Great Meadows Regional
Mathematics
Grade 8

CURRICULUM GUIDE
Approved
August 22, 2017

Mr. David C. Mango, Superintendent
Mrs. Debra Grigoletti, Director of Curriculum & Instruction

Developed by:
Deborah Exley

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

Approved by the Great Meadows Board of Education
At the regular meeting held on August 22, 2017
And
Aligned with the New Jersey Student Learning Standards

Table of Contents

Philosophy and Rationale

New Jersey Student Learning Standards for Mathematics set the framework for a coherent mathematics curriculum across the grade levels. Students best acquire mathematical skills when they are engaged in activities that enable them to discover, understand and apply mathematical concepts. When students are challenged to use mathematics in meaningful ways, they develop their reasoning and problem solving skills and come to realize the usefulness of mathematics in their lives.

Learning mathematics is not dependent on special abilities but can be achieved by all students. Differentiating instruction, flexible grouping, cooperative learning, individualized and whole class instruction are some strategies that will help students achieve high level expectations. A positive attitude towards mathematics is one of the keys to success. When taught in a supportive, developmentally appropriate environment where decision making, risk taking, self-assessment and self-confidence are encouraged students will thrive.

Preparing students for 21st century careers in our information-based society must involve solving real-world problems, reasoning effectively and making logical connections. Students are encouraged to develop the critical thinking skills required to persevere through a tiered problem solving challenge. This, incorporated with a strong foundation in mathematical operations and number sense, will enable students to produce convincing oral and written mathematical arguments. Infusing technology supports visualization, organization and analysis of data so that students are better able to focus on the “Whys” and “Hows” of mathematical learning.

Through rich and varied educational experiences, students are encouraged to think critically and collaborate with peers; to use mathematics and 21st century skills for effective college and career readiness. Successful completion of this course will prepare students to become contributing members of a global society.

Mission Statement

The Great Meadows Regional School District will provide quality educational opportunities that ensure the individual success of all students within a safe and supportive environment and to build lifelong learners who will meet society’s challenges into and beyond the 21st century. To that end, it is anticipated that all students will achieve the New Jersey Student Learning Standards at all grade levels.

Scope and Sequence

Unit 1: The Number System and Exponents

- Know that there are numbers that are not rational called irrational
- Use rational approximations of irrational numbers and locate them on a number line
- Know and apply the properties of integer exponents
- Evaluate square roots and cube roots of small perfect squares and perfect cubes
- Express very large and very small numbers in scientific notation
- Perform operations with numbers expressed in scientific notation

Unit 2: Expressions and Equations

- Understand the connections between proportional relationships, lines and linear equations
- Graph proportional relationships, interpreting the unit rate as the slope; derive the equations y=mx and y=mx+b from data and graphs
- Solve simple and multi-step linear equations with rational number coefficients
- Understand that a linear equation in one variable can have one solution, no solution or infinitely many solutions
- Analyze and solve pairs of simultaneous linear equations
- Solve multi-variable equations (formulas) for a given variable

Unit 3: Functions

- Define, evaluate and compare functions (algebraically, graphically, numerically in tables or by verbal descriptions)
- Understand that y=mx+b is a linear function and recognize non-linear functions
- Interpret the rate of change and initial value of a function

Unit 4: Geometry: Pythagorean Theorem, Congruence and Similarity, Transformations

- Understand and apply the Pythagorean Theorem
- Understand that a two-dimentional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections and translations
- Understand Congruence and Similarity using physical models, transparencies or geometry software
- Know the formulas for the volumes of cones, cylinders and spheres and use them to solve real-world and mathematical problems
- Use informal arguments to establish facts about the angle sum and exterior angles of triangles, and about angles created when parallel lines are cut by a transversal

Unit 5: Statistics and Probability: Scatterplots and Association

- Investigate patterns of association in bivariate data
- Use functions to model relationships between quantities
- Analyze and solve linear equations and simultaneous linear equations

Stage 1: Desired Results

Unit 1 - Number Systems and Exponents

Topics

- Identifying Rational and Irrational Numbers
- Integer Exponents and Radicals

Content Standards

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., π2). For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

8.EE.A.1 Work with radicals and integer exponents
Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √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 × 108 and the population of the world as 7 × 109 , 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.

Essential Questions

1. What situations would require an estimated value of an irrational number?

2. Why are exponents useful mathematically and how would using exponents and scientific notation help to simplify mathematical comparisons and operations.

Enduring Understandings

1. All numbers that can be written in the form of a/b; where a and b are integers and b ≠ 0 are rational numbers.

2. If the decimal equivalent of a number is non-repeating, non-terminating that number is irrational.

3. Raising a base to an integer exponent is equivalent to repeated multiplication of that base; using the same base value will result in reciprocals if the base is raised to opposite exponents (2 and -2).

4. The operation of squaring a number is the inverse of evaluating the square root of a given number.

5. Using scientific notation to estimate the values of very large or very small numbers helps when comparing or calculating

Knowledge and Skills (SWBAT embedded course proficiencies)

Students will be able to:

- identify numbers as rational or irrational using a calculator as needed
- place rational and irrational numbers on a number line appropriately using their fraction or decimal form (or an approximation)
- problem solve using both rational and irrational numbers
- determine if answers should be given in a rational or irrational form
- use the properties of integer exponents to generate equivalent expressions
- use scientific notation to estimate very large or very small quantities
- perform operations with numbers expressed in scientific notation
- evaluate square roots and cube roots

Stage 2: Evidence of Understanding, Learning Objectives and

Expectations

Benchmarks (embedded student proficiencies administered quarterly)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Formative
Teacher Observation/Anecdotal notes
Graphic organizers/Information Wheel
Do Now / Problem of the Day
Journal / Explanations / Reflections
Exit Tickets
Daily homework
Group work
Discussion (large group, small group and partner share)
Problem of the Week Solutions
Quizzes
Individual Response System
IXL
Braining Camp

Summative
Chapter Tests
Unit Test
Short and Extended Constructed Responses
Technology based Math Assessments
Individual Student Unit Projects with Rubric
Benchmark Assessments

Other evidence and/or student self-assessment
Math Journal reflections
Vocabulary Journal entries
Journal opened-ended, multiple-step responses
Self-evaluations with personal whiteboards
Self-assessment checklists
Card pass review & practice
Group Projects with self-assessment and group rubrics
Student generated practice activities
Student Constructed Assessments (peer evaluations)
Student Reflection and corrections on Assessments

Stage 3: Learning Plan

In Unit 1 students will develop an understanding of the framework of Real numbers. They will be able to appropriately catagorize whole numbers, integers, rational and

irrational numbers whether the numbers are presented in fraction, decimal or radical format. They will learn to compare and order rational and irrational numbers using approximations as needed. Knowing when and why the outcome of various problems will result in an irrational number is a major part of this unit.

Unit 1 will extend to include work with integer exponents. Understanding that the use of exponents is a simplified way of expressing repeated multiplication of a given base is part 1 of the concept development. Moving forward, students will include negative exponents and rational number bases to increase their level of understanding. Although working with negative exponents is often challenging for students, many find clarity by working through examples where the bases are the same and the exponents are opposites, resulting in reciprocal answers ($2^3 = 2 \times 2 \times 2 = 8$; $2^{-3} = ½ \times ½ \times ½ = ⅛$). An investigative approach to computation with exponential expressions often works well; allowing students to use multiple forms of technology in addition to paper and pencil.

Scientific Notation will be used in Science as well as Math. Students will be able to write both large and small numbers in Scientific Notation as well as calculate using basic operations and compare values with numbers in this exponential form. Through the use of multiple learning style activities (e.g. visual, auditory, kinesthetic, and tactile) students will be actively engaged throughout the unit.

Differentiation will be embedded into the unit in the form of:
Adjusting curriculum expectations, compacting
Tiered instructions and assignments
Adjusting question types; more leading questions as needed
limiting multiple choice answers and number of constructed responses
small group instruction
peer coaching and review
use of graphic organizers
Study guides provided as needed
choice options determined by level of independence required

The **21st century skills and technology** used in this unit are:

Creativity and Innovation

- Compare different ways of approaching traditional mathematical problems
- Find innovative solutions, using practical examples where appropriate
- Listen to and evaluate others' reasoning and offer improvements and corrections with supporting arguments
- Listen to others' feedback and modify solutions as needed.
- Learn from mistakes and make repeated attempts at solving problems
- Look for patterns and make generalizations from patterns observed

Critical Thinking and Problem Solving

- Identify and ask significant questions about mathematics and engage in analyzing each other's answers
- Analyze how parts of a whole interact with each other in mathematics
- Make judgements and solve problems in both conventional and innovative ways

Communication and Collaboration

- Articulate mathematical thoughts and ideas using oral and written communication skills
- Analyze others' reasoning and construct viable arguments using reasoning with attention to mathematical fact
- Listen respectfully to the reasoning of others'
- Communicate respectfully in diverse teams articulating mathematical thoughts and ideas effectively

Information, Media and Technology Literacy

- Explore and share with others new areas of mathematics and its applications
- Learn about mathematics from reliable websites and share knowledge with others
- Evaluate information critically and competently
- Use technology as a tool to research, organize, evaluate and communicate information

Life and Career Skills

- Demonstrate the ability to work in pairs and small groups to solve mathematical problems with flexibility, adaptability and respect for others ideas and cultural differences
- Set goals, establish priorities and timelines to complete short-term and long-term project

Integration of Digital Tools

- Google Classroom, Big Ideas Math (online site), various websites and online resources will be used with the Chromebooks, IPads, Interactive SMARTBoard

Each student will come away with pivotal skills and understandings while being appropriately challenged throughout the unit. The 8 Standards for Mathematical Practice will be embedded in this unit of instruction.

Standards for Mathematical Practice:

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

MP.8 Look for and express regularity in repeated reasoning.

Time Allotment Days

~ Identifying Rational and Irrational Numbers __5__

~ Integer Exponents and Radicals
__25__

Total Days __30__

Resources

Suggested resources will include but are not limited to the following:

District approved Math textbook (Big Ideas Series) and supplemental reference materials including: Resources by Chapter, Record and Practice Journal, Computer Generated Assessments, Chapter Tests, Section Quizzes, Standards assessments
Interactive Websites
Videos
Informational Websites
STEM/STEAM activities
Teacher collected Resources
Mathematics Manipulatives
Graphing Calculators / desmos.com
Algebra Tiles
Teacher developed SMART BOARD lessons
Wipe-off graph boards, graph paper
2 and 3 dimensional shapes
multi-purpose cubes
compass
protractor
ruler

Stage 1: Desired Results
Unit 2 - Expressions and Equations

Topics

- Understand the connections between proportional relationships, lines, and linear equations
- Analyze and solve linear equations in one variable with rational coefficients
- Analyze and solve pairs of simultaneous linear equations
- Solve real-world mathematical problems using two bivariate linear equations

Content Standards

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.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.EE.C.7a Solve linear equations in one variable
Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which 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.C.7b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.C.8a Analyze and solve pairs of simultaneous linear equations. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

8.EE.C.8b 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.

8.EE.C.8c 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.

Essential Questions

1. How does the slope of a line depict the unit rate for a given real-life situation?
2. Can a linear equation be used to solve when there is only one unknown?

3. What information can do the intercepts and point of intersection provide when working with multiple bivariate equations?

Enduring Understandings

1. Writing and graphing linear equations to represent situations in real life can help you to make connections, analyze and solve problems.
2. Linear equations in one variable can have one solution, no solution or infinitely many solutions.
3. Understand that the solution to a system of two linear equations in two variables corresponds to the point of intersection of their graphs because points of intersection satisfy both equations simultaneously.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students will be able to:

- Solve linear equations with rational number coefficients, including equations whose solutions require use of the distributive property and collecting like terms
- Transform equations using equality properties to solve for a given variable
- Find the slope of a line given a graph or from two points (two sets of data) and recognize the slope as the unit rate
- Derive y=mx and y=mx+b from a given situation
- Understand that the solution to a system of two linear equations in two variables corresponds to the point of intersection of their graphs
- Solve bivariate systems of linear equations graphically and algebraically
- Solve real-world mathematical problems leading to systems of two linear equations in two variables

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies administered quarterly)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Formative

Teacher Observation/Anecdotal notes
Graphic organizers/Information Wheel
Do Now / Problem of the Day
Journal / Explanations / Reflections
Exit Tickets
Daily homework
Group work
Discussion (large group, small group and partner share)

Problem of the Week Solutions
Quizzes
Individual Response System
IXL
Braining Camp

Summative
Chapter Tests
Unit Test
Short and Extended Constructed Responses
Technology based Math Assessments
Individual Student Unit Projects with Rubric
Benchmark Assessments

Other evidence and/or student self-assessment
Math Journal reflections
Vocabulary Journal entries
Journal opened-ended, multiple-step responses
Self-evaluations with personal whiteboards
Self-assessment checklists
Card Pass review & practice
Group Projects with self-assessment and group rubrics
Student generated practice activities
Student Constructed Assessments (peer evaluations)
Student Reflection and corrections on Assessments

Stage 3: Learning Plan

Unit 2, Expressions and Equations, will challenge students to use 7th grade solving equations skills and raise them to the next level by including rational coefficients along with distributive property and combining like terms. Students will also learn to solve equations with variables on both sides of the equal sign.

Turning a real-world situation into multiple bivariate equations is one of the more challenging concepts introduced in 8th grade. Students will learn to use information and collected data to create equations. They will graph their equations to analyze slope and y-intercepts; then solve by finding the point they have in common. This unit requires advanced logic and reasoning skills and will challenge students to stay focused, follow multiple steps, and use higher level thinking skills. Through the use of multiple learning style activities (e.g. visual, auditory, kinesthetic, and tactile) students will be actively engaged throughout the unit.

Differentiation will be embedded into the unit in the form of:
Adjusting curriculum expectations, compacting
Tiered instructions and assignments
Adjusting question types; more leading questions as needed
limiting multiple choice answers and number of constructed responses

small group instruction
peer coaching and review
use of graphic organizers
Study guides provided as needed
choice options determined by level of independence required

The **21st century skills and technology** used in this unit are:

Creativity and Innovation

- Compare different ways of approaching traditional mathematical problems
- Find innovative solutions, using practical examples where appropriate
- Listen to and evaluate others' reasoning and offer improvements and corrections with supporting arguments
- Listen to others' feedback and modify solutions as needed.
- Learn from mistakes and make repeated attempts at solving problems
- Look for patterns and make generalizations from patterns observed

Critical Thinking and Problem Solving

- Identify and ask significant questions about mathematics and engage in analyzing each other's answers
- Analyze how parts of a whole interact with each other in mathematics
- Make judgements and solve problems in both conventional and innovative ways

Communication and Collaboration

- Articulate mathematical thoughts and ideas using oral and written communication skills
- Analyze others' reasoning and construct viable arguments using reasoning with attention to mathematical fact
- Listen respectfully to the reasoning of others'
- Communicate respectfully in diverse teams articulating mathematical thoughts and ideas effectively

Information, Media and Technology Literacy

- Explore and share with others new areas of mathematics and its applications
- Learn about mathematics from reliable websites and share knowledge with others
- Evaluate information critically and competently
- Use technology as a tool to research, organize, evaluate and communicate information

Life and Career Skills

- Demonstrate the ability to work in pairs and small groups to solve mathematical problems with flexibility, adaptability and respect for others ideas and cultural differences
- Set goals, establish priorities and timelines to complete short-term and long-term project

Integration of Digital Tools

- Google Classroom, Big Ideas Math (online site), various websites and online resources will be used with the Chromebooks, IPads, Interactive SMARTBoard

Each student will come away with pivotal skills and understandings while being appropriately challenged throughout the unit. The 8 Standards for Mathematical Practice will be embedded in this unit of instruction.

Standards for Mathematical Practice:

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

Time Allotment Days

~ Connections between proportional relationships, lines, and linear equations	__5__
~ Analyze and solve linear equations in one variable with rational coefficients	__10_
~ Analyze and solve pairs of simultaneous linear equations	__15__
~ Solve real-world mathematical problems using two bivariate linear equations	__15__
Total Days	__45__

Resources

Suggested resources will include but are not limited to the following:

District approved Math textbook (Big Ideas Series) and supplemental reference materials including: Resources by Chapter, Record and Practice Journal, Computer Generated Assessments, Chapter Tests, Section Quizzes, Standards assessments
Interactive Websites
Videos
Informational Websites
STEM/STEAM activities
Teacher collected Resources
Mathematics Manipulatives
Graphing Calculators / desmos.com
Algebra Tiles
Teacher developed SMART BOARD lessons

Wipe-off graph boards, graph paper
2 and 3 dimensional shapes
multi-purpose cubes
compass
protractor
ruler

Stage 1: Desired Results
Unit 3- Functions

Topics

- Definition of a function
- Compare and write functions represented in different ways (words, tables, graphs)
- Understand that y=mx+b is a linear function and recognize non-linear functions
- Interpret the rate of change and initial value of a function

Content Standards

8.F.A.1 Define, evaluate, and compare functions
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.A.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.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 = s2 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.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.

Essential Questions

1. How can functions be used to represent situations in real life?
2. How can graphs of function rules help you to better analyze a given situation?

Enduring Understandings

1. Most situations can be described and analyzed by using a graph and/or a function rule.
2. Collecting data, developing function rules and graphing are helpful when analyzing, comparing, predicting and problem solving.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students will be able to:

- understand that a function is a rule that assigns to each input exactly one output
- compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
- interpret the equation y=mx+b as defining a linear function, whose graph is a straight line
- recognize functions that are not linear
- determine the rate of change and initial value of a function from a description of a relationship or from two (x,y) values
- describe qualitatively the functional relationship between two quantities by analyzing a graph
- sketch a graph that exhibits the qualitative features of a function that has been described verbally

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies administered quarterly)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Formative

Teacher Observation/Anecdotal notes
Graphic organizers/Information Wheel
Do Now / Problem of the Day
Journal / Explanations / Reflections
Exit Tickets

Daily homework
Group work
Discussion (large group, small group and partner share)
Problem of the Week Solutions
Quizzes
Individual Response System
IXL
Braining Camp

Summative
Chapter Tests
Unit Test
Short and Extended Constructed Responses
Technology based Math Assessments
Individual Student Unit Projects with Rubric
Benchmark Assessments

Other evidence and/or student self-assessment
Math Journal reflections
Vocabulary Journal entries
Journal opened-ended, multiple-step responses
Self-evaluations with personal whiteboards
Self-assessment checklists
Card pass review & practice
Group Projects with self-assessment and group rubrics
Student generated practice activities
Student Constructed Assessments (peer evaluations)
Student Reflection and corrections on Assessments

Stage 3: Learning Plan

A broad introduction to functions using data from situations, tables, and graphs will help students to grasp the idea of having exactly one output assigned to each specific input value. Graphing data will help students to recognize mathematical patterns, allowing them to quickly identify both linear and non-linear functions. Finding the slope of a linear function in y=mx or y=mx+b form using the rise over run technique will help students better understand the idea of unit rate. Analyzing and comparing multiple functions will help students develop more complete responses to short constructed and extended constructed response questions. Through the use of multiple learning style activities (e.g. visual, auditory, kinesthetic, and tactile) students will be actively engaged throughout the unit.

Differentiation will be embedded into the unit in the form of:
Adjusting curriculum expectations, compacting
Tiered instructions and assignments
Adjusting question types; more leading questions as needed
limiting multiple choice answers and number of constructed responses

small group instruction
peer coaching and review
use of graphic organizers
Study guides provided as needed
choice options determined by level of independence required

The **21st century skills and technology** used in this unit are:

Creativity and Innovation

- Compare different ways of approaching traditional mathematical problems
- Find innovative solutions, using practical examples where appropriate
- Listen to and evaluate others' reasoning and offer improvements and corrections with supporting arguments
- Listen to others' feedback and modify solutions as needed.
- Learn from mistakes and make repeated attempts at solving problems
- Look for patterns and make generalizations from patterns observed

Critical Thinking and Problem Solving

- Identify and ask significant questions about mathematics and engage in analyzing each other's answers
- Analyze how parts of a whole interact with each other in mathematics
- Make judgements and solve problems in both conventional and innovative ways

Communication and Collaboration

- Articulate mathematical thoughts and ideas using oral and written communication skills
- Analyze others' reasoning and construct viable arguments using reasoning with attention to mathematical fact
- Listen respectfully to the reasoning of others'
- Communicate respectfully in diverse teams articulating mathematical thoughts and ideas effectively

Information, Media and Technology Literacy

- Explore and share with others new areas of mathematics and its applications
- Learn about mathematics from reliable websites and share knowledge with others
- Evaluate information critically and competently
- Use technology as a tool to research, organize, evaluate and communicate information

Life and Career Skills

- Demonstrate the ability to work in pairs and small groups to solve mathematical problems with flexibility, adaptability and respect for others ideas and cultural differences
- Set goals, establish priorities and timelines to complete short-term and long-term project

Integration of Digital Tools

- Google Classroom, Big Ideas Math (online site), various websites and online resources will be used with the Chromebooks, IPads, Interactive SMARTBoard

Each student will come away with pivotal skills and understandings while being appropriately challenged throughout the unit. The 8 Standards for Mathematical Practice will be embedded in this unit of instruction.

Standards for Mathematical Practice:

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

Time Allotment Days

~ Definition of a function	__3__
~ Compare and write functions represented in different ways (words, tables, graphs)	_ 10__
~ Understand that y=mx+b is a linear function and recognize non-linear functions	__4___
~ Interpret the rate of change and initial value of a function	__3__
Total Days	__20___

Resources

Suggested resources will include but are not limited to the following:

District approved Math textbook (Big Ideas Series) and supplemental reference materials including: Resources by Chapter, Record and Practice Journal, Computer Generated Assessments, Chapter Tests, Section Quizzes, Standards assessments
Interactive Websites
Videos
Informational Websites
STEM/STEAM activities
Teacher collected Resources
Mathematics Manipulatives
Graphing Calculators / desmos.com
Algebra Tiles

Teacher developed SMART BOARD lessons
Wipe-off graph boards, graph paper
2 and 3 dimensional shapes
multi-purpose cubes
compass
protractor
ruler

Stage 1: Desired Results
Unit 4 - Geometry

Topics

- Transformations: translations, reflections, rotations
- Congruent figures
- Transformations including dilations on the coordinate plane
- Similar figures, including perimeter and area relationships
- Angles: construction, relationships, in triangles, in polygons
- Parallel lines and transversals
- Pythagorean Theorem
- Volume of Cones, Cylinders and Spheres
- Surface Area and Volume of Similar Solids

Content Standards

8.G.A.1 Understand congruence and similarity using physical models, transparencies, or geometry software.
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 Understand and apply the Pythagorean Theorem.
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 realworld 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 Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Essential Questions

1. How can knowledge of geometric shapes and transformations of those shapes be used in possible future professions?
2. When would the Pythagorean Theorem be used in a real-world situation?

Enduring Understandings

1. Translations, Reflections and Rotations will create congruent shapes.
2. Dilations will create Similar Figures that are enlargements or reductions of the original shape.
3. The Pythagorean Theorem can be used to find missing side lengths in right triangles and side lengths can be used to verify if the triangle contains a right angle.
4. Use the appropriate formulas for Cylinders, Cones and Spheres to solve real-life problems.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students will be able to:

- Create and follow a translation rule
- Create and follow a reflection rule
- Create and follow a rotation rule
- Identify and create congruent figures on a coordinate plane
- Create and follow a dilation rule
- Identify and create similar figures on a coordinate plane

- Use ratios and similar figures to determine perimeter and area of polygons
- Understand angle relationships in triangles (interior and exterior angles) and other polygons
- Understand the angle relationships created by parallel lines and transversals
- Use the Pythagorean Theorem and its converse to solve problems
- Apply the Pythagorean Theorem to find the distance between two points on a coordinate plane
- Use the formulas for Cylinders, Cones, and Spheres to solve real-world mathematical problems (including transforming these formulas to solve for a missing measurement)

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies administered quarterly)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Formative
Teacher Observation/Anecdotal notes
Graphic organizers/Information Wheel
Do Now / Problem of the Day
Journal / Explanations / Reflections
Exit Tickets
Daily homework
Group work
Discussion (large group, small group and partner share)
Problem of the Week Solutions
Quizzes
Individual Response System
IXL
Braining Camp

Summative
Chapter Tests
Unit Test
Short and Extended Constructed Responses
Technology based Math Assessments
Individual Student Unit Projects with Rubric
Benchmark Assessments

Other evidence and/or student self-assessment
Math Journal reflections
Vocabulary Journal entries

Journal opened-ended, multiple-step responses
Self-evaluations with personal whiteboards
Self-assessment checklists
Card pass review & practice
Group Projects with self-assessment and group rubrics
Student generated practice activities
Student Constructed Assessments (peer evaluations)
Student Reflection and corrections on Assessments

Stage 3: Learning Plan

The Geometry unit includes introductions to four types of transformations: translations, reflections, rotations, and dilations. Students will learn to create and follow rules for each type; these skills help students create complex geometric patterns and lead students to the strategies needed for introductory coding. This unit extends the concepts of congruent and similar figures through the use of transformations. Using an investigative approach with similar figures will help students determine the ratio relationship that exists when finding perimeters and areas.

Drawings and reasoning skills will allow students to reach mathematical conclusions with regard to interior and exterior angles of triangles and polygons as well as angles created by parallel lines and transversals. The Pythagorean Theorem and its converse will be explored extensively in this unit using a variety of real-life situations.

Students will conclude this unit with an exploration of volume and surface area of 3-dimensional shapes (cylinder, cone, sphere). Students will not only calculate using specific formulas but will extend their solving equation skills to include transforming formulas to solve for a missing measurement. Through the use of multiple learning style activities (e.g. visual, auditory, kinesthetic, and tactile) students will be actively engaged throughout the unit.

Differentiation will be embedded into the unit in the form of:
Adjusting curriculum expectations, compacting
Tiered instructions and assignments
Adjusting question types; more leading questions as needed
limiting multiple choice answers and number of constructed responses
small group instruction
peer coaching and review
use of graphic organizers
Study guides provided as needed
choice options determined by level of independence required

The **21st century skills and technology** used in this unit are:

Creativity and Innovation

- Compare different ways of approaching traditional mathematical problems
- Find innovative solutions, using practical examples where appropriate

- Listen to and evaluate others' reasoning and offer improvements and corrections with supporting arguments
- Listen to others' feedback and modify solutions as needed.
- Learn from mistakes and make repeated attempts at solving problems
- Look for patterns and make generalizations from patterns observed

Critical Thinking and Problem Solving

- Identify and ask significant questions about mathematics and engage in analyzing each other's answers
- Analyze how parts of a whole interact with each other in mathematics
- Make judgements and solve problems in both conventional and innovative ways

Communication and Collaboration

- Articulate mathematical thoughts and ideas using oral and written communication skills
- Analyze others' reasoning and construct viable arguments using reasoning with attention to mathematical fact
- Listen respectfully to the reasoning of others'
- Communicate respectfully in diverse teams articulating mathematical thoughts and ideas effectively

Information, Media and Technology Literacy

- Explore and share with others new areas of mathematics and its applications
- Learn about mathematics from reliable websites and share knowledge with others
- Evaluate information critically and competently
- Use technology as a tool to research, organize, evaluate and communicate information

Life and Career Skills

- Demonstrate the ability to work in pairs and small groups to solve mathematical problems with flexibility, adaptability and respect for others ideas and cultural differences
- Set goals, establish priorities and timelines to complete short-term and long-term project

Integration of Digital Tools

- Google Classroom, Big Ideas Math (online site), various websites and online resources will be used with the Chromebooks, IPads, Interactive SMARTBoard

Each student will come away with pivotal skills and understandings while being appropriately challenged throughout the unit. The 8 Standards for Mathematical Practice will be embedded in this unit of instruction.

Standards for Mathematical Practice:

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

Time Allotment Days

~ Transformations: translations, reflections, rotations	__6__
~ Congruent figures	__3__
~ Transformations including dilations on the coordinate plane	__4__
~ Similar figures, including perimeter and area relationships	__6__
~ Angles: construction, relationships, in triangles, in polygons	__5__
~ Parallel lines and transversals	__5__
~ Pythagorean Theorem	__10_
~ Volume of Cones, Cylinders and Spheres	__6__
~ Surface Area and Volume of Similar Solids	__3__
Total Days	__48__

Resources

Suggested resources will include but are not limited to the following:

District approved Math textbook (Big Ideas Series) and supplemental reference materials including: Resources by Chapter, Record and Practice Journal, Computer Generated Assessments, Chapter Tests, Section Quizzes, Standards assessments
Interactive Websites
Videos
Informational Websites
STEM/STEAM activities
Teacher collected Resources
Mathematics Manipulatives

Graphing Calculators / desmos.com
Algebra Tiles
Teacher developed SMART BOARD lessons
Wipe-off graph boards, graph paper
2 and 3 dimensional shapes
multi-purpose cubes
compass
protractor
ruler

Stage 1: Desired Results
Unit 5 - Statistics and Probability

Topics

- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities; introducing “Line of Best Fit”
- Describe scatter plot patterns such as: clustering, outliers, positive or negative correlations, linear vs. non-linear
- Use equations of lines of best fit to solve problems; interpret slope and y-intercept
- Construct and interpret 2-way tables
- Choosing appropriate data displays

Content Standards

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

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?

Essential Questions

1. When analyzing patterns of association between two quantities using a scatter plot, what information can you derive from a line of best fit?
2. How can the joint and marginal frequencies, and the percents associated with these sets of data, help to focus your decision-making process when analyzing two-way tables?

Enduring Understandings

1. Using scatter plots to organize and analyze bivariate data allows you to make accurate predictions and estimate solutions with a higher degree of acuracy

2. The ability to write an equation in slope-intercept form for a line of best fit is an invaluable tool when using data to make predictions and/or solve problems mathematically

Knowledge and Skills (SWBAT embedded course proficiencies)

Students will be able to:

- Construct and interpret scatter plots
- Find and analyze lines of best fit for bivariate data sets
- Develop and use equations for lines of best fit to solve problems and interpret the slope and y-intercept
- Construct and analyze two-way tables; including joint and marginal frequencies
- Choose appropriate data displays

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies administered quarterly)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Formative
Teacher Observation/Anecdotal notes
Graphic organizers/Information Wheel
Do Now / Problem of the Day
Journal / Explanations / Reflections
Exit Tickets
Daily homework
Group work
Discussion (large group, small group and partner share)
Problem of the Week Solutions
Quizzes
Individual Response System
IXL
Braining Camp

Summative
Chapter Tests
Unit Test
Short and Extended Constructed Responses
Technology based Math Assessments
Individual Student Unit Projects with Rubric
Benchmark Assessments

Other evidence and/or student self-assessment
Math Journal reflections
Vocabulary Journal entries
Journal opened-ended, multiple-step responses
Self-evaluations with personal whiteboards
Self-assessment checklists
Card pass review & practice
Group Projects with self-assessment and group rubrics
Student generated practice activities
Student Constructed Assessments (peer evaluations)
Student Reflection and corrections on Assessments

Stage 3: Learning Plan

The Statistics and Probability Unit will focus on various data displays. Using prior knowledge of simpler graphs and data displays will be important as we progress. Students will use information about linear equations and comparing sets of data to construct scatter plots and draw lines of best fit. Collecting and organizing data using technology will be a key component of this unit. Students will develop an understanding of how scatter plots can represent two sets of data and creating a line of best fit will show students how closely the data sets are related. It will also help them to analyze and predict solutions to problems. Use of other data displays (2-way tables, box & whisker plots) will be introduced and rely heavily on data collection and percent

analysis. Each student will be able to interpret the meaning of the slope and the y-intercept in addition to deriving information and meaning from graphs, tables and various data displays. Many of the 21st Century skills listed below will be utilized in this unit. Through the use of multiple learning style activities (e.g. visual, auditory, kinesthetic, and tactile) students will be actively engaged throughout the unit.

Differentiation will be embedded into the unit in the form of:
Adjusting curriculum expectations, compacting
Tiered instructions and assignments
Adjusting question types; more leading questions as needed
limiting multiple choice answers and number of constructed responses
small group instruction
peer coaching and review
use of graphic organizers
Study guides provided as needed
choice options determined by level of independence required

The **21st century skills and technology** used in this unit are:

Creativity and Innovation
- Compare different ways of approaching traditional mathematical problems
- Find innovative solutions, using practical examples where appropriate
- Listen to and evaluate others' reasoning and offer improvements and corrections with supporting arguments
- Listen to others' feedback and modify solutions as needed.
- Learn from mistakes and make repeated attempts at solving problems
- Look for patterns and make generalizations from patterns observed

Critical Thinking and Problem Solving
- Identify and ask significant questions about mathematics and engage in analyzing each other's answers
- Analyze how parts of a whole interact with each other in mathematics
- Make judgements and solve problems in both conventional and innovative ways

Communication and Collaboration
- Articulate mathematical thoughts and ideas using oral and written communication skills
- Analyze others' reasoning and construct viable arguments using reasoning with attention to mathematical fact
- Listen respectfully to the reasoning of others'
- Communicate respectfully in diverse teams articulating mathematical thoughts and ideas effectively

Information, Media and Technology Literacy
- Explore and share with others new areas of mathematics and its applications

- Learn about mathematics from reliable websites and share knowledge with others
- Evaluate information critically and competently
- Use technology as a tool to research, organize, evaluate and communicate information

Life and Career Skills

- Demonstrate the ability to work in pairs and small groups to solve mathematical problems with flexibility, adaptability and respect for others ideas and cultural differences
- Set goals, establish priorities and timelines to complete short-term and long-term project

Integration of Digital Tools

- Google Classroom, Big Ideas Math (online site), various websites and online resources will be used with the Chromebooks, IPads, Interactive SMARTBoard

Each student will come away with pivotal skills and understandings while being appropriately challenged throughout the unit. The 8 Standards for Mathematical Practice will be embedded in this unit of instruction.

Standards for Mathematical Practice:

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

Time Allotment	**Days**
~ Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities; introducing "Line of Best Fit"	__6___
~ Describe scatter plot patterns such as: clustering, outliers, positive or negative correlations, linear vs. non-linear	__4___
~ Use equations of lines of best fit to solve problems; interpret slope and y-intercept	__8___
~ Construct and interpret 2-way tables	__5___
~ Choosing appropriate data displays	__2___

Total Days __25__

Resources

Suggested resources will include but are not limited to the following:

District approved Math textbook (Big Ideas Series) and supplemental reference materials including: Resources by Chapter, Record and Practice Journal, Computer Generated Assessments, Chapter Tests, Section Quizzes, Standards assessments
Interactive Websites
Videos
Informational Websites
STEM/STEAM activities
Teacher collected Resources
Mathematics Manipulatives
Graphing Calculators / desmos.com
Algebra Tiles
Teacher developed SMART BOARD lessons
Wipe-off graph boards, graph paper
2 and 3 dimensional shapes
multi-purpose cubes
compass
protractor
ruler

New Jersey Student Learning Standards

http://www.state.nj.us/education/cccs/

Integration of 21st Century Theme(s)

The following websites are sources for the following 21st Century Themes and Skills: http://www.nj.gov/education/code/current/title6a/chap8.pdf http://www.p21.org/about-us/p21-framework . http://www.state.nj.us/education/cccs/standards/9/index.html

21st Century Interdisciplinary Themes (into core subjects)

- **Global Awareness**
- **Financial, Economic, Business and Entrepreneurial Literacy**
- **Civic Literacy**
- **Health Literacy**
- **Environmental Literacy**

Learning and Innovation Skills

- **Creativity and Innovation**
- **Critical Thinking and Problem Solving**
- **Communication and Collaboration**

Information, Media and Technology Skills

- **Information Literacy**
- **Media Literacy**
- **ICT (Information, Communications and Technology) Literacy**

Life and Career Skills

- **Flexibility and Adaptability**
- **Initiative and Self-Direction**
- **Social and Cross-Cultural Skills**
- **Productivity and Accountability**
- **Leadership and Responsibility**

Integration of Digital Tools

- **Classroom computers/laptops**
- **Technology Lab**
- **FM system**
- **Other software programs**