Milford Public Schools Curriculum

Department: Mathematics
Course Name: Grade 8 Math

UNIT 1

Unit Title: The Number System
Unit Description: Know that there are numbers that are not rational, and approximate them by rational numbers

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Real world situations require the use of various forms of real numbers, including scientific notation. All real numbers can be compared, classified, and expressed in various forms.	Why do I need to understand the types of numbers found in the real number system? How do I determine the best numerical representation for a given situation?

Content and Skills:
Know rational and irrational numbers
Understand decimal expansion
Show decimal expansion repeats
Convert repeating decimal expansion to a rational number
Use rational approximations of irrational numbers
Compare sizes of rational numbers
Locate rational numbers approximately on a number line
Estimate value of expressions

- square root and cube root symbols

Evaluate

- square roots of perfect squares
- cube roots of perfect cubes

Standards Addressed:
8.NS.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.
Connections: 8.EE.4; 8.EE.7b; 6-8.RST.4;
6-8.RST.7
8.MP.2. Reason abstractly and quantitatively.
8.MP.6. Attend to precision.
8.MP.7. Look for and make use of structure.
8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., p2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
Connections: 8.G.7; 8.G.8; 6-8.RST.5;
8.MP.2. Reason abstractly and quantitatively.

8.MP.4. Model with mathematics.
8.MP.7. Look for and make use of structure.
8.MP.8. Look for and express regularity in repeated reasoning

UNIT 2

Unit Title: Exponential Expressions & Equations
Unit Description: Work with radicals, integers exponents, and scientific notation

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Real world situations require the use of various forms of real numbers, including scientific notation. All real numbers can be compared, classified, and expressed in various forms.	Why do I need to understand the types of numbers found in the real number system? How do I determine the best numerical representation for a given situation?

Content and Skills:
Know/apply properties of integer exponents
Generate equivalent numerical expressions
Estimate large or small quantities
Express magnitude of numbers using powers of 10
Represent solutions to equations
Represent very large and very small numbers using scientific notation
Choose units of appropriate size
Evaluate

- square roots of perfect squares
- cube roots of perfect cubes

Calculate/convert numbers expressed in scientific notation/decimal form
Interpret scientific notation generated by technology

Standards Addressed:
8.EE.1. 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.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.
(Connections: 8.G.7; 8.G.8; 6-8.RST.4)
8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

UNIT 3

Unit Title: Pythagorean Theorem
Unit Description: This unit builds on prior knowledge of the properties of right triangles, and on computing the squares and square roots of rational numbers. The unit focuses on understanding the Pythagorean Theorem to (1) determine the missing length of one side of a right triangle when the lengths of the other two sides are known, and (2) decide whether or not a triangle with three given side lengths is a right triangle. Students will apply the theorem to problems involving right triangles that model real world problems. They will also find distances between two points on the coordinate plane.

LEARNING GOALS

Enduring Understanding(s):
There are many practical applications of the Pythagorean Theorem, such as deconstructing larger shapes into right triangles to find the area of an irregularly shaped room.
Students can use them and trust that they will get an accurate answer every time

Essential Question(s):
How can our understanding of the Pythagorean Theorem affect our understanding of the world around us?
Why is it necessary to prove formulas true?

Content and Skills:
Apply the Pythagorean Theorem
Determine unknown side lengths in right triangles
Find distance between two points in a coordinate system
Explain a proof of the Pythagorean Theorem and its converse
Use square root and cube root symbols
Represent solutions to equations using radical symbols
Evaluate square roots of small perfect squares and cube roots of small perfect cubes

Standards Addressed:
8.G.6 Explain a proof of the Pythagorean Theorem and its converse.
8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

UNIT 4

Unit Title: Congruence and Similarity
Unit Description: Understand congruence and similarity using physical models, transparencies, or geometry software.

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Spatial relationships help to make sense of the physical space around us. Reflections, translations, and rotations are actions that produce congruent geometric objects. A dilation is a transformation that changes the size of a figure, but not the shape. When parallel lines are cut by a transversal, corresponding, alternate interior and alternate exterior angles are congruent.	How are spatial relationships used to represent real situations? What is the relationship between reflections, translations, and rotations? What is a dilation and how does this transformation affect a figure in the coordinate plane? How can I tell if two figures are similar?

Content and Skills:

Verify experimentally the properties of

- Rotations
- Reflections
- Translations
- Dilations

Describe a sequence of rotations, reflections, and translations that exhibits congruence between two figures

Describe a sequence of rotations, reflections, translations, and dilations that exhibits similarity between two figures

Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures

Use coordinates to describe the effect of dilations, translations, rotations and reflections on two-dimensional figures

Prove informally

- angle relationships in parallel lines cut by a transversal
- sum of angles in a triangle = 180°

Find missing angle measures of a triangle

Find missing angle measures when two parallel lines are cut by a transversal

Determine if two triangles are similar using the Angle-Angle criterion of similar triangles

Standards Addressed:

8.G.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.1 Verify experimentally the properties of rotations, reflections, and translations:

a. Lines are taken to lines, and line segments to line segments of the same length.

b. Angles are taken to angles of the same measure.

c. Parallel lines are taken to parallel lines.

8.G.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.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

UNIT 5

Unit Title: Proportional Relationships
Unit Description: In this unit, students will learn about the connections between proportional relationships, lines, and linear equations.

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
There are many real world applications for rate of change and solving linear relationships. Linear relationships can be modeled by algebraic, tabular, graphical, mathematical or verbal descriptions. Rate of change (slope) and the y-intercept of a linear relationship define important applications in real world situations.	How is mathematics used to measure, model and calculate change? How are the characteristics of a linear relationship relevant in a real world situation?

Content and Skills:
Graph proportional relationships
Interpret unit rate as slope
Compare different representations of proportional relationships
Explain why slope is the same between any two points on a non-vertical line
Derive linear equations ($y = mx$ and $y = mx + b$)
Graph sets of ordered pairs

Standards Addressed:
8.EE.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.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.

UNIT 6

Unit Title: Linear Equations
Unit Description: In this unit, students will analyze and solve linear equations with distributing, combining like terms, and variables on both sides.

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Many situations can be modeled using a system of linear equations. Solving those systems can help	How is determining the solution for a system of linear equations valuable in describing relationships

determine the most appropriate option. Different systems of linear equations can be more easily solved using different methods.	in real world situations? What are the benefits of having different types of strategies to solve systems of linear equations related to real world situations?

Content and Skills:
Solve linear equations including equations with fractional number coefficients
Expand expressions and equations by

- Use distributive property
- Collect like terms

Graph sets of ordered pairs
Solve multi-step equations including distributive property, combing or collecting like terms and with variables on both sides of the equations
Analyze linear equation
Understand solutions
Solve systems of liner equations algebraically

Standards Addressed:
8.EE.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.EE.8. Analyze and solve pairs of simultaneous linear equations.
a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
c. Solve real world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

UNIT 7

Unit Title: Functions
Unit Description: Using functions, students will define, evaluate, and compare model relationships between quantities. Students will demonstrate their understanding through tables and graphs. Included are examples from real world applications and verbal descriptions.

LEARNING GOALS

Enduring Understanding(s): There are many real world applications for rate of	**Essential Question(s):** How can mathematics be used to measure, model and

change and solving linear relationships. Linear relationships can be modeled by algebraic, tabular, graphical, or verbal descriptions. Rate of change (slope) and the y-intercept define important applications in real world situations. The various methods to display linear relationships provide opportunities to understand a situation more thoroughly.	calculate change? How can linear relationships influence your real world decision-making? Why is it valuable to understand a situation in multiple representations?

Content and Skills:

Interpret the form y= mx + b as defining a linear function
Give example of linear and nonlinear equations
Compare functions

- Algebraically
- Graphically
- Numerically in tables
- Verbal descriptions

Construct functions

- Algebraically
- Graphically
- Numerically in tables
- Verbal descriptions
- Model linear relationships

Determine rate of change
Interpret the rate of change
Determine initial value of a function
Interpret initial value of a linear function

- in terms of the situation it models
- in terms of its graph or a table of values

Read a description of a relationship from a table or a graph
Describe a functional relationship between two quantities
Sketch a graph (linear or non-linear) from a verbal description

Standards Addressed:

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
8.F.2 Compare properties 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.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.
8.F.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.

UNIT 8

Unit Title: Patterns and Data
Unit Description: Investigate patterns of association in bivariate data

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Data collection and analysis assigns meaning to the information and allows you to understand the implications. Data can be used to influence others by drawing conclusions from and recognizing the significance of the information analyzed. Data analysis allows you to draw conclusions and make predictions based on possible association between the two variables	Why is data collected and analyzed? How do people use data to influence others? How can predictions be made based on data?

Content and Skills:
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. CC.8.SP.1
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, informally assess the model fit by judging the closeness of the data points to the line, and make sense of the slope and y-intercept. CC.8.SP.2
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. CC.8.SP.3
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? CC.8.SP.4

Standards Addressed:
8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
8.SP.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.
8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. 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.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

UNIT 9

Unit Title: Volume
Unit Description: Within this unit, students will solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. Students will discover the formulas for finding the volume of cones and spheres. Students will also relationship to the volume of a cylinder.

LEARNING GOALS

Enduring Understanding(s):	**Essential Question(s):**
Real world situations are not organized and labeled for analysis. Therefore formulating flexible geometric models, representing such models, and analyzing them can help solve real world problems.	How can the volume of 3-D objects be used to solve real world problems?

Content and Skills:
Know the formulas for volume of cones, cylinders, and spheres
Use the formulas for volume of cones, cylinders, and spheres to solve real-world problems
Solve the formulas for volume of cones, cylinders, and spheres within the context of a problem

Standards Addressed:
8.G.9 Know the formulas for the volumes of cones, cylinders and spheres and use them to solve real-world and mathematical problems
SMP.1 Make sense of problems and persevere in solving them.
SMP.2 Reason abstractly and quantitatively
SMP.4 Model with mathematics
SMP.5 Use appropriate tools strategically
SMP.6 Attend to precision