Readington Township Public Schools

Grade 6 Honors Math and Grade 7 Advanced Math

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Grade Six Honors and Seventh Grade Advanced Mathematics

Overview

This is a fast-paced course where students will cover some of the seventh-grade New Jersey Student Learning Standards (NJSLS) as well as the eighth-grade NJSLS. Topics will include Ratios and Proportional Relationships, The Number System, Expressions and Equations, Functions, Geometry, Statistics, and Probability. Through their work in this course, students will understand and apply their knowledge in real-world applications. The Mathematical Practices focus on the development of competencies used by mathematicians in all grades and throughout life.

STUDENT OUTCOMES

(Linked to New Jersey Student Learning Standards for Mathematics 2023)

THE NUMBER SYSTEM (8.NS)

A. Know that there are numbers that are not rational and approximate them by rational numbers

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.
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 2 is between 1 and $\sqrt{2}$, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
3. Understand that the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

EXPRESSIONS AND EQUATIONS (7.EE)

A. Use properties of operations to generate equivalent expressions

1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."

B. Solve real-life and mathematical problems using numerical and algebraic expressions and equations

3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 ¾ inches long in the center of a door that is 27 ½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

a. Solve word problems leading to equations of the form px + q = r and p(x = q= r, where p, q, and r are specific rational numbers. Solve equations of these forms with accuracy and efficiency. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

b. . Solve word problems leading to inequalities of the form px + q> r or px + q<r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want

your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.

EXPRESSIONS AND EQUATIONS (8.EE)

A. Work with radicals and integer exponents

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
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.
    a. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
    b. Simplify numerical radicals, limiting to square roots (i.e. nonperfect squares).
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.
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.

B. Understand the connections between proportional relationships, lines, and linear equations

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.

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.

C. Analyze and solve linear equations and pairs of simultaneous linear equations

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 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 using the substitution method and estimate solutions by graphing the equations. Solve simple cases by inspection. For example: by inspection, conclude that 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6. Solve 3x + y = 30 and y = 2x using the substitution method; Solve y = 3x + 1 and y = -2x + 7 using the substitution method.

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.

FUNCTIONS (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. (Clarification: 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.
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.

B. Use functions to model relationships between quantities

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.

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.

GEOMETRY (7.G)

A. Draw, construct, and describe geometrical figures and describe the relationships between them

1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
2. Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

B. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume

4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

5 Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

GEOMETRY (8.G)

A. Understand congruence and similarity using physical models, transparencies, or geometry software

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.

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.
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
5. 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.

B. Understand and apply the Pythagorean Theorem

6 Explain a proof of the Pythagorean Theorem and its converse.

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 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

STATISTICS AND PROBABILITY (7.SP)

A. Use random sampling to draw inferences about a population

1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

B. Draw informal comparative inferences about two populations

3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

C. Investigate chance processes and develop, use, & evaluate probability models

5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For

example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
   a. Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.
   b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?

8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
   a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
   b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
   c. Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

STATISTICS AND PROBABILITY (8.SP)

A. Investigate patterns of association in bivariate data

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.
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.
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.
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. 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.

Strategies

- Teacher presentation
- Teacher read-aloud
- Group discussion
- Small Group instruction
- Group presentations
- Interactive Smartboard Lessons
- Partner work
- Museum walks
- Math talk (students explain their thinking)
- Small Group Work
- Centers/ stations

Accommodations

Accommodations and Modification Addendum

Assessments

Formative	Summative
• Independent student work • Ready Classroom Lesson Quizzes • Teacher Observations • Class Participation • Class Discussions • Class Assignments • Homework Assignments • Notebooks • Anecdotal Records	• Mid-Unit Test • Unit Test
Benchmark	**Alternative**
• I-Ready Diagnostic • Performance Assessments	• Live Online Assessment Tools (Kahoot, Brainpop) • Student Projects • Student Presentations • Self-Assessments

Resources

Required/Primary	Supplemental
• *EdGems Math Courses 2* and *3* *(Shannon McCaw; published by EdGems Math LLC)*	• Brain Pop • IXL • *Big Ideas Math Advanced 2 textbook* (Ron Larson and Laurie Boswell; published by Big Ideas Learning) • Reflex Math • Online Tutorials (Learnzillion, Khan Academy, Math Antics) • Online Math Games (Math is Fun, Funbrain, Cool Math Games, Math Playground) • Illustrative Mathematics (www.illustratviemathematics.org) • Estimation 180

Essential Questions And Content

Expressions and Equations (7.EE)

- How can I add and subtract linear expressions having rational coefficients, using properties of operations?
- How do I factor and expand linear expressions having rational coefficients, using properties of operations?

- How do I write expressions in equivalent forms to shed light on the problem and interpret the relationship between the quantities in the context of the problem?
- How can I solve multi-step real-life problems and mathematical problems using rational numbers in any form?
- How do I convert between decimals and fractions and apply properties of operations when calculating rational numbers?
- How do I estimate to determine the reasonableness of answers?
- How do I compare an arithmetic solution to a word problem to the algebraic solution for the word problem, identifying the sequence of operations in each solution?
- How do I write and fluently solve an equation of the form px + q + r or p(x + q) = r in order to solve a word problem?
- How do I write an inequality of the form px + q > r, px + q < r, px + q $\geq$ r, or px + q $\leq$ r to solve a word problem?
- How do I graph the solution set of the inequality?
- How do I interpret the solution to an inequality in the context of the problem?

The Number System (8.NS)

Numbers that are not rational are irrational; every number has a decimal expansion.

- How can decimal expansions of rational and irrational numbers be compared?
- How can a rational number be represented with its decimal expansion, showing that it eventually repeats?
- How can a decimal expansion (which eventually repeats) be converted into a rational number?

Rational approximation of irrational numbers.

- How can irrational numbers be compared using their rational approximations?
- How are rational approximations located on a number line?
- How are the values of expressions containing irrational numbers estimated?

EXPRESSIONS AND EQUATIONS (8.EE)

Exponents as simplified representations of repeated multiplication.

- What are the properties of exponents?
- How are the properties of exponents applied to numerical expressions?
- How can equivalent numerical expressions be generated using positive and negative integer exponents?

Square roots, cube roots, perfect squares and perfect cubes; Inverse relationship between powers and square roots.

- What are the values of the square roots of small perfect squares?
- What are the solutions to equations of the form $x^2 = p$, where p is a positive rational number?
- How can the square root symbol be used to represent solutions to equations of the form $x^2 = p$?
- What are the values of cube roots of small perfect cubes?
- What are the solutions to equations of the form $x^3 = p$, where p is a positive rational number?
- How can the cube root symbol be used to represent solutions to equations of the form $x^3 = p$?
- Why is the $\sqrt{2}$ an irrational number?

Very large and very small quantities can be approximated with numbers expressed in the form of a single digit times an integer power of 10.

- How can very large or very small quantities be estimated with numbers expressed in the form of a single digit times an integer power of 10?
- How can numbers written in the form of a single digit times an integer power of 10 be compared and how can it be expressed how many times as much one is than the other?

Operations with scientific notation

- How can numbers expressed in scientific notation be multiplied and divided?
- How can numbers expressed in scientific notation be added and subtracted?
- How can scientific notation and units of appropriate size be used to represent measurements of very large or very small quantities?
- How is scientific notation generated by technology interpreted?

Quantitative relationships can be represented in different ways.

- How are proportional relationships graphed?
- How is the unit rate interpreted as the slope of a graph?
- How can two different proportional relationships that are represented in different ways (table of values, equation, graph, verbal description) be compared?

Slope and similar triangles; Slope-intercept form of an equation.

- How can it be proved using similar triangles that the slope m, is the same between any two distinct points on a non-vertical line?
- How can the equation $y = mx$ be derived from two points for a line that passes through the origin?
- How can the equation $y = mx + b$ be derived from two points for a line that intercepts the vertical axis at b?

Linear equations may have a single solution, no solution or infinite solutions.

- What are some examples of linear equations in one variable with one solution ($x = a$), infinitely many solutions ($a = a$), or no solutions ($a = b$)?
- How can a given equation be transformed using the properties of equality into simpler forms?
- How can a given equation be transformed into an equivalent equation of the form $x = a$, $a = a$ or $a = b$ (a *and* b *are different numbers*)?
- How is a linear equation solved that has fractional coefficients? (including equations that require the use of the distributive property and combining like terms)

Simultaneous linear equations may have a single solution, no solution or infinite solutions; Solutions to a system of two linear equations in two variables correspond to the intersection point of their graphs.

- How is a system of linear equations in two variables solved algebraically?
- How is the solution of a linear system of two equations estimated by graphing?
- How are simple cases of linear systems of two equations solved by inspection?
- How are real-world and mathematical problems leading to two linear equations in two variables solved?

FUNCTIONS (8.F)

A function is a rule in which each input has exactly one output.

- What is function language and how is it used?
- How can a function be described as a single output for each input?
- How can it be determined whether a non-numerical relationship is a function?
- How can a function be described as a set of ordered pairs?
- How can inputs and outputs be read from a graph?
- How can an ordered pair be described as containing an input and the corresponding output?

Functions (quantitative relationships) can be represented in different ways; Functions/linear functions have properties.

- How can functions be analyzed when represented algebraically, as a table of values, and as a graph?
- How can functions be interpreted when represented by a verbal description?
- How are the properties of two functions compared when each are represented differently?

A linear function is defined by the equation $y = mx + b$; the graph of a linear function is a straight line.

- How can the analysis of tables of values, graphs, and equations be used to classify a function as linear or nonlinear?
- How can it be determined if equations presented in forms other than $y = mx + b$ (for example$3y - 2x = 7$) define a linear function?
- What are examples of equations that are nonlinear functions?
- How can it be shown that a function is not linear using a pair of points?

Two (x, y) values can be used to construct a function.

- How can the rate of change and initial value of a function from a description of a relationship be determined?
- How can the rate of change and initial value of a function from two (x, y) values by reading from a table of values be determined?
- How can the rate of change and initial value of a function from two (x, y) values by reading these from a graph be determined?
- How can a function be constructed to model a linear relationship?
- How can the rate of change and initial value of a linear function in context be interpreted?

Graphs of functional relationships.

- How can the graph of a functional relationship be analyzed?
- What are qualitative descriptions of graphs? (e.g. where increasing or decreasing, linear or nonlinear)
- How can the graph of a function be sketched given a verbal description based on qualitative features?

GEOMETRY

Geometry (7.G)

- How do I solve problems by finding the area and circumference of circles?
- How can I show that the area of a circle can be derived from the circumference?
- How can I use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations?
- How can I solve mathematical problems by writing and solving simple algebraic equations based on the relationships between and properties of angles (supplementary, complementary, vertical, and adjacent)?
- How can I solve real-world and mathematical problems involving area of two-dimensional objects composed of triangles, quadrilaterals, and polygons?
- How can I solve real-world and mathematical problems involving volume and surface area of three-dimensional objects composed of cubes and right prisms?
- How can I draw geometric shapes with given conditions, including constructing triangles from three measures of angles or sides?
- How do I recognize conditions determining a unique triangle, more than one triangle, or no triangle?
- How do I analyze three-dimensional shapes (right rectangular pyramids and prisms) by examining and describing all of the two-dimensional figures that result from slicing it at various angles?

Geometry (8.G)

Two-dimensional objects under rigid motion transformations (rotation, reflection, and translation) remain unchanged.

- Do performing rotations, reflections, and translations on lines result in a line?
- Do performing rotations, reflections, and translations on line segments result in line segments with un-altered lengths?
- Do performing rotations, reflections, and translations on angles result in angles with un-altered measures?
- Does performing rotations, reflections, and translations on parallel lines result in parallel lines?
- Does the measure of a two-dimensional object remain unchanged when under a rigid motion transformation (rotation, reflection, and translation)?

Two-dimensional figures are congruent if the second can be obtained from the first by a sequence of rotations, reflections, and translations.

- How can two figures be identified as congruent using a sequence of transformations?

The effects of transformations on two-dimensional figures using coordinates.

- What results after applying dilations with a scale factor greater than, less than, and equal to 1 on the coordinates of a two-dimensional figure?
- What results after applying translations, rotations, and reflections to the coordinates of a two-dimensional figure?

Two-dimensional figures are similar if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; congruent figures are also similar.

- What transformation or sequence of transformations can be performed to describe the similarity between two given similar two-dimensional figures?

Angle sum and exterior angles of triangles; Parallel lines cut by a transversal.

- How can the interior angle sum of a triangle be justified?
- What are the facts about the exterior angles of a triangle?
- What are the facts about the angles created when parallel lines are cut by a transversal?
- How can the angle-angle criterion for the similarity of triangles be established?

Pythagorean Theorem; the converse of the Pythagorean Theorem

- How can a proof of the Pythagorean Theorem be explained?
- How can a proof of the converse of the Pythagorean Theorem be explained?

Apply the Pythagorean Theorem.

- How can the side lengths of two-dimensional right triangles in real-world and mathematical problems be determined using the Pythagorean Theorem?
- How can the side lengths of three-dimensional right triangles in real-world and mathematical problems be determined using the Pythagorean Theorem?

Find the distance between two coordinate points.

- How can the distance between two points in a coordinate plane be determined using the Pythagorean Theorem?

Volume of cones, cylinders, and spheres.

- How can the volumes of cones, cylinders, and spheres be used to solve real-world problems?
- How can a single unknown dimension of cones, cylinders, and spheres be found using volume formulas in real-world problems?

STATISTICS AND PROBABILITY

Statistics and Probability (7.SP)

- How can I analyze and distinguish between representative and non-representative samples of a population?
- How do I analyze data from a sample to draw inferences about the population?
- How do I generate and analyze the variation in multiple samples of the same size?
- How can I locate, approximately, the measure of center (mean or median) of a distribution?
- How do I visually assess, given the distribution, the measure of spread (mean absolute deviation or interquartile range)?
- How do I visually compare two numerical data distributions and describe the degree of overlap?
- How do I measure or approximate the difference between the measures of center and express it as a multiple of a measure of variability?
- How can I use measures of center and variability to draw inferences and compare them about two populations?
- How can I draw conclusions about the likelihood of events given their probability?
- How can I collect data on chance processes, noting the long-run relative frequency?
- How can I predict the approximate relative frequency given the theoretical probability?
- How can I develop and use a uniform probability model to determine the probability of events?
- How do I develop (non-uniform) probability models by observing frequencies in data that has been generated from a chance process?
- How can I use organized lists, tables, and tree diagrams to represent sample spaces?
- How can I identify the outcomes in a sample space that make up the described event given a description of an event using everyday language?
- How can I design and use simulations to generate frequencies for compound events?

Statistics and Probability (8.SP)

Association in bivariate measurement data

- How is a scatter plot constructed and interpreted?
- How are patterns of association between two quantities represented by a scatter plot analyzed?
- How are the terms clustering, outliers, positive or negative association, linear or nonlinear association used when describing patterns of association in a scatter plot?

Approximately linear relationships between quantitative variables are modeled using straight lines.

- How can a line of best fit be used on a scatter plot to suggest a linear association?
- How can the model's fit be assessed by judging the closeness of the data points to the line of best fit?

Use the equation of a linear model with bivariate data.

- How can the slope and intercept be interpreted when given the equation for a linear model (line of best fit)?
- How can problems in the context of measurement data be solved when given the equation for a linear model?

Analyzing categorical data using two-way tables.

- How is a two-way frequency table containing data on two categorical variables constructed and interpreted?
- How is a two-way relative frequency table containing data on two categorical variables constructed and interpreted?

- How can any association between two categorical variables using relative frequencies calculated for rows or columns be described?

Pacing and Interdisciplinary Connections

Expressions and Equations (7.EE)

Expressions (8 days)

1. Order of Operations
2. Algebraic Expressions
3. The Distributive Property
4. Equivalent Expressions

Equations and Inequalities (7 days)

1. Solving One-Step Equations
2. Solving Two-Step Equations
3. Simplifying and Solving Equations
4. Linear Inequalities

Interdisciplinary Connections:

- **W.IW.7.2 Write** informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
  Activity: Students will write a lesson on simplifying an algebraic expression.

- **MS-LS2-2- Construct** an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
  Activity: Students will write inequalities comparing the pounds of fish a killer whale eats in captivity versus its normal ecosystem.
  Activity: Students will listen to *Sir Cumference and the First Round Table* by Cindy Neuschwander and explain how the main ideas and supporting details in the story clarify their understanding of pi.

Expressions and Equations (8.EE) & The Number System (8.NS)

Equations (15 days)

1. Solving One- and Two-Step Equations
2. Solving Multi-Step Equations
3. Solutions to Linear Equations
4. Square Roots and Cube Roots
5. Rational and Irrational Numbers
6. Solving Equations with Exponents

Proportional Relationships and Slope (14 days)

1. Understanding Functions
2. Proportional Relationships
3. Calculating Slope from Graphs
4. The Slope Formula

Systems of Equations (15 days)

1. Parallel, Intersecting, or the Same Line
2. Solving Systems by Graphing
3. Solving Systems Using Substitution
4. Solving Systems Using Elimination
5. Application of Systems of Equations
6. Converting Repeating Decimals to Fractions

Exponent Properties (13 days)

1. Multiplication Properties of Exponents
2. Division Properties of Exponents
3. Scientific Notation

4. Application of Scientific Notation

Interdisciplinary Connections:

- **MS-ESS2-5-**Collect data to provide evidence for how the motions and complex interactions of air masses results in changing weather conditions.
  Activity: Students will watch a STEM video on hurricanes and graph linear equations of wind speed of storms in the Gulf of Mexico and determine when storms become tropical storms or hurricanes.
- **MS-LS4-1-**Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
  Activity: Students will compare three geologic periods using scientific notation, make a timeline of the eras, make inferences about geologic time, and use the Internet to assess their inferences.
- **RL.CR.8.1** Cite a range of textual evidence and make clear and relevant connections to strongly support an analysis of multiple aspects of what a literary text says explicitly as well as inferences drawn from the text.
  Activity: Students will read a nursery rhyme from 1730, determine the information given as well as what they are trying to find, and write the number of items in the poem as a power.

Functions (8.F)

Functions (19 days)

1. Graphing Using Slope-Intercept Form
2. Writing Linear Equations for Graphs
3. Writing Linear Equations from Key Information
4. Linear Equations in Other Forms
5. Introduction to Non-Linear Functions
6. Interpreting Graphs of Functions

Interdisciplinary Connections:

- **W..AW.8.1** Write arguments on discipline-specific content (e.g. social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence.
  Activity: Students will graph data and use the graphs to test the truth of each statement. Students will then write arguments to support their claims about the truth of the statements.

- **MS-ESS2-6-**Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
  Activity: Students will watch the Big Ideas STEM video on Apparent Temperature and explore the Heat Index and its role in climate through the construction of a table, identification of variables, and writing linear functions.

Geometry

Geometry (7.G)

Two-Dimensional Geometry (14 days)

1. Complementary and Supplementary Angles
2. Adjacent and Vertical Angles
3. Drawing Triangles with Given Conditions
4. Area of Polygons
5. Circumference and Pi
6. Area of a Circle
7. Composite Figures

Three-Dimensional Geometry (10 days)

1. Three-Dimensional Figures
2. Surface Area of Prisms

3. Surface Area of Pyramids
4. Volume of Prisms and Pyramids

Interdisciplinary Connections:

- **SL.II.7.2** Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

Geometry (8.G)

The Pythagorean Theorem (10 days)

1. The Pythagorean Theorem
2. Applying the Pythagorean Theorem
3. Distance on the Coordinate Plane

Angle Relationships (12 days)

1. Alternate Exterior and Interior Angles
2. Corresponding and Same-Side Interior Angles
3. Angle Sum of a Triangle
4. Congruent and Similar Triangles
5. Angle Relationships

Transformations (10 days)

1. Reflections
2. Translations
3. Rotations
4. Dilations
5. Composition of Transformations

Volume (6 days)

1. Volume of Cylinders
2. Volume of Cones
3. Volume of Spheres

Interdisciplinary Connections:

- **SL.PE.8.1-**Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
  Activity: Students will analyze the converse of statements, provide examples and counterexamples, and explore the converse of the Pythagorean Theorem with a partner or small group.

- **MS-ESS3-5-**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
  Activity: Students will research camouflage packaging and explore the environmental effects in terms of resources, production, and shipping. Students will calculate packaging waste on selected products and design alternative packaging.

Statistics and Probability

Statistics and Probability (7.SP)

Probability and Statistics (10 days)

1. Probability
2. Using Probability to Predict
3. Compound Probability
4. Random Sampling and Inferences
5. Measures of Center and Variability in Two Data Sets

Interdisciplinary Connections:

- **MS-LS3-2-**Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

Activity: Students will create Punnett squares and find probabilities of various gene combinations

Statistics and Probability (8.SP)

Bivariate Data (10 days)

1. Scatter Plots and Associations
2. Lines of Fit
3. Writing Equations for Lines of Fit
4. Bivariate Data and Frequency Tables

Interdisciplinary Connections:

- **MS-ESS3-3-**Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
  Activity: Students will analyze, interpret, and choose the best method to display roadkill data and then come up with ways to reduce the number of animals killed by vehicles.

- **W.WR.8.5** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related focused questions that allow for multiple avenues of exploration.
  Activity: Students will use the internet to write a report about an animal species that is endangered and include graphical displays of the data.

Career, Computer Science, and Key Skills

Expressions and Equations

- **Career Ready Practices**
  - Apply appropriate academic and technical skills
    Communicate clearly and effectively and with reason.
    Utilize critical thinking to make sense of problems and persevere in solving them.
    Work productively in teams while using cultural global competence.
    Activity: Students will utilize the Standards for Mathematical Practices to graph linear equations in standard form through real-life situations and will communicate and explain their reasoning.

- **9.2 Career Awareness, Exploration, and Preparation**
  - **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
    Activity: Students will write and
    graph linear equations to calculate when an online business will become profitable through
    ad clicks.

- **9.4 Life Literacies and Key Skills**
  9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem
  9.4.8.TL.1: Construct a spreadsheet to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
  9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.
  9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation.
  Activity: Students gather data about the real-world cost of three different styles of floor tiles, write equations modeling the costs, make comparisons, and share their findings digitally.

- **Computer Science**
  - **8.1.8.A.1.** Demonstrate knowledge of a real-world problem using digital tools.
    Activity: Students will use graphing calculators to write and graph linear equations in real-world situations.

Functions

- **Career Ready Practices**
  - Apply appropriate academic and technical skills
    Communicate clearly and effectively and with reason.
    Utilize critical thinking to make sense of problems and persevere in solving them.
    Activity: Students will utilize the Standards for Mathematical Practices to analyze graphs of real-life situations and will communicate and explain their reasoning.

- **9.2 Career Awareness, Exploration, and Preparation**
  - **9.2.8.B.1** Research careers within the 16 Career Clusters and determine attributes of career success.
    Activity: Students will write and graph linear functions, comparing the salaries of different types of employees as well as the impact of education levels on earnings.

- **9.4 Life Literacies and Key Skills**
  - **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.IML.4**: Ask insightful questions to organize different types of data and create meaningful visualizations.
  - **9.4.8.TL.3**: Select appropriate tools to organize and present information digitally.
    Activity: Students will analyze the relationship between two quantities using graphs and will sketch graphs to represent the relationship between two quantities.

- **Computer Science**
  - **8.1.8.E.1.** Effectively use a variety of search tools and filters in professional public databases to find information to solve a real-world problem.
    Activity: Students will make a mapping diagram and graph of scuba diving depths and pressures. Students will then use search engines to research common depths of experienced versus novice divers, as well as popular locations and associated costs.

Geometry

- **Career Ready Practices**
  - 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 technology to enhance productivity.
    Work productively in teams while using cultural global competence.
    Activity: Students will work collaboratively with a partner/small group to use geometry software, protractors, and indirect measurement to determine whether triangles are similar.

- **9.2 Career Awareness, Exploration, and Preparation**
  - **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
    Activity: Students will work with a partner and make a table of the relationship between an original figure and its image under four types of transformations. Students will explore how enlarging/reducing figures in a technical drawing is important in a career such as drafting.

- **9.4 Life Literacies and Key Skills**
  - **9.4.8.TL.2:** Gather data and digitally represent information to communicate a real-world problem
    Activity: Students will use geometry software to draw triangles with two given angle measures.

- **Computer Science**
  - **8.1.8.A.3** Use and/or develop a simulation that provides an environment to solve a real-world problem or theory.
    Activity: Students will use geometry software to draw parallel lines intersected by a transversal to explore angle measures and will use that knowledge to solve problems involving the construction of buildings.

Statistics and Probability

- **Career Ready Practices**
  - **CRP4.** Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Activity: Students will work with a partner/small group to read, make, and interpret two-way tables and use data from the tables to make purchasing decisions.

- **9.2 Career Awareness, Exploration, and Preparation**
  - **9.2.8.B.3** Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
    Activity: Students will work with a partner/small group to find lines of best fit and use lines of fit to solve problems about biologists studying wildlife populations.

- **9.4 Life Literacies and Key Skills**
  - **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.IML.3**: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
  - **9.4.8.TL.1:** Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
    Activity: Students will find the number of possible outcomes of one or more events using password security.

- **Computer Science**
  - **8.1.8.F.1** Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.
    Activity: Students will review data relating to absences and final grades in courses. Students will collect data digitally and then discuss solutions and reasons why attendance may or may not relate to final grades.