7th Grade Math
Course Syllabus

Seventh grade is the last year in which there is a large focus on students' foundation in number and is an important year for students on the path towards algebra. Learning math this year will require thought, questioning, wondering, connecting, and most importantly hard work. In math class students share their ideas and thinking with each other through discussion, group work, reflection, and review. Since students are expected to apply concepts that they learn to new situations, see that problems can be solved in many ways, and make connections. It is important they understand how a math concept works as well as demonstrate the procedure/strategy for solving it.

Course Expectations:

In middle school mathematics, students are more responsible for their own learning. There will be opportunities provided for every type of learner and enrichment is available for students willing to seek it out and work for it. Students are expected to show up for class every day ready to engage and make the most out of their learning opportunities. Students are expected to interact with one another in ways that build confidence in themselves and others and in ways that help them to understand the content that we are studying. Students are expected to show respect for themselves and the learning community by being where the learning is. Lastly, students are expected to be open to new ideas and to one another.

Homework can be expected weekly and quizzes will occur approximately once every two weeks with lots of small check-ins in between. Tests will be administered at the end of each unit with a minimum of one week's notice given. All quizzes and tests can be retaken by appointment once students review their work.

The Standards for Mathematical Practice:

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.

In other words, Students will:

- Communicate their understanding of mathematics
- Create and use representations to communicate mathematical ideas to solve problems
- Recognize, explore, and develop mathematical connections

- Use problem-solving strategies to investigate and understand increasingly complex mathematical content
- Use mathematical reasoning and/or proof throughout the study of geometry and algebra
- Apply mathematical concepts and skills to solve problems across the content areas of number operations, algebra, geometry, and probability and statistics
- Demonstrate the skills to work independently
- Demonstrate the skills to work collaboratively
- Organize and evaluate information for its relevance to a question or problem

Course Content:

7.1 Scale Drawings

In this unit, students learn to understand and use the terms "scaled copy," "to scale," "scale factor," "scale drawing," and "scale," and recognize when two pictures or plane figures are or are not scaled copies of each other. They use tables to reason about measurements in scaled copies, and recognize that angle measures are preserved in scaled copies, but lengths are scaled by a scale factor and areas by the square of the scale factor. They make, interpret, and reason about scale drawings. These include maps and floor plans that have scales with and without units.

- I can tell whether or not a figure is a scaled copy of another figure.
- I can describe some characteristics of a scaled copy.
- In a pair of figures, I can identify corresponding points, corresponding segments, and corresponding angles.
- I can describe what the scale factor has to do with a figure and its scaled copy.
- I know what operation to use on the side lengths of a figure to produce a scaled copy.
- I can draw a scaled copy of a figure using a given scale factor.
- I can use corresponding distances and corresponding angles to tell whether one figure is a scaled copy of another.
- When I see a figure and its scaled copy, I can explain what is true about corresponding angles.
- When I see a figure and its scaled copy, I can explain what is true about corresponding distances.
- I can describe the effect on a scaled copy when I use a scale factor that is greater than 1, less than 1, or equal to 1.
- I can explain how the scale factor that takes Figure A to its copy Figure B is related to the scale factor that takes Figure B to Figure A.
- I can describe how the area of a scaled copy is related to the area of the original figure and the scale factor that was used.
- I can explain what a scale drawing is, and I can explain what its scale means.
- I can use a scale drawing and its scale to find actual distances.
- I can use actual distances and a scale to find scaled distances.
- I can use a map and its scale to solve problems about traveling.
- When I know the actual measurements, I can create a scale drawing at a given scale.
- I know how different scales affect the lengths in the scale drawing.

- I can determine the scale of a scale drawing when I know lengths on the drawing and corresponding actual lengths.

7.2 Introducing Proportional Relationships

In this unit, students learn to understand and use the terms “proportional,” “constant of proportionality,” and “proportional relationship,” and recognize when a relationship is or is not proportional. They represent proportional relationships with tables, equations, and graphs. Students use these terms and representations in reasoning about situations that involve constant speed, unit pricing, and measurement conversions.

- I can use equivalent ratios to describe scaled copies of shapes.
- I know that two recipes will taste the same if the ingredients are in equivalent ratios.
- I understand the terms proportional relationship and constant of proportionality.
- I can use a table to reason about two quantities that are in a proportional relationship.
- I can find missing information in a proportional relationship using a table.
- I can find the constant of proportionality from information given in a table.
- I can write the the constant of proportionality as an entry in a table.
- I can write an equation of the form y=kx to represent a proportional relationship described by a table or a story.
- I can find two constants of proportionality for a proportional relationship.
- I can write two equations representing a proportional relationship described by a table or story.
- I can relate all parts of an equation like y=kx to the situation it represents.
- I can find missing information in a proportional relationship using the constant of proportionality.
- I can decide if a relationship represented by a table could be proportional and when it is definitely not proportional.
- I can decide if a relationship represented by an equation is proportional or not.
- I can ask questions about a situation to determine whether two quantities are in a proportional relationship.
- I can solve all kinds of problem involving proportional relationships.
- I know that the graph of a proportional relationship lies on a line through (0,0).
- I understand the information given by graphs of proportional relationships that are made of up of points or a line.
- I can find the constant of proportionality from a graph.
- I can draw the graph of a proportional relationship given a single point on the graph (other than the origin).
- I know that the steeper graph of two proportional relationships has a larger constant of proportionality.
- I can compare two, related proportional relationships based on their graphs.
- I can interpret a graph of a proportional relationship using the situation.
- I can write an equation representing a proportional relationship from a graph.
- I can use units to help me understand information about proportional relationships.

- I can make connections between the graphs, tables, and equations of a proportional relationship.
- I can answer a question by representing a situation using proportional relationships.
- I understand that it can be difficult to measure the quantities in a proportional relationship accurately.
- I can examine quotients and use a graph to decide whether two associated quantities are in a proportional relationship.

7.3 Measuring Circles

In this unit, students learn to understand and use the term "circle" to mean the set of points that are equally distant from a point called the "center." They gain an understanding of why the circumference of a circle is proportional to its diameter, with constant of proportionality π. They see informal derivations of the fact that the area of a circle is equal to π times the square of its radius. Students use the relationships of circumference, radius, diameter, and area of a circle to find lengths and areas, expressing these in terms of π or using appropriate approximations of π to express them numerically.

- I can identify the diameter, center, radius, and circumference of a circle.
- I can describe the characteristics that make a shape a circle.
- I can describe the relationship between circumference and diameter of any circle.
- I can explain what π means.
- I can choose an approximation for π based on the situation or problem.
- If I know the radius, diameter, or circumference of a circle, I can find the other two.
- If I know the radius or diameter of a wheel, I can find the distance the wheel travels in some number of revolutions.
- I can calculate the area of a complicated shape by breaking it into shapes whose area I know how to calculate.
- If I know a circle's radius or diameter, I can find an approximation for its area.
- I know whether or not the relationship between the diameter and area of a circle is proportional and can explain how I know.
- I can explain how the area of a circle and its circumference are related to each other.
- I know the formula for area of a circle.
- I can write exact answers in terms of π.
- I can calculate the area of more complicated shapes that include fractions of circles.
- I can decide whether a situation about a circle has to do with area or circumference.
- I can use formulas for circumference and area of a circle to solve problems.
- I can apply my understanding of area and circumference of circles to solve more complicated problems.

7.4 Proportional Relationships and Percentages

In this unit, students use ratios, scale factors, unit rates (also called constants of proportionality), and proportional relationships to solve multi-step, real-world problems that involve fractions and percentages. They use long division to write fractions presented in the form ab as decimals, e.g., 1130=0.36____. They learn to understand and use the terms "repeating decimal," "terminating decimal," "percent increase," "percent decrease," "percent error," and "measurement error." They represent amounts and corresponding

percent rates with double number line diagrams and tables. They use these terms and representations in reasoning about situations involving sales taxes, tips, markdowns, markups, sales commissions, interest, depreciation, and scaling a picture. Students use equations to represent proportional relationships in which the constant of proportionality arises from a percentage, e.g., relationship between price paid and amount of sales tax paid.

- I remember how to compute percentages.
- I can find dimensions on scaled copies of a rectangle.
- I can solve problems about ratios of fractions and decimals.
- When there is a constant rate, I can identify the two quantities that are in a proportional relationship.
- I can use a table with 2 rows and 2 columns to find an unknown value in a proportional relationship.
- I understand that “half as much again” and “multiply by 32” mean the same thing.
- I can use the distributive property to rewrite an expression like $x+12x$ as $(1+12)x$.
- I can write fractions as decimals.
- I can use the distributive property to rewrite an equation like $x+0.5x=1.5x$.
- I understand that “half as much again” and “multiply by 1.5” mean the same thing.
- I can draw a tape diagram that represents a percent increase or decrease.
- When I know a starting amount and the percent increase or decrease, I can find the new amount.
- When I know the new amount and the percentage of increase or decrease, I can find the original amount.
- I understand that if I know how much a quantity has grown, then the original amount represents 100%.
- I can use a double number line diagram to help me solve percent increase and decrease problems.
- I can solve percent increase and decrease problems by writing an equation to represent the situation and solving it.
- I understand that to find 0.1% of an amount I have to multiply by 0.001.
- I can find percentages of quantities like 12.5% and 0.4%.
- I understand and can solve problems about sales tax and tip.
- I understand and can solve problems about commission, interest, markups, and discounts.
- I can find the percentage increase or decrease when I know the original amount and the new amount.
- I understand that all measurements include some error.
- I can represent measurement error as a percentage of the correct measurement.
- I can solve problems that involve percent error.
- I can find a range of possible values for a quantity if I know the maximum percent error and the correct value.
- I can write and solve problems about real-world situations that involve percent increase and decrease.

7.5 Rational Number Arithmetic

In this unit, students interpret signed numbers in contexts (e.g., temperature, elevation, deposit and withdrawal, position, direction, speed and velocity, percent change) together with their sums, differences, products, and quotients. ("Signed numbers" include all rational numbers, written as decimals or in the form ab.) Students use tables and number line diagrams to represent sums and differences of signed numbers or changes in quantities represented by signed numbers such as temperature or elevation, becoming more fluent in writing different numerical addition and subtraction equations that express the same relationship. They compute sums and differences of signed numbers. They plot points in the plane with signed number coordinates, representing and interpreting sums and differences of coordinates. They view situations in which objects are traveling at constant speed (familiar from previous units) as proportional relationships. For these situations, students use multiplication equations to represent changes in position on number line diagrams or distance traveled, and interpret positive and negative velocities in context. They become more fluent in writing different numerical multiplication and division equations for the same relationship. Students extend their use of the "next to" notation (which they used in expressions such as 5x and 6(3+2) in grade 6) to include negative numbers and products of numbers, e.g., writing -5x and (-5)(-10) rather than $(-5)\cdot(x)$ and $(-5)\cdot(-10)$. They extend their use of the fraction bar to include variables as well as numbers, writing -8.5÷x as well as -8.5x.

- I can compare rational numbers.
- I can use rational numbers to describe temperature and elevation.
- I can use a number line to add positive and negative numbers.
- I understand how to add positive and negative numbers in general.
- I understand what positive and negative numbers mean in a situation involving money.
- I can use a number line to subtract positive and negative numbers.
- I can explain the relationship between addition and subtraction of rational numbers.
- I can find the difference between two rational numbers.
- I understand how to subtract positive and negative numbers in general.
- I can solve problems that involve adding and subtracting rational numbers.
- I can multiply a positive number with a negative number.
- I can use rational numbers to represent speed and direction.
- I can explain what it means when time is represented with a negative number in a situation about speed and direction.
- I can multiply two negative numbers.
- I can solve problems that involve multiplying rational numbers.
- I can divide rational numbers.
- I can solve problems that involve negative rates.
- I can solve problems that involve multiplying and dividing rational numbers.
- I can add, subtract, multiply, and divide rational numbers.
- I can evaluate expressions that involve rational numbers.
- I can solve problems using the four operations with rational numbers.
- I can represent situations with expressions that include rational numbers.
- I can solve equations that include rational numbers and have rational solutions.
- I can write and solve equations to represent situations that involve rational numbers.
- I can explain what the solution to an equation means for the situation.

- I can solve problems about the stock market using rational numbers and percentages.

7.6 Expressions, Equations, and Inequalities

In this unit, students solve equations of the forms $px+q=r$ and $p(x+q)=r$ where p, q, and r are rational numbers. They draw, interpret, and write equations in one variable for balanced "hanger diagrams," and write expressions for sequences of instructions, e.g., "number puzzles." They use tape diagrams together with equations to represent situations with one unknown quantity. They learn algebraic methods for solving equations. Students solve linear inequalities in one variable and represent their solutions on the number line. They understand and use the terms "less than or equal to" and "greater than or equal to," and the corresponding symbols. They generate expressions that are equivalent to a given numerical or linear expression. Students formulate and solve linear equations and inequalities that represent real-world situations.

- I can think of ways to solve some more complicated word problems.
- I can explain how a tape diagram represents parts of a situation and relationships between them.
- I can use a tape diagram to find an unknown amount in a situation.
- I can match equations and tape diagrams that represent the same situation.
- If I have an equation, I can draw a tape diagram that shows the same relationship.
- I can draw a tape diagram to represent a situation where there is a known amount and several copies of an unknown amount and explain what the parts of the diagram represent.
- I can find a solution to an equation by reasoning about a tape diagram or about what value would make the equation true.
- I can draw a tape diagram to represent a situation where there is more than one copy of the same sum and explain what the parts of the diagram represent.
- I can find a solution to an equation by reasoning about a tape diagram or about what value would make the equation true.
- I understand the similarities and differences between the two main types of equations we are studying in this unit.
- When I have a situation or a tape diagram, I can represent it with an equation.
- I can find an unknown weight on a hanger diagram and solve an equation that represents the diagram.
- I can write an equation that describes the weights on a balanced hanger.
- I can explain how a balanced hanger and an equation represent the same situation.
- I can explain why some balanced hangers can be described by two different equations, one with parentheses and one without.
- I can explain how a balanced hanger and an equation represent the same situation.
- I can write an equation that describes the weights on a balanced hanger.
- I can find an unknown weight on a hanger diagram and solve an equation that represents the diagram.
- I can use the idea of doing the same to each side to solve equations that have negative numbers or solutions.
- For an equation like $3(x+2)=15$, I can solve it in two different ways: by first dividing each side by 3, or by first rewriting $3(x+2)$ using the distributive property.

- For equations with more than one way to solve, I can choose the easier way depending on the numbers in the equation.
- I can solve story problems by drawing and reasoning about a tape diagram or by writing and solving an equation.
- I can solve story problems about percent increase or decrease by drawing and reasoning about a tape diagram or by writing and solving an equation.
- I understand what it means for a number to make an inequality true.
- I can explain what the symbols $\leq$ and $\geq$ mean.
- I can represent an inequality on a number line.
- I can write an inequality to represent a situation.
- I can describe the solutions to a inequality by solving a related equation and then reasoning about values that make the inequality true.
- I can solve inequalities by solving a related equation and then checking which values are solutions to the original inequality.
- I can graph the solutions to an inequality on a number line.
- If I have a situation and an inequality that represents it, I can explain what the parts of the inequality mean in the situation.
- I can match an inequality to a situation it represents, solve it, and then explain what the solution means in the situation.
- I can use what I know about inequalities to solve real-world problems.
- I can re-write subtraction as adding the opposite and then rearrange terms in an expression.
- I can organize my work when I use the distributive property.
- I can organize my work when I use the distributive property.
- I can use the distributive property to rewrite expressions with positive and negative numbers.
- I understand that factoring and expanding are words used to describe using the distributive property to write equivalent expressions.
- When possible, I can write an equivalent expression that has fewer terms.
- I can figure out whether two expressions are equivalent to each other.
- When possible, I can write an equivalent expression that has fewer terms.
- I am aware of some common pitfalls when writing equivalent expressions, and I can avoid them.
- Given an expression, I can use various strategies to write an equivalent expression.
- When I look at an expression, I can notice if some parts have common factors and make the expression shorter by combining those parts.

7.7 Angles, Triangles, and Prisms

In this unit, students investigate whether sets of angle and side length measurements determine unique triangles or multiple triangles, or fail to determine triangles. Students also study and apply angle relationships, learning to understand and use the terms "complementary," "supplementary," "vertical angles," and "unique." The work gives them practice working with rational numbers and equations for angle relationships. Students analyze and describe cross-sections of prisms, pyramids, and polyhedra. They understand and use the formula for the volume of a right rectangular prism, and solve problems involving area, surface area, and volume.

- I can find unknown angle measures by reasoning about adjacent angles with known measures.
- I can recognize when an angle measures 90°, 180°, or 360°.
- I can recognize when adjacent angles are complementary or supplementary.
- I can find unknown angle measures by reasoning about complementary or supplementary angles.
- I can determine if angles that are not adjacent are complementary or supplementary.
- I can explain what vertical angles are in my own words.
- I can reason through multiple steps to find unknown angle measures.
- I can recognize when an equation represents a relationship between angle measures.
- I can write an equation to represent a relationship between angle measures and solve the equation to find unknown angle measures.
- I can show that the 4 side lengths that form a quadrilateral can be rearranged to form different quadrilaterals.
- I can show that the 3 side lengths that form a triangle cannot be rearranged to form a different triangle.
- I can show whether or not 3 side lengths will make a triangle.
- I can reason about a figure with an unknown angle.
- I understand that changing which sides and angles are next to each other can make different triangles.
- Given two angle measures and one side length, I can draw different triangles with these measurements or show that these measurements determine one unique triangle or no triangle.
- Given two side lengths and one angle measure, I can draw different triangles with these measurements or show that these measurements determine one unique triangle or no triangle.
- I can picture different cross sections of prisms and pyramids.
- I can explain that when a three dimensional figure is sliced it creates a face that is two dimensional.
- I can explain why the volume of a prism can be found by multiplying the area of the base and the height of the prism.
- I can calculate the the volume of a prism with a complicated base by decomposing the base into quadrilaterals or triangles.
- I can picture the net of a prism to help me calculate its surface area.
- I can find and use shortcuts when calculating the surface area of a prism.
- I can decide whether I need to find the surface area or volume when solving a problem about a real-world situation.
- I can solve problems involving the volume and surface area of children's play structures.
- I can build a triangular prism from scratch.

7.8 Probability and Sampling

In this unit, students understand and use the terms "event," "sample space," "outcome," "chance experiment," "probability," "simulation," "random," "sample," "random sample," "representative sample," "overrepresented," "underrepresented," "population," and "proportion." They design and use simulations to estimate probabilities of outcomes of chance experiments and understand the probability of an outcome as its long-run relative frequency. They represent sample spaces (that is, all possible

outcomes of a chance experiment) in tables and tree diagrams and as lists. They calculate the number of outcomes in a given sample space to find the probability of a given event. They consider the strengths and weaknesses of different methods for obtaining a representative sample from a given population. They generate samples from a given population, e.g., by drawing numbered papers from a bag and recording the numbers, and examine the distributions of the samples, comparing these to the distribution of the population. They compare two populations by comparing samples from each population.

- I can get an idea for the likelihood of an event by using results from previous experiments.
- I can describe the likelihood of events using the words impossible, unlikely, equally likely as not, likely, or certain.
- I can tell which event is more likely when the chances of different events are expressed as fractions, decimals, or percentages.
- I can use the sample space to calculate the probability of an event when all outcomes are equally likely.
- I can write out the sample space for a simple chance experiment.
- I can explain whether certain results from repeated experiments would be surprising or not.
- I can estimate the probability of an event based on the results from repeating an experiment.
- I can explain why results from repeating an experiment may not exactly match the expected probability for an event.
- I can calculate the probability of an event when the outcomes in the sample space are not equally likely.
- I can simulate a real-world situation using a simple experiment that reflects the probability of the actual event.
- I can use a simulation to estimate the probability of a multi-step event.
- I can write out the sample space for a multi-step experiment, using a list, table, or tree diagram.
- I can use the sample space to calculate the probability of an event in a multi-step experiment.
- I can design a simulation to estimate the probability of a multi-step real-world situation.
- I can calculate the difference between two means as a multiple of the mean absolute deviation.
- When looking at a pair of dot plots, I can determine whether the distributions are very different or have a lot of overlap.
- I can explain why it may be useful to gather data on a sample of a population.
- When I read or hear a statistical question, I can name the population of interest and give an example of a sample for that population.
- I remember that when a distribution is not symmetric, the median is a better estimate of a typical value than the mean.
- I can determine whether a sample is representative of a population by considering the shape, center, and spread of each of them.
- I know that some samples may represent the population better than others.
- I know that selecting a sample at random is usually a good way to get a representative sample.
- I can describe ways to get a random sample from a population.
- I can consider the variability of a sample to get an idea for how accurate my estimate is.
- I can estimate the mean or median of a population based on a sample of the population.
- I can estimate the proportion of population data that are in a certain category based on a sample.

- I know that as the sample size gets bigger, the sample mean is more likely to be close to the population mean.
- I can use the means from many samples to judge how accurate an estimate for the population mean is.
- I can determine whether there is a meaningful difference between two populations based on a sample from each population.
- I can calculate the difference between two medians as a multiple of the interquartile range.
- I can decide what information I need to know to be able to compare two populations based on a sample from each.
- I can compare two groups by taking a random sample, calculating important measures, and determining whether the populations are meaningfully different.