

# Seventh Grade Math: Core Essentials

## CMP3 Shapes and Designs

Properties of Polygons: Understand the properties of polygons that affect their shape

Goal	Standard
Explore the ways that polygons are sorted into families according to the number and length of their sides and the size of their angles	
Explore the patterns among interior and exterior angles of a polygon	
Explore the patterns among side lengths in a polygon	
Investigate the symmetries of a shape—rotation or reflection	
Determine which polygons fit together to cover a flat surface and why	
Reason about and solve problems involving various polygons	

Relationships Among Angles: Understand special relationships among angles

Goal	Standard
Investigate techniques for estimating and measuring angles	
Use tools to sketch angles	
Reason about the properties of angles formed by parallel lines and transversals	
Use information about supplementary, complementary, vertical, and adjacent angles in a shape to solve for an unknown angle in a multi-step problem	

Constructing Polygons: Understand the properties needed to construct polygons

Goal	Standard
Draw or sketch polygons with given conditions by using various tools and techniques such as freehand, use of a ruler and protractor, and use of technology	
Determine what conditions will produce a unique polygon, more than one polygon, or no polygon, particularly triangles and quadrilaterals	
Recognize the special properties of polygons, such as angle sum, side-length relationships, and symmetry, that make them useful in building, design, and nature	
Solve problems that involve properties of shapes	

List of Common Core Standards in Shapes and Designs:

**7.EE.A.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. *Investigation 2*

**7.EE.B.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. *Investigation 2*

**7.G.A.2** Draw (freehand, with ruler and protractor, and with technology) 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. *Investigations 1, 2, and 3*

**7.G.B.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. *Investigations 1, 2, and 3*

Rational Numbers: Develop an understanding that rational numbers consist of positive numbers, negative numbers, and zero

Goal	Standard
Explore relationships between positive and negative numbers by modeling them on a number line	
Use appropriate notation to indicate positive and negative numbers	
Compare and order positive and negative rational numbers (integers, fractions, decimals, and zero) and locate them on a number line	
Recognize and use the relationship between a number and its opposite (additive inverse) to solve problems	
Relate direction and distance to the number line	
Use models and rational numbers to represent and solve problems	

Operations With Rational Numbers: Develop understanding of operations with rational numbers and their properties

Goal	Standard
Develop and use different models (number line, chip model) for representing addition, subtraction, multiplication, and division	
Develop algorithms for adding, subtracting, multiplying, and dividing integers	
Recognize situations in which one or more operations of rational numbers are needed	
Interpret and write mathematical sentences to show relationships and solve problems	
Write and use related fact families for addition/subtraction and multiplication/division to solve simple equations	
Use parentheses and the Order of Operations in computations	
Understand and use the Commutative Property for addition and multiplication	
Apply the Distributive Property to simplify expressions and solve problems	

List of Common Core Standards in Accentuate the Negative:

**7.NS.A.1** Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line. *Investigations 1, 2, and 4*

**7.NS.A.1a** Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged. *Investigations 1 and 2*

**7.NS.A.1b** Understand  $p+q$  as a number located a distance  $|q|$  from  $p$ , in a positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of zero. Interpret sums of rational numbers by describing real-world contexts. *Investigations 1 and 2*

**7.NS.A.1c** Understand subtraction of rational numbers as adding the inverse,  $p-q=p+(-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. *Investigations 1 and 2*

**7.NS.A.1d** Apply properties of operations as strategies to add or subtract rational numbers. *Investigations 2 and 4*

**7.NS.A.2** Apply and extend previous understandings of multiplication and division of fractions to divide rational numbers. *Investigations 3 and 4*

**7.NS.A.2a** Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1)=1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. *Investigations 3 and 4*

**7.NS.A.2b** Understand that integers can be divided provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q)=(-p)/q=p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts. *Investigation 3*

**7.NS.A.2c** Apply properties of operations as strategies to multiply and divide rational numbers. *Investigations 3 and 4*

**7.NS.A.2d** Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. *Investigation 3*

**7.NS.A.3** Solve real-world problems involving the four operations with rational numbers. *Investigations 1, 2, 3, and 4*

**7.EE.B.3** Solve multi-step and real-life 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. *Investigations 2, 3, and 4*

**7.EE.B.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. *Investigation 1*

**7.EE.B.4b** 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. *Investigation 1*

## CMP3 Stretching and Shrinking

Similar Figures: Understand what it means for figures to be similar

Goal	Standard
Identify similar figures by comparing corresponding sides and angles	
Use scale factors and ratios to describe relationships among the side lengths, perimeters, and areas of similar figures	
Generalize properties of similar figures	

Recognize the role multiplication plays in similarity relationships	
Recognize the relationship between scale factor and ratio in similar figures	
Use informal methods, scale factors, and geometric tools to construct similar figures (scale drawings)	
Compare similar figures with non similar figures	
Distinguish algebraic rules that produce similar figures from those that produce non similar figures	
Use algebraic rules to produce similar figures	
Recognize when a rule shrinks or enlarges a figure	
Explore the effect on the image of a figure if a number is added to the $x$ - or $y$ -coordinates of the figure's vertices	

**Reasoning With Similar Figures** Develop strategies for using similar figures to solve problems

Goal	Standard
Use the properties of similarity to find distances and heights that cannot be measured directly	
Predict the ways that stretching or shrinking a figure will affect side lengths, angle measures, perimeters, and areas	
Use scale factors or ratios to find missing side lengths in a pair of similar figures	
Use similarity to solve real-world problems	

List of Common Core Standards in Stretching and Shrinking:

**7.RP.A.2** Recognize and represent proportional relationships between quantities. *Investigations 1, 2, 3, and 4*

**7.RP.A.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. *Investigations 2, 3, and 4*

**7.RP.A.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. *Investigations 1, 2, 3, and 4*

**7.RP.A.3** Use proportional relationships to solve multistep ratio and percent problems. *Investigation 4*

**7.EE.B.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. *Investigation 4*

**7.EE.B.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. *Investigation 4*

**Note:** During this Investigation, students use variables to represent quantities and reason about unknown amounts. They are not directly asked to construct simple equations and inequalities in this Unit.

**7.G.A.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. *Investigations 1, 2, 3, and 4*

**7.G.A.2** Draw (freehand, with ruler and protractor, and with technology) 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. *Investigations 1 and 3*

**7.G.B.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. *Investigations 1, 2, 3, and 4*

**Note:** The development in this Unit is primarily with two-dimensional objects. Three-dimensional objects are further developed in *Filling and Wrapping*.

**Essential for 7.EE.B.4a** 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 fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *Investigations 2, 3, and 4*

## MP3 Comparing and Scaling

Ratios, Rates, and Percents: Understand ratios, rates, and percents

Goal	Standard
Use ratios, rates, fractions, differences, and percents to write statements comparing two quantities in a given situation	
Distinguish between and use both part-to-part and part-to-whole ratios in comparisons	
Use percents to express ratios and proportions	
Recognize that a rate is a special ratio that compares two measurements with different units	
Analyze comparison statements made about quantitative data for correctness and quality	
Make judgments about which kind of comparison statements are most informative or best reflect a particular point of view in a specific situation	

Proportionality: Understand proportionality in tables, graphs, and equations

Goal	Standard
Recognize that constant growth in a table, graph, or equation is related to proportional situations	
Write an equation to represent the pattern in a table or graph of proportionally related variables	
Relate the unit rate and constant of proportionality to an equation, graph, or table describing a proportional situation	

Reasoning Proportionally: Develop and use strategies for solving problems that require proportional reasoning

Goal	Standard
Recognize situations in which proportional reasoning is appropriate to solve the problem	
Scale a ratio, rate, percent, or fraction to make a comparison or find an equivalent representation	
Use various strategies to solve for an unknown in a proportion, including scaling, rate tables, percent bars, unit rates, and equivalent ratios	
Set up and solve proportions that arise from real-world applications, such as finding discounts and markups and converting measurement units	



List of Common Core Standards in Comparing and Scaling:

**7.RP.A.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *Investigations 2 and 3*

**7.RP.A.2** Recognize and represent proportional relationships between quantities. *Investigations 1, 2, and 3*

**7.RP.A.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. *Investigations 1, 2, and 3*

**7.RP.A.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. *Investigations 2 and 3*

**7.RP.A.2c** Represent proportional relationships by equations. *Investigations 1, 2, and 3*

**7.RP.A.2d** Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate. *Investigations 2 and 3*

**7.RP.A.3** Use proportional relationships to solve multistep ratio and percent problems. *Investigations 1, 2, and 3*

**7.NS.A.3** Solve real-world and mathematical problems involving the four operations with rational numbers. *Investigation 3*

**7.EE.B.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. *Investigation 3*

**7.EE.B.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. *Investigations 1, 2, and 3*

**7.EE.B.4a** 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 fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *Investigations 2 and 3*

## CMP3 Moving Straight Ahead

Linear Relationships: Recognize problem situations in which two variables have a linear relationship

Goal	Standard
Identify and describe the patterns of change between the independent and dependent variables for linear relationships represented by tables, graphs, equations, or contextual settings	
Construct tables, graphs, and symbolic equations that represent linear relationships	
Identify the rate of change between two variables and the $x$ - and $y$ -intercepts from graphs, tables, and equations that represent linear relationships	
Translate information about linear relationships given in a contextual setting, a table, a graph, or an equation to one of the other forms	
Write equations that represent linear relationships given specific pieces of information, and describe what information the variables and numbers represent	
Make a connection between slope as a ratio of vertical distance to horizontal distance between two points on a line and the rate of change between two variables that have a linear relationship	
Recognize that $y=mx$ represents a proportional relationship	
Solve problems and make decisions about linear relationships using information given in tables, graphs, and equations	

Equivalence: Understand that the equality sign indicates that two expressions are equivalent

Goal	Standard
Recognize that the equation $y=mx+b$ represents a linear relationship and means that $mx+b$ is an expression equivalent to $y$	
Recognize that linear equations in one unknown, $k=mx+b$ or $y=m(t)+b$ , where $k$ , $t$ , $m$ , and $b$ are constant numbers, are special cases of the equation $y=mx+b$	
Recognize that finding the missing value of one of the variables in a linear relationship, $y=mx+b$ , is the same as finding a missing coordinate of a point $(x,y)$ that lies on the graph of the relationship	
Solve linear equations in one variable using symbolic methods, tables, and graphs	
Recognize that a linear inequality in one unknown is associated with a linear equation	
Solve linear inequalities using graphs or symbolic reasoning	
Show that two expressions are equivalent	
Write and interpret equivalent expressions	

List of Common Core Standards in Moving Straight Ahead:

**7.RP.A.2** Recognize and represent proportional relationships between quantities. *Investigation 1*

**7.RP.A.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. *Investigation 1*

**7.RP.A.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. *Investigations 1 and 2*

**7.RP.A.2c** Represent proportional relationships by equations. *Investigations 1 and 2*

**7.RP.A.2d** Explain what a point  $(x,y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0,0)$  and  $(1,y)$ , where  $r$  is the unit rate. *Investigations 2 and 4*

**7.EE.A.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. *Investigations 3 and 4*

**7.EE.A.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. *Investigations 3 and 4*

**7.EE.B.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. *Investigations 1, 2, 3, and 4*

**7.EE.B.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. *Investigations 1, 2, 3, and 4*

**7.EE.B.4a** 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 fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *Investigations 1, 2, 3, and 4*

**7.EE.B.4b** 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. *Investigation 3*

## CMP3 What Do You Expect?

Experimental and Theoretical Probabilities: Understand experimental and theoretical probabilities

Goal	Standard
Recognize that probabilities are useful for predicting what will happen over the long run	
For an event described in everyday language, identify the outcomes in a sample space that compose the event	
Interpret experimental and theoretical probabilities and the relationship between them and recognize that experimental probabilities are better estimates of theoretical probabilities when they are based on larger numbers	
Distinguish between outcomes that are equally likely or not equally likely by collecting data and analyzing experimental probabilities	
Realize that the probability of simple events is a ratio of favorable outcomes to all outcomes in the sample space	
Recognize that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring	
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	
Determine the fairness of a game	

Reasoning With Probability: Explore and develop probability models by identifying possible outcomes and analyze probabilities to solve problems

Goal	Standard
Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events	
Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process	
Represent sample spaces for simple and compound events and find probabilities using organized lists, tables, tree diagrams, area models, and simulation	
Realize that, just as with simple events, the probability of a compound event is a ratio of favorable outcomes to all outcomes in the sample space	
Design and use a simulation to generate frequencies for simple and compound events	

Analyze situations that involve two or more stages (or actions) called <i>compound events</i>	
Use area models to analyze the theoretical probabilities for two-stage outcomes	
Analyze situations that involve binomial outcomes	
Use probability to calculate the long-term average of a game of chance	
Determine the expected value of a probability situation	
Use probability and expected value to make a decision	

List of Common Core Standard in What Do You Expect?:

**7.RP.A.2** Recognize and represent proportional relationships between quantities. *Investigations 1, 2, 3, 4, and 5*

**7.RP.A.2a** Decide whether two quantities are in a proportional relationship. *Investigations 1, 2, 3, 4, and 5*

**7.RP.A.3** Use proportional relationships to solve multistep ratio and percent problems. *Investigations 1, 2, 3, 4, and 5*

**7.SP.C.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  $\frac{1}{2}$  indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. *Investigations 2, 3, 4, and 5*

**7.SP.C.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. *Investigations 1, 2, 3, and 4*

**7.SP.C.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. *Investigations 2, 3, 4 and 5*

**7.SP.C.7a** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *Investigations 1, 3, 4 and 5*

**7.SP.C.7b** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *Investigations 1, 2, 3 and 4*

**7.SP.C.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. *Investigations 2, 3, 4 and 5*

**7.SP.C.8a** 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. *Investigations 2, 3, 4, and 5*

**7.SP.C.8b** 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. *Investigations 2, 4, and 5*

**7.SP.C.8c** Design and use a simulation to generate frequencies for compound events. *Investigations 4 and 5*

## CMP3 Filling and Wrapping

Surface Areas and Volumes of Polygonal Prisms and Cylinders: Understand surface areas and volumes of prisms and cylinders and how they are related

Goal	Standard
Describe prisms by using their vertices, faces, and edges	
Visualize three-dimensional shapes and the effects of slicing those shapes by planes	
Deepen understanding of volumes and surface areas of rectangular prisms	
Estimate and calculate surface areas and volumes of polygonal prisms by relating them to rectangular prisms	
Explore the relationships between the surface areas and volumes of prisms	
Relate surface areas and volumes for common figures, especially optimization of surface area for fixed volume	
Predict the effects of scaling dimensions on linear, surface area, and volume measures of prisms, cylinders, and other figures	
Investigate the relationship between volumes of prisms and volumes of cylinders as well as the relationship between surface areas of prisms and surface areas of cylinders	
Use volumes and surface areas of prisms to develop formulas for volumes and surface areas of cylinders	
Discover that volumes of prisms and cylinders can be calculated as the product of the area of the base and the height	
Solve problems involving surface areas and volumes of solid figures	

Areas and Circumferences of Circles: Understand the areas and circumferences of circles and how they are related

Goal	Standard
Relate area of a circle to covering a figure and circumference to surrounding a figure	
Estimate and calculate areas and circumferences of circles	
Explore the relationship between circle radius (or diameter) and circumference	
Explore the relationship between circle radius (or diameter) and area	

Investigate the connection of $\pi$ to area calculation by estimating the number of radius squares needed to cover a circle	
Investigate the relationship between area and circumference of a circle	
Solve problems involving areas and circumferences of circles	

Volumes of Spheres and Cones: Understand the relationships between the volumes of cylinders and the volumes of cones and spheres

Goal	Standard
Relate volumes of cylinders to volumes of cones and spheres	
Estimate and calculate volumes of spheres and cones	
Solve problems involving surface areas and volumes of spheres and cones	

List of Common Core Standards in Filling and Wrapping:

7.RP.A.2 Recognize and represent proportional relationships between quantities. *Investigation 1*

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers. *Investigations 2, 3, and 4*

7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. *Investigation 3*

7.EE.A.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. *Investigations 1 and 3*

7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and area from a scale drawing and reproducing a scale drawing at a different scale. *Investigation 1*

7.G.A.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. *Investigation 2*

7.G.B.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. *Investigations 3 and 4*

7.G.B.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. *Investigations 1, 2, 3, and 4*





## CMP3 Samples and Populations

The Process of Statistical Investigation: Deepen the understanding of the process of statistical investigation and apply this understanding to samples

Goal	Standard
Pose questions, collect data, analyze data, and interpret data to answer questions	

Analysis of Samples: Understand that data values in a sample vary and that summary statistics of samples, even same-sized samples, taken from the same population also vary

Goal	Standard
Choose appropriate measures of center (mean, median, or mode) and spread (range, IQR, or MAD) to summarize a sample	
Choose appropriate representations to display distributions of samples	
Compare summary statistics of multiple samples drawn from either the same population or from two different populations and explain how the samples vary	

Design and Use of Simulations: Understand that simulations can model real-world situations

Goal	Standard
Design a model that relies on probability concepts to obtain a desired result	
Use the randomly generated frequencies for events to draw conclusions	

Predictions and Conclusions About Populations: Understand that summary statistics of a representative sample can be used to gain information about a population

Goal	Standard
Describe the benefits and drawbacks to various sampling plans	
Use random-sampling techniques to select representative samples	
Apply concepts from probability to select random samples from populations	
Explain how sample size influences the reliability of sample statistics and resulting conclusions and predictions	
Explain how different sampling plans influence the reliability of sample statistics and resulting conclusions and predictions	
Use statistics from representative samples to draw conclusions about populations	

Use measures of center, measures of spread, and data displays from more than one random sample to compare and draw conclusions about more than one population	
Use mean and MAD, or median and IQR, from random samples to assess whether the differences in the samples are due to natural variability or due to meaningful differences in the underlying populations	

List of Common Core Standards in Samples and Populations:

**7.RP.A.2** Recognize and represent proportional relationships between quantities. *Investigation 3*

**7.NS.A.1** Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

*Investigations 1 and 3*

**7.NS.A.1b** Understand  $p+q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative . . . Interpret sums of rational numbers by describing real-world contexts. *Investigations 1 and 3*

**7.SP.A.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. *Investigations 2 and 3*

**7.SP.A.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. *Investigations 2 and 3*

**7.SP.B.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. *Investigations 1 and 3*

**7.SP.B.4** Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *Investigations 1 and 3*

**7.SP.C.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  $1/2$  indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. *Investigation 3*

**7.SP.C.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. *Investigations 2 and 3*

**7.SP.C.7a** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *Investigations 2 and 3*

