics.org
  - http://mathsnacks.com
  - http://www.openmiddle.com
  - http://https://nysed-prod.engageny.org/
  - https://www.desmos.com/
- Videos:
  - Properties of Rational and Irrational Numbers Explained!
  - Approximating Square Roots on a Number Line
  - BrainPOP Rational and Irrational Numbers

- o [Math Antics Exponents & Square Roots](#)
- o [Math Antics Intro to Exponents](#)
- o [Math Antics Laws of Exponents](#)
- o [Simplify the Middle: Powers of 10](#)
- o [Math Antics Scientific Notation](#)
- o [Scientific Notation and Their Operations](#)

Wayne Township Public Schools
Grade 8 Mathematics Curriculum

Content Area/ Grade Level/ Course:	**Mathematics/Grade 8**
Unit Plan Title:	**Unit 2 – Linear Relationships/Functions**
Time Frame	**12 Weeks (see pacing guide)**

Anchor Standards/Domain*

Anchor Standards for Mathematics
- 8.EE.B. Understand the connections between proportional relationships, lines, and linear equations.
- 8.EE.C Analyze and solve linear equations and pairs of simultaneous linear equations.
- 8.F.A Define, evaluate, and compare functions.
- 8.F.B Use functions to model relationships between quantities.

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills
9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

Information and Media Literacy
- Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.

Technology Literacy
- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.

WIDA Standards
- ELD Standard 1: Social and Instructional Language
- ELD Standard 3: The Language of Mathematics

Unit Summary

In Grade 7, students learned to solve equations. In this unit, they begin to understand the connection between proportional relationships, lines, and linear equations. They build on this knowledge to solve and analyze multi-step linear equations and pairs of simultaneous linear equations.

In this unit, students grasp the concept of a function and use functions to describe quantitative relationships. They describe how aspects of functions are reflected in different representations. Students also determine which functions are linear. Students use linear equations to represent, analyze, and solve a variety of problems. Students investigate non-linear functions through the use of tables, graphs, and equations.

Standard Numbers

8.EE.C.7. 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 an 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.

8.F.A. Define, evaluate, and compare functions.
   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.)
   2. Compare properties (e.g. rate of change, intercepts, domain and range) 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.EE.B.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

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. *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.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.

8.EE.B.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 $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

8.F.B.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.

8.EE.C.8. 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.*
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.*

Mathematical Practices 1-8:
   1. Make sense of problems and persevere in solving them.
   2. Reason abstractly and quantitatively.
   3. Construct viable arguments and critique the reasoning of others.
   4. Model with mathematics.
   5. Use appropriate tools strategically.
   6. Attend to precision.

7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

New Jersey Student Learning Standards for Career Readiness, Life Literacy, and Key Skills

9.4 Life Literacies, and Key Skills

Critical Thinking and Problem-Solving
- 9.4.8.CT.3 Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Information and Media Literacy
- 9.4.8.IML.5 Analyze and interpret local or public data sets to summarize and effectively communicate the data.

Technology Literacy
- 9.4.8.TL.2 Gather data and digitally represent information to communicate a real-world problem.

Essential Questions

- How does one interpret the number of solutions to linear equations in one variable?
- How can algebraic expressions and equations be used to model, analyze, and solve mathematical situations?
- When is a relationship between two variables proportional?
- How does thinking of a unit rate as the slope of a line help to solve problems?
- How are functions useful?
- When should functions be evaluated and compared?
- What applications could be represented by variables that are not related by a linear function?
- What are the distinguishing characteristics of a graph of a function?
- What applications require solving simultaneous linear equations?

Enduring Understandings

- The solution to a linear equation is a point or set of points which will make the equation true.
- Algebraic expressions and equations are used to model real-life problems and represent quantitative relationships.
- A unit rate is a ratio between two measurements in which the denominator is one.
- The relationship between variables can be represented using word descriptions, tables, graphs, and equations.
- Proportional relationships can be represented by lines and linear equations.
- The slope m is the same between any two distinct points on a line.
- When the ratio of rise to run is the same between two right triangles, their corresponding sides must be proportional.
- Graphing linear equations will enable one to estimate solutions.
- A function is a rule that assigns each input exactly one output.
- Functions can be represented in four different ways: graphically, algebraically, numerically in tables, and verbal descriptions.
- Rate of change and initial values of linear functions can be determined in terms of the situations it models, its graph, or a table of values.
- There are many different functional relationships that are not linear.
- Solutions to a system of two linear equations are points that will make both equations true.
- Solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs.

Interdisciplinary Connections

- Topic "STEM Project"
- Topic "3 ACT Math"
- MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. Understanding of very small and very large quantities and ability to express how many times as much one is than the other will allow students to be successful in this science standard.
- MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
  Being able to interpret the equation $y=mx+b$ as defining a linear function, whose graph is a straight line, and give examples of functions that are not linear will allow students to be successful in this science standard.
- MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
  Being able to interpret the equation $y=mx+b$ as defining a linear function, whose graph is a straight line, and give examples of functions that are not linear will allow students to be successful in this science standard.
- MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
  Being able to interpret the equation $y=mx+b$ as defining a linear function, whose graph is a straight line, and give examples of functions that are not linear will allow students to be successful in this science standard.

In this unit plan, the following 21st Century themes and skills are addressed.

Check all that apply. **21st Century Themes**		*Check all that apply* **21st Century Skills**	
	Global Awareness	x	Creativity and Innovation
x	Environmental Literacy	x	Critical Thinking and Problem Solving
	Health Literacy	x	Communication
	Civic Literacy	x	Collaboration
x	Financial, Economic, Business, and Entrepreneurial Literacy		

Student Learning Targets/Objectives (Students will know/Students will understand)

- How to solve equations with rational number coefficients.
- How to solve and give examples of linear equations with one solution, infinitely many solutions, and no solution.
- How to expand expressions using the distributive property.
- How to compare representations of proportional relationships, *e.g. graph, table, and equation.*
- How to interpret the unit rate as the slope of the graph.
- How to derive the equation (for proportional relationships) $y=mx$ for the line that goes through the origin.
- How to derive the equation (for linear relationships) $y=mx+b$ for the line intercepting the *y*-axis at *b*.
- How to determine if a relationship between values is a function.

- How to compare properties of two functions each represented in a different way: graphically, algebraically, numerically, or by verbal description.
- How to interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line.
- How to give examples of functions that are not linear.
- How to determine the rate of change and initial value of linear functions given a graph, table, or verbal description.
- How to describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear).
- How to analyze and algebraically solve pairs of simultaneous linear equations.
- How to estimate the solution to a system of linear equations by graphing the equations.
- How to solve real-world and mathematical problems leading to two linear equations in two variables.

Assessments (Pre, Formative, Summative, Other)   *Denote required common assessments with an **

Assessments (some can be in more than one category):
- *Pre-Assessment:* Beginning-of-the-Year Assessment, Topic Readiness Assessments, "Review What You Know" activities at the beginning of a new topic, classroom warm-up activities
- *Formative*: "Try It!," "Convince Me!," "Do You Understand?," and "Do You Know How?" activities throughout a topic, lesson quizzes, Mid-Topic Checkpoints, informal student questioning, communicator activities, homework, class participation, exit cards/tickets, use of digital assessment tools through, Chromebooks, smart phones, or other devices, Edulastic
- *Summative*: Topics 2, 3, and 5 Assessments
- *Benchmark*: *District mid-year benchmark assessment
- *Alternative* (available for individual students as needed): Topic Performance Tasks, Student Self-Assessment Tool (Teacher's Resource Masters, Volume 2), evaluate student work using the Cognitive Rigor Matrix for Mathematics (Assessment Book), portfolio assessment of student work

Teaching and Learning Activities

Activities	- Lessons 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, Topic 2 Review - Lessons 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, Topic 3 Review - Lessons 5-1, 5-2, 5-3, 5-4, Topic 5 Review "3-Act Math" activities - STEM projects "Solve & Discuss It"/""Explore It!"/"Explain It!" activities at the beginning of each lesson - students should be encouraged to: - Work productively in teams - Communicate clearly and effectively and with reason - Demonstrate creativity and innovation - Utilize critical thinking to make sense of problems and persevere in solving them - Use digital tools to enhance their group response - Utilize digital tools to present their work to the class, where appropriate - Ongoing use of NJSLA online tools, NJSLA online calculator, and reference sheet to gain comfort and familiarity [Desmos: Which is Steepest?](#) [Desmos: Coin Capture: Lines](#) [Functions Google Slides Activity](#) [Qualitative Graph Google Slides Intro](#) [Qualitative Graphs & Stories Activity](#)

	● [Systems of Equations Scavenger Hunt](#)
Differentiation Strategies	● Use of extra skill practice/calculators ● Choice of process on assessments of solving linear systems ● Transparencies for line of best fit ● enVision Differentiated Intervention: Reteach to Build Understanding, Additional Vocabulary Support, Build Mathematical Literacy, Enrichment, Math Tools and Games ● Online enVision resources: (Today's Challenge, accessible student edition of text, Another Look activities and videos, reteaching activities) ● Online enVision resources for student assistance/differentiation: digital tools, extra practice, interactive eText, glossary, games ● Math Diagnosis and Intervention System ● English Language Learners Toolkit ● [Differentiation Strategies for Special Education Students](#) ● [Differentiation Strategies for Gifted and Talented Students](#) ● [Differentiation Strategies for ELL Students](#) ● [Differentiation Strategies for At Risk Students](#) ● [Differentiation Strategies for Students with a 504](#)

Resources

- enVision 2.0 Grade 8 Topics 2, 3, and 5
- Communicators, graph boards, calculators
- Graph paper, colored pencils, rulers, 3-D manipulatives
- Projection System, Document Camera, Chromebooks, other student devices
- Websites:
  - http://nlvm.usu.edu/en/nav/vlibrary.html
  - http://illuminations.nctm.org/
  - http://map.mathshell.org/materials/index.php
  - http://www.ixl.com
  - http://insidemathematics.org
  - http://mathsnacks.com
  - http://www.openmiddle.com
  - http://https://nysed-prod.engageny.org/
  - https://www.desmos.com/
- Reference Sheets
  - [Solving Multi-Step Equations Reference Sheet](#)
  - [Functions Anchor Chart](#)
  - [Linear vs. Nonlinear Functions Reference Sheet](#)
  - [One Solution, No Solution, Infinitely Many Solutions Visual](#)
  - [How Many Solutions in a System of Equations Chart](#)
  - [Inspection Method for Systems of Equations Reference Sheet](#)
  - [Elimination Method for Systems of Equations Reference Sheet](#)
  - [Substitution Method Example](#)
- Videos:
  - [BrainPOP: Two-Step Equations](#)
  - [Khan Academy: Intro to Solving Equations with Variables on Both SIdes](#)

- EdPuzzle: Solve Multistep Equations with the DIstributive Property
- Math Antics Basic Linear Functions
- EdPuzzle: Slope-Intercept Form
- Math Antics Slope and Distance
- Math Antics Graphing on the Coordinate Plane
- EdPuzzle: Is it a Function?
- Khan Academy: Recognizing Linear Functions
- Math Antics What are Functions?
- EdPuzzle: Qualitative Graphs
- EdPuzzle: Systems of Equations
- MyWhyU: Solving Systems of Equations by Substitution
- Khan Academy: Systems of Equation with Elimination

Content Area/ Grade Level/ Course:	**Mathematics/Grade 8**
Unit Plan Title:	**Unit 3 – Geometry**
Time Frame	**9 Weeks (see pacing guide)**

Anchor Standards/Domain*

Anchor Standards for Mathematics
- 8.G.A Understand congruence and similarity using physical models, transparencies, or geometry software.
- 8.G.B Understand and apply the Pythagorean Theorem.
- 8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills
9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- Multiple solutions often exist to solve a problem.
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

Technology Literacy
- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.

WIDA Standards
- ELD Standard 1: Social and Instructional Language
- ELD Standard 3: The Language of Mathematics

Unit Summary

In this unit, students describe, analyze, and solve problems about two-dimensional figures using ideas about distance and angles under transformations. Transformations also allow students to explore congruence and similarity. Students investigate angle relationships through working with triangles and intersecting lines. Specifically, right triangles help students discover the Pythagorean Theorem and its converse. Using the Pythagorean Theorem, students find distances between points, find lengths, and analyze polygons. This unit also allows students to revisit their work with volume by solving problems involving cones, spheres, and cylinders.

Standard Numbers

8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations.
a. Lines are transformed to lines, and line segments to line segments of the same length.
b. Angles are transformed to angles of the same measure.
c. Parallel lines are transformed 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.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.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.

Mathematical Practices 1-8:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

New Jersey Student Learning Standards for Career Readiness, Life Literacy, and Key Skills
9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- 9.4.8.CT.2 Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
- 9.4.8.CT.3 Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Technology Literacy
- 9.4.8.TL.2 Gather data and digitally represent information to communicate a real-world problem.

Essential Questions
- Why does one need to perform transformations on figures?
- How does knowing two figures are congruent or similar help one to solve problems?
- How can one use the Pythagorean Theorem to solve real world and mathematical problems?
- How can one use finding volume to solve real world and mathematical problems?
- What is the relationship between volumes of cones, spheres, and cylinders?

Enduring Understandings

- Geometric attributes provide descriptive information about an object's properties and position in space.
- Reflections, translations, and rotations are transformations that create congruent figures in alternate positions.
- Dilations are transformations that create similar figures if the scale factor is applied uniformly.
- There are relationships among the angles formed when parallel lines are cut by a transversal.
- Congruence of corresponding angles determines similarity only for triangles.
- Application of the Pythagorean Theorem.
- Application of the converse of the Pythagorean Theorem.
- Why the Pythagorean Theorem can be used to find the distance between two points.
- Volume is a unit of measurement that indicates the amount of cubic units a 3 dimensional shape takes up.

Interdisciplinary Connections

- Topic "STEM Project"
- Topic "3 ACT Math"

In this unit plan, the following 21st Century themes and skills are addressed.

Check all that apply. 21st Century Themes		Check all that apply 21st Century Skills	
x	Global Awareness	x	Creativity and Innovation
	Environmental Literacy	x	Critical Thinking and Problem Solving
	Health Literacy	x	Communication
	Civic Literacy	x	Collaboration
	Financial, Economic, Business, and Entrepreneurial Literacy		

Student Learning Targets/Objectives (Students will know/Students will understand)

- How to reflect, translate, rotate, and dilate 2 dimensional figures.
- The effects of a transformation on a 2 dimensional figure using coordinates.
- How to describe a sequence of transformations that exhibits the congruence between two figures.
- How to describe a sequence of transformations that exhibits the similarity between two figures.
- How to identify angle relationships when two parallel lines are cut by a transversal.
- Application of the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two- and three-dimensions.
- Application of the Pythagorean Theorem to find the distance between two points in a coordinate plane.
- How to use the converse of the Pythagorean Theorem to determine if a triangle is right.
- The formulas for Volume of cones, cylinders, and spheres.
- How to use the volume formulas of cones, cylinders, and spheres to solve real-world and mathematical problems.

Assessments (Pre, Formative, Summative, Other)   *Denote required common assessments with an ***

Assessments (some can be in more than one category):

- *Pre-Assessment:* Beginning-of-the-Year Assessment, Topic Readiness Assessments, "Review What You Know" activities at the beginning of a new topic, classroom warm-up activities
- *Formative*: "Try It!," "Convince Me!," "Do You Understand?," and "Do You Know How?" activities throughout a topic, lesson quizzes, Mid-Topic Checkpoints, informal student questioning, communicator activities, homework, class participation, exit cards/tickets, use of digital assessment tools through, Chromebooks, smart phones, or other devices, Edulastic
- *Summative*: Topics 6, 7, and 8 Assessments
- *Benchmark*: *District mid-year benchmark assessment
- *Alternative* (available for individual students as needed): Topic Performance Tasks, Student Self-Assessment Tool (Teacher's Resource Masters, Volume 2), evaluate student work using the Cognitive Rigor Matrix for Mathematics (Assessment Book), portfolio assessment of student work

Teaching and Learning Activities	
Activities	- Lessons 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, Topic 6 Review - Lessons 7-1, 7-2, 7-3, 7-4, Topic 7 Review - Lessons 8-1, 8-2, 8-3, 8-4, Topic 8 Review "3-Act Math" activities - STEM projects "Solve & Discuss It"/""Explore It!"/"Explain It!" activities at the beginning of each lesson - students should be encouraged to: - Work productively in teams - Communicate clearly and effectively and with reason - Demonstrate creativity and innovation - Utilize critical thinking to make sense of problems and persevere in solving them - Use digital tools to enhance their group response - Utilize digital tools to present their work to the class, where appropriate - Ongoing use of NJSLA online tools, NJSLA online calculator, and reference sheet to gain comfort and familiarity - Desmos: Transformers - Desmos: Transformations with Coordinates - Desmos: Polygraph Transformations Partner Activity - Math Playground: Reflection Painter Game - Transformations Cut & Paste Activity - Desmos: Sketchy Dilations - Desmos: Dilations Mini Golf - Pythagorean Theorem Jeopardy - Pythagorean Explorer - Converse of the Pythagorean Theorem Maze
Differentiation Strategies	- Allow students to use transparencies to help with drawing transformations - Use hands-on manipulatives (geometric solids and sand/rice) to show volume relationships - Color-coding for angle relationships - Use of extra skill practice/calculators

	● enVision Differentiated Intervention: Reteach to Build Understanding, Additional Vocabulary Support, Build Mathematical Literacy, Enrichment, Math Tools and Games
	● Online enVision resources: (Today's Challenge, accessible student edition of text, Another Look activities and videos, reteaching activities)
	● Online enVision resources for student assistance/differentiation: digital tools, extra practice, interactive eText, glossary, games
	● Math Diagnosis and Intervention System
	● English Language Learners Toolkit
	● [Differentiation Strategies for Special Education Students](#)
	● [Differentiation Strategies for Gifted and Talented Students](#)
	● [Differentiation Strategies for ELL Students](#)
	● [Differentiation Strategies for At Risk Students](#)
	● [Differentiation Strategies for Students with a 504](#)

Resources

- enVision 2.0 Grade 8 Topics 6,7, and 8
- Communicators, graph boards, calculators
- Graph paper, colored pencils, rulers, 3-D manipulatives
- Projection System, Document Camera, Chromebooks, other student devices
- Websites:
    - http://nlvm.usu.edu/en/nav/vlibrary.html
    - http://illuminations.nctm.org/
    - http://map.mathshell.org/materials/index.php
    - http://www.ixl.com
    - http://insidemathematics.org
    - http://mathsnacks.com
    - http://www.openmiddle.com
    - http://https://nysed-prod.engageny.org/
    - https://www.desmos.com/
    - MathIsFun.com: How to Find if Triangles are Similar
- Reference Sheets:
    - Motion Rules Reference Sheet
    - Angles Cheat Sheet
    - Find the Missing Hypotenuse Example
    - Find the Missing Leg Example
    - Volume of Cones, Spheres, & Cylinders Help Sheet
- Videos:
    - BrainPOP: Transformations
    - Math Mashup: Geometry Transformations
    - Geometry Rotations Explained (90, 180, 270, 360)
    - Math Mashup: The Difference Between Similar & Congruent Figures
    - Math Antics Angle Basics
    - Math Antics Angles & Degrees
    - Math Antics Triangles
    - Shmoop: Pythagorean Theorem
    - Math Antics The Pythagorean Theorem

- o [Converse of the Pythagorean Theorem](#)
- o [Math Antics Volume](#)
- o [Math Mashup: Finding the Volume of a Cone Explained](#)

Content Area/ Grade Level/ Course:	Mathematics/Grade 8
Unit Plan Title:	Unit 4 – Statistics and Probability
Time Frame	2 Weeks (see pacing guide)

Anchor Standards/Domain*

Anchor Standards for Mathematics
- 8.SP.A Investigate patterns of association in bivariate data.

New Jersey Student Learning Standards for Career Readiness, Life Literacy, and Key Skills

9.1 Personal Financial Literacy
Credit Profile
- There are strategies to build and maintain good credit history.

Planning and Budgeting
- A budget aligned with an individual's financial goal can help prepare for life events.
- Goals (e.g., higher education, autos, and homes, retirement), affect your finances.

9.2. Career Awareness, Exploration, Preparation, and Training
Career Awareness and Planning
- An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
- Early planning can provide more options to pay for postsecondary training and employment.

9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- Multiple solutions often exist to solve a problem.
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

Technology Literacy
- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.

WIDA Standards
- ELD Standard 1: Social and Instructional Language
- ELD Standard 3: The Language of Mathematics

Technology Standards
- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Unit Summary

In this unit, students apply their experience with the coordinate plane and linear functions to study possible associations between two variables. Students analyze bivariate data by describing clustering, outliers, and correlations. They summarize data in two-way tables to look for patterns of association. This allows students to determine linear models for their data.

Standard Numbers

8.SP.A.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

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 (e.g. line of best fit) by judging the closeness of the data points to the line.

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. *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.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. *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?*

Mathematical Practices 1-8:
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2. Reason abstractly and quantitatively.
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4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

New Jersey Student Learning Standards for Career Readiness, Life Literacy, and Key Skills
9.1 Personal Financial Literacy
Credit Profile
- 9.1.8.CP.2 Analyze how spending habits affect one's ability to save.
Planning and Budgeting
- 9.1.8.PB.4 Construct a simple personal savings and spending plan based on various sources of income and different stages of life (e.g. teenager, young adult, family).
- 9.1.8.PB.6 Construct a budget to save for short-term, long-term, and charitable goals.

9.2. Career Awareness, Exploration, Preparation, and Training
Career Awareness and Planning
- 9.2.8.CAP.1 Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
- 9.2.8.CAP.2 Develop a plan that includes information about career areas of interest.

- 9.2.8.CAP.3 Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
- 9.2.8.CAP.6 Compare the costs of postsecondary education with the potential increase in income from a career of choice.

9.4 Life Literacies, and Key Skills
Critical Thinking and Problem-Solving
- 9.4.8.CT.2 Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
- 9.4.8.CT.3 Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Technology Literacy
- 9.4.8.TL.2 Gather data and digitally represent information to communicate a real-world problem.

Essential Questions

- Why is it important to describe patterns of the relationship between two quantities?
- How is a scatterplot used to determine if there is a relationship between two quantities?
- How is a two-way table used to determine if there is a relationship between two variables?
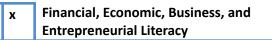
Enduring Understandings

- Lines used to model the association between two quantities will provide more information than just the data points themselves.
- Once the equation of a linear model is found, it can be used to solve problems in the context of bivariate measurement data.
- The slope and y-intercept of the linear model can be interpreted in the context of the problem.
- Scatterplots show whether or not there is an association between two quantities.
- Patterns of association can also be seen in bivariate data by displaying frequencies and relate frequencies in a two-way table.

Interdisciplinary Connections

- Topic "STEM Project"
- Topic "3 ACT Math"

In this unit plan, the following 21st Century themes and skills are addressed.

Check all that apply. 21st Century Themes		*Check all that apply* 21st Century Skills	
x	Global Awareness	x	Creativity and Innovation
	Environmental Literacy	x	Critical Thinking and Problem Solving
	Health Literacy	x	Communication
x	Civic Literacy	x	Collaboration

x	Financial, Economic, Business, and Entrepreneurial Literacy	

Student Learning Targets/Objectives (Students will know/Students will understand)

- How to construct and interpret scatterplots of bivariate data to investigate patterns of association between two quantities.
- How to describe patterns: clustering, outliers, positive and negative correlation, linear and non-linear correlation.
- How to informally fit a straight line for scatterplots that suggest a linear correlation.
- The use of the equation of a linear model to solve problems in the context of bivariate measurement data.
- How to construct and interpret a two-way table summarizing data in two variables collected from the same subjects.
- The use of relative frequencies calculated for rows or columns to describe possible association between two variables.

Assessments (Pre, Formative, Summative, Other)   *Denote required common assessments with an ***

Assessments (some can be in more than one category):

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- *Formative*: "Try It!," "Convince Me!," "Do You Understand?," and "Do You Know How?" activities throughout a topic, lesson quizzes, Mid-Topic Checkpoints, informal student questioning, communicator activities, homework, class participation, exit cards/tickets, use of digital assessment tools through, Chromebooks, smart phones, or other devices, Edulastic
- *Summative*: Topic 4 Assessment
- *Benchmark*: *District mid-year benchmark assessment
- *Alternative* (available for individual students as needed): Topic Performance Tasks, Student Self-Assessment Tool (Teacher's Resource Masters, Volume 2), evaluate student work using the Cognitive Rigor Matrix for Mathematics (Assessment Book), portfolio assessment of student work

Teaching and Learning Activities

Activities	- Lessons 4-1, 4-2, 4-3, 4-4, 4-5, Topic 4 Review "3-Act Math" activities - STEM projects "Solve & Discuss It"/""Explore It!"/"Explain It!" activities at the beginning of each lesson - students should be encouraged to: - Work productively in teams - Communicate clearly and effectively and with reason - Demonstrate creativity and innovation - Utilize critical thinking to make sense of problems and persevere in solving them - Use digital tools to enhance their group response - Utilize digital tools to present their work to the class, where appropriate - Ongoing use of NJSLA online tools, NJSLA online calculator, and reference sheet to gain comfort and familiarity - Desmos: Scatter Plot Capture - Grade 8 Project - Math Related Careers - Students will research Math/STEM related careers and choose one.

	- Students will research the average salary of that job, create a budget based on that salary (food, utilities, mortgage, car), then reflect on cost of living and importance of a budget and responsible spending. - Desmos: Scatter Plot Capture - Scatter Plot Google Slides Activity - Scatter Plot Google Form Practice
Differentiation Strategies	- Graphing technology - Different sized graph paper - Use of extra skill practice/calculators - Transparencies for line of best fit - enVision Differentiated Intervention: Reteach to Build Understanding, Additional Vocabulary Support, Build Mathematical Literacy, Enrichment, Math Tools and Games - Online enVision resources: (Today's Challenge, accessible student edition of text, Another Look activities and videos, reteaching activities) - Online enVision resources for student assistance/differentiation: digital tools, extra practice, interactive eText, glossary, games - Math Diagnosis and Intervention System - English Language Learners Toolkit - Differentiation Strategies for Special Education Students - Differentiation Strategies for Gifted and Talented Students - Differentiation Strategies for ELL Students - Differentiation Strategies for At Risk Students - Differentiation Strategies for Students with a 504

Resources

- enVision 2.0 Topic 4
- Communicators, graph boards, calculators
- Graph paper, colored pencils, rulers, 3-D manipulatives
- Projection System, Document Camera, Chromebooks, other student devices
- Videos:
  - Two-Way Relative Frequency Tables
  - Khan Academy: Interpreting Scatter Plots
- Websites:
  - http://nlvm.usu.edu/en/nav/vlibrary.html
  - http://illuminations.nctm.org/
  - http://map.mathshell.org/materials/index.php
  - http://www.ixl.com
  - http://insidemathematics.org
  - http://mathsnacks.com
  - http://www.openmiddle.com
  - http://https://nysed-prod.engageny.org/
  - https://www.desmos.com/