Core Content

Cluster Title: Analyze proportional relationships and use them to solve real-world and mathematical problems.
Standard 1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.*
Concepts and Skills to Master
• Extend the concept of a unit rate to include ratios of fractions.   • Compute a unit rate, involving quantities measured in like or different units.

Supports for Teachers

Critical Background Knowledge
• Understand the concept of a unit rate. (6.RP.2)   • Solve unit rate problems (If Eliza drives 400 miles in 8 hours, what is her average rate?) (6.RP.3)   • Simplify a complex fraction. (6.NS.1)
Academic Vocabulary
Complex fractions, equivalent ratios, unit rate

Suggested Instructional Strategies	Resources
• Launch with integer problems familiar from Grade 6 and extend to fractional problems. • Use grocery store ads to find unit rates for various products. • Use ratios of real-life and model figures measured in fractional standard units to determine scale factors.	*Developing Essential Understanding of Ratios, Proportions, and Proportional Reasoning for Teaching Mathematics: Grade 6-8*, NCTM

Sample Formative Assessment Tasks	
Skill-based Task • If the temperature is rising 1/5 degree each ½ hour, what is the increase in temperature expressed as a unit rate? • If Monica reads 7 ½ pages in 9 minutes, what is her average reading rate in pages per minute, and in pages per hour?	Problem Task John mows 1/3 of a lawn in 10 minutes. Marcia mows ¼ of a lawn in 6 minutes. A student claims that Marcia is mowing faster because she only worked for 6 minutes, while John worked for 10. Is the student's reasoning correct? Why or why not?

Core Content

Cluster Title: Analyze proportional relationships and use them to solve real-world and mathematical problems.
Standard 2: Recognize and represent proportional relationships between quantities.   *a)* 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.   *b)* Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.   *c)* Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t=pn.*   *d)* 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.
Concepts and Skills to Master
• Verify that two quantities expressed in a table or in a graph are in a proportional relationship.   • Determine a unit rate from a table, graph, equation, diagram or verbal description and relate it to the constant of proportionality.   • Write an equation for a proportional relationship in the form *y = kx*.   • Explain the meaning of the point *(x,y)* in the context of a proportional relationship.   • Explain the significance of (0,0) and (1,*r*) in a graph of a proportional relationship, where *r* is the unit rate.

Supports for Teachers

Critical Background Knowledge
• Understand the concept of a unit rate a/b. (6.RP.1)   • Make tables and plot points generated from equivalent ratios. (6.RP.3)
Academic Vocabulary
Proportional relationship, constant of proportionality, linear, equivalent ratios, unit rate

Suggested Instructional Strategies	Resources
• Match verbal descriptions, graphs, tables, and equations of proportional relationships, including real-life proportional relationships. • Use technology to make a table of equivalent ratios and visualize graphs. • Connect the concept of a unit rate to the understanding of directly proportional relationships as a foundation for linear equations in 8th grade.	*Developing Essential Understanding of Ratios, Proportions, and Proportional Reasoning for Teaching Mathematics: Grade 6-8*, NCTM

Sample Formative Assessment Tasks	
Skill-based Task Gas is selling at the pump at $3.75 per gallon. Represent this relationship using a table, graph, and an equation.	**Problem Task** Measure the circumference and radius of a variety of circles, and plot the radius against the circumference. What is the relationship between radius and circumference? How do you know?

Core Content

Cluster Title: Analyze proportional relationships and use them to solve real-world and mathematical problems.
Standard 3: Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*
Concepts and Skills to Master
• Solve multistep problems involving percent using proportional reasoning. • Find the percent of a number and extend the concept to solving real life percent applications. • Calculate percent, percent increase, decrease, and error.

Supports for Teachers

Critical Background Knowledge
• Find a percent of a quantity as a rate per 100. (6.RP.3) • Solve problems involving finding the whole given a part and the percent. (6.RP.3) • Work fluently among fractions, decimals, and percent.
Academic Vocabulary
Percent error, gratuity, commission, markup, markdown, simple interest, percent increase, percent decrease

Suggested Instructional Strategies	Resources
Use authentic information such as sales ads, menus, and tax rates to solve authentic problems involving percent.	National Library of Virtual Manipulatives

Sample Formative Assessment Tasks	
Skill-based Task • Find the selling price of a $60 video game with a 28% markup and 6% tax. • If you estimate that there are 90 jellybeans in a jar when there are actually 130, what is your percent of error based on the actual number in the jar?	Problem Task • An item is discounted 30% and then reduced another 20%. Use an example to demonstrate if the resulting discount is equivalent to a discount of 50%? • Write several percent problems in which the solution is 35%. • Does taking a 6% discount on an item, and then adding 6% sales tax result in the original price of an item? Support your answer with an example.

Core Content

Cluster Title: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
Standard 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. a) 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.* b) 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. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c) Understand subtraction of rational numbers as adding the additive 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. d) Apply properties of operations as strategies to add and subtract rational numbers.
Concepts and Skills to Master
• Understand, apply, and explain the additive inverse property. • Model addition and subtraction of rational numbers, including integers, decimals, and fractions, on a vertical or horizontal number line. • Add and subtract rational numbers, including integers, decimals, and fractions.

Supports for Teachers

Critical Background Knowledge	
• Fluency with addition and subtraction of positive fractions and decimals.	
Academic Vocabulary	
Integer, rational number, additive inverse, commutative property, associative property	
Suggested Instructional Strategies	**Resources**
• Use a number line to model operations with rational numbers.	Illuminations (NCTM)
Sample Formative Assessment Tasks	
Skill-based Task Compute: $-\dfrac{3}{4}+\dfrac{1}{2}$ $-3+7$ $-3-7$ $1.35+(-3.57)$ $-8\dfrac{1}{8}-(-3\dfrac{5}{6})$ $-3-7+(-5)$ $4.5-(-7.9)$	**Problem Task** Write a story that would result in the problem: (-3)+6+5.7- 8 Model the solution in two different ways.

7.NS.1

Core Content

Cluster Title: Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers.
Standard 2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a) 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. b) 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. c) Apply properties of operations as strategies to multiply and divide rational numbers. d) 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.
Concepts and Skills to Master
• Multiply and divide rational numbers, including integers, decimals, and fractions, and use properties of arithmetic to model multiplication and division of rational numbers. • Explain why division by zero is undefined. • Use long division to change a fraction into a terminating or repeating decimal. • Interpret products and quotients of rational numbers, including integers, decimals, and fractions, in real-world contexts.

Supports for Teachers

Critical Background Knowledge
• Fluency with multiplication and division of positive fractions and decimals.
Academic Vocabulary
Distributive property, integer, terminating decimal, rational number, commutative property, associative property

Suggested Instructional Strategies	Resources
• Explore real world contexts that result in multiplication or division of rational numbers	

Sample Formative Assessment Tasks	
Skill-based Task	**Problem Task**
Compute: $\dfrac{2}{3} \times \left(-\dfrac{1}{4}\right)$ Convert $\dfrac{2}{3}$ to a decimal using long division.	Write a story that would result in the problem: $-1.25 \div 2$

7.NS.2

Core Content

Cluster Title: Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers.
Standard 3: Solve real-world and mathematical problems involving the four operations with rational numbers.
Concepts and Skills to Master
• Model and solve real world problems using numbers and operations. • Explain the solution to a real-world problem in context.

Supports for Teachers

Critical Background Knowledge	
• Set up a number sentence to model a real-life situation. • Order of operations (6.EE.2c) • Compute fluently the four operations using rational numbers.	
Academic Vocabulary	
Sum, difference, product, quotient, difference	
Suggested Instructional Strategies	**Resources**
• Embed problems with credit card examples, sports scores and statistics, submarine depth examples, helicopter height examples, time-lines and other real world situations. • Talk about situations where solely identifying key words (e.g. sum) may lead to incorrect answers.	Illuminations (NCTM)
Sample Formative Assessment Tasks	
Skill-based Task A hot air balloon rises 2,150.825 feet then falls $583\frac{1}{3}$ feet. What is the final height of the balloon?	**Problem Task** • Create three word problems arising from situations at home that require negative numbers to solve. Write the stories and the math problems and find the solutions. Explain what the solution means in context. • Write a story problem that uses the word "sum", but does not require addition to solve.

Core Content

Cluster Title: Use properties of operations to generate equivalent expressions.
Standard 1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
Concepts and Skills to Master
• Use the Distributive Property to expand and factor linear expressions with rational numbers.   • Combine like terms with rational coefficients.

Supports for Teachers

Critical Background Knowledge	
• Commutative Property, Associative Property, Distributive Property • Order of Operations • Generate equivalent expressions (e.g. simplify) involving whole numbers.(6.EE.3)	
Academic Vocabulary	
Terms, coefficient, like-terms, distribute, expression, rational, linear, expand, factor, equivalent, simplify	
Suggested Instructional Strategies	**Resources**
• Model equivalent expressions such as $4x+14 = 2(2x)+2(7) = 2(2x+7)$ and have students explain why all three are equivalent. • Use manipulatives such as Algebra Tiles or candy to model equivalent expressions.	• Algebra Tiles • Algebra Blocks • Algebra Lab Gear
Sample Formative Assessment Tasks	

Skill-based Task	**Problem Task**
Simplify the following linear expression. $\frac{1}{2}x + \left(\frac{2}{5}x - 7\right)$ Factor $-3x+9$	Which students correctly simplified the expressions? Justify your reasoning. Fix all incorrectly simplified expressions. Brianda: $\frac{dc}{ca} = \frac{d}{a}$ Sara: $\frac{n+x}{n+m} = \frac{x}{m}$ Jorge: $\frac{-5xyz}{7xy} = \frac{5z}{-7}$ Julia: $\frac{3s+7t}{4s} = \frac{3+7t}{4}$ Trent: $\frac{x+xy}{xz} = \frac{1+y}{z}$

7.EE.1

Core Content

Cluster Title: Use properties of operations to generate equivalent expressions.
Standard 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."*
Concepts and Skills to Master
• Recognize and explain the meaning of a given expression and its component parts. • Recognize that different forms of an expression may reveal different attributes of the context.

Supports for Teachers

Critical Background Knowledge
• Commutative Property, Associative Property, Distributive Property • Order of Operations • Generate equivalent expressions (e.g. simplify) involving whole numbers.(6.EE.3)
Academic Vocabulary
Terms, coefficient, like-terms, distribute, expression, rational, linear, expand, factor, equivalent, simplify

Suggested Instructional Strategies	Resources
• Use multiple student-generated equivalent representations of the same problem to explore how the structure of an expression reveals different attributes of the context.	"Uncovering Student Thinking in Mathematics Grades 6-12" Rose and Arline

Sample Formative Assessment Tasks	
Skill-based Task Are the following equivalent? Why or why not? 1) $\frac{1}{2}bh = \frac{bh}{2}$ 2) $x-(-3)=x+3$ 3) $7y\frac{\sqrt{3}}{\sqrt{3}}=7y$	**Problem Task** Write three equivalent expressions for: $\frac{2}{3}(6x+9)+6x$ Justify the equivalence of your expressions.

7.EE.2

Core Content

Cluster Title: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
Standard 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 3/4 inches long in the center of a door that is 27 1/2 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.
Concepts and Skills to Master
• Solve multi-step mathematical problems involving calculations with positive and negative rational numbers in a variety of forms.   • Solve multi-step real-life problems involving calculations with positive and negative rational numbers in a variety of forms.   • Convert between forms of a rational number to simplify calculations or communicate solutions meaningfully.   • Assess the reasonableness of answers using mental computation and estimation.

Supports for Teachers

Critical Background Knowledge
• Solve one-step linear equations involving non-negative rational numbers. (6.EE.7)   • Convert between fractions, decimals, and percent.
Academic Vocabulary
Estimate, rational number, reasonableness, solution

Suggested Instructional Strategies	Resources
• Choose real life problems to highlight the advantages of using different numerical representations (fractions, decimals, percent) or models (bar, equation, drawing). • Assign student partners to solve problems, present solutions, and compare solution strategies.	• MSSM Chocolate Milk Problem • "Problem Solving Strategies Crossing the River with Dogs" Johnson and Herr
Sample Formative Assessment Tasks	

Skill-based Task	Problem Task
Malie and her sister won a $45 iTunes gift card. They agree to split the money so that Malie gets 2/3 of the value and her sister gets the rest. If songs on iTunes cost $1.29, how many songs will each sister be able to buy?	Braxton wants to spend his $60 savings on new longboard parts online. He has a promotional code that he can use for 1/5 off his cost before shipping or for free shipping. If shipping costs are $1.75 for each $10 spent, how should he use his promotional code? Justify your answer.

Core Content

Cluster Title: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
Standard 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 fluently. 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.*
Concepts and Skills to Master
• Use variables to create equations and inequalities that model word problems. • Solve word problems leading to linear equations and inequalities. • Connect arithmetic solution processes that do not use variables to algebraic solution processes that use equations. • Use symbols of inequality to express phrases such as "at most", "at least as much as", or "no more than".

Supports for Teachers

Critical Background Knowledge
• Represent solutions of inequalities such as x<c or x>c on a number line. (6.EE.8) • Solve 1-step equations and inequalities.
Academic Vocabulary
Algebraic, inequality, equation, inverse operations, solution set, at most, at least, less than, greater than, $<$, $\leq$, $>$, $\geq$

Suggested Instructional Strategies	Resources
• Solve simple problems arithmetically and compare the process to that of finding solutions algebraically. • Partner problems: One student solves, the other writes reasons why steps work. • Find and analyze mistakes in student work samples. • Have students solve problems based on a verbal or written description • Use arithmetic and algebraic approaches to problems to examine the structure of the mathematics.	NLVM-Balance scales
Sample Formative Assessment Tasks	

Skill-based Task	Problem Task
John and his friend have $20 to go to the movies. Tickets are $6.50 each. How much will they have left for candy? Connect the arithmetic and algebraic methods.	When Zuri picks any number between -10 and 10, triples it, adds 9, divides by 3, and subtracts 3, what number does she get? Why? Evaluate and use algebraic evidence to support your conclusion.

Core Content

Cluster Title: Draw, construct, and describe geometrical figures and describe the relationships between them.
Standard 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.

Concepts and Skills to Master
• Use a scale or scale factor to find a measurement. • Find actual lengths and areas from a scale drawing, using a scale factor. • Create multiple scale drawings from the original model or drawing, using different scales.

Supports for Teachers

Critical Background Knowledge
• Find areas of geometric figures. (6.G.1)

Academic Vocabulary
Scale, scale factor, scale drawing, enlarge, reduce

Suggested Instructional Strategies	Resources
• Use blueprints to explore consumer questions such as "how much carpet or tile should I buy?" • Use Google Earth to determine the area of the school property.	• Maps/Atlases • Rulers/Measuring tapes • Scale models/drawings • *If You Hopped Like a Frog* book • *Gulliver's Travels* book/movie

Sample Formative Assessment Tasks	
Skill-based Task	**Problem Task**
Given a map with the scale 1 inch = 9 miles, two cities are 3.75 inches apart, how many miles are they from one another?	Cut an 8 ½ X 11" sheet of paper so that it represents a scale model of your desk. Place three items on the desk and using the appropriate scale factor create a scale drawing of the desk and the items on the desk. Justify your results.

7.G.1

Core Content

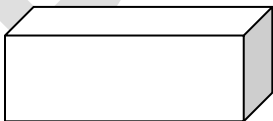| Cluster Title: Draw, construct, and describe geometrical figures and describe the relationships between them. |
|---|
| **Standard 2:** Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. |
| **Concepts and Skills to Master** |
| • Draw precise geometric figures based on given conditions.
• Discover the conditions necessary for a given set of angles or sides to make a triangle.
• Explore conditions that determine unique triangles, multiple triangles, or no triangles. |

Supports for Teachers

Critical Background Knowledge
• Drawing precise angles using a protractor and ruler.
Academic Vocabulary
Angle (∠), angle measure ($m\angle$), acute, obtuse, right, degrees (°), polygon, vertex, line segment (side AB of ΔABC)

Suggested Instructional Strategies	Resources
• Give students the same three angle measures, have them draw triangles on their own, compare their triangles, and discuss how the triangles are similar and different from one another. Do the same activity given three side lengths. Could use Patty Paper also. • Have students create triangles and other geometric figures using dynamic geometry software to determine conditions necessary to create polygons.	• Dynamic geometry software • Patty Paper • Protractor • Ruler

Sample Formative Assessment Tasks	
Skill-based Task Given the two side lengths, 6 and 7, what is the shortest possible length of the third side? What is the longest possible length of the third side?	**Problem Task** Draw a triangle where one angle is twice as large as another. Measure the third angle. What is the relationship between the three angles? Given the following angles, 0°, 10°, 15°, 30°, 35°, 65°, 70°, 75°, 80°, and 100°, find all the possible angle combinations that will form a triangle. Precisely draw all possible triangles using a protractor and ruler.

7.G.2

Core Content

Cluster Title: Draw, construct, and describe geometrical figures and describe the relationships between them.
Standard 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.

Concepts and Skills to Master
• Describe the different ways to slice a 3D figure (i.e. vertical slice, horizontal slice, and angled slice).   • Describe the different 2D cross-sections that will result depending on how you slice the 3D figure.

Supports for Teachers

Critical Background Knowledge
• Identify polygons.

Academic Vocabulary
Cube, Right rectangular prism, Right rectangular pyramid, Cross-sections, Two-dimensional figure (2D), Three-dimensional figure (3D), Plane sections

Suggested Instructional Strategies	Resources
• Slice a variety of objects (e.g. Styrofoam shapes, molding clay, or potatoes), using fishing line, dental floss, or string, and describe the two-dimensional figures that result from the slices. • Explore topographical maps as a two-dimensional representation of a three dimensional landscape. • Take potatoes and cut into right rectangular prisms or any other type of right prism. Cut potato prisms at different angles, color the cross-section using a marker or stamp pad, and stamp it onto a piece of paper to help students see that the cross-section is 2D.	• National Library of Virtual Manipulatives - Platonic Solids – Slicing • Google Sketchup

Sample Formative Assessment Tasks	
Skill-based Task Explain how a single slice through the right rectangular prism can create a triangle, a rectangle, a trapezoid, or a square?	**Problem Task** Create three-dimensional models based on topographical maps. What are all the possible 2-D figures you can create by slicing an ice-cream cone? an umbrella? a 3-D object of your choice?

Core Content

Cluster Title: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
Standard 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.

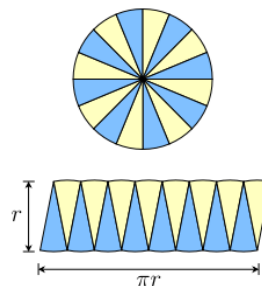| Concepts and Skills to Master |
|---|
| • Use the formulas for area and circumference of a circle to solve problems.
 • Know the relationship between diameter, circumference, and pi.
 • Show and explain how the circumference and area of a circle are related. |

Supports for Teachers

Critical Background Knowledge
• Parts of a circle (radius, diameter, center).

Academic Vocabulary
Circumference, Radius, Diameter, Center, Area, Pi (π)

Suggested Instructional Strategies	Resources
• Divide a circle into equal parts; rearrange pieces into a parallelogram to model the derivation of the area of a circle. Relate the base of the parallelogram to half the circumference of the circle and the height of the parallelogram to its radius. (See picture.) • Cut two strings, one the length of the circumference, and the other the length of the diameter. Compare the lengths of the two strings to show that the circumference is approximately three diameters. • Have students measure the circumference and diameter of several circular objects of different sizes and take the ratio of the circumference to the diameter to discover pi.	• *Sir Cumference and the First Round Table* and/or any Sir Cumference books. • Dynamic geometry software • *Exploring Geometry with The Geometer's Sketchpad*® - The Circumference/Diameter Ratio activity.

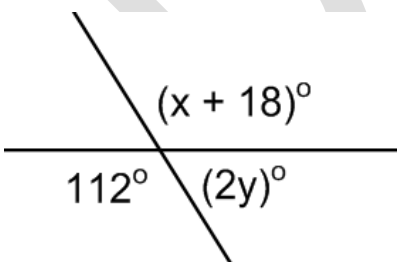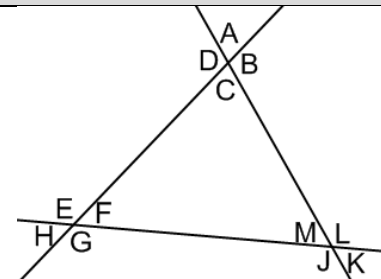| Sample Formative Assessment Tasks	
Skill-based Task Find the area and circumference of a circle with a radius of 4cm. Round to the nearest tenth.	**Problem Task** Tennis balls are packaged in a cylindrical container containing three balls. Without measuring, determine which is longer, the height of a tennis ball container or the distance around it?

Core Content

Cluster Title: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
Standard 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.

Concepts and Skills to Master
• Define and understand properties of supplementary, complementary, vertical and adjacent angles. • Use properties of supplementary, complementary, vertical and adjacent angles to solve for unknown angles in a figure. • Write and solve equations based on a diagram of intersecting lines with some known angle measures.

Supports for Teachers

Critical Background Knowledge
• Solve multi-step equations.

Academic Vocabulary
Supplementary, complementary, vertical angles, adjacent angles, Intersecting lines

Suggested Instructional Strategies	Resources
• Use patty paper or a reflecting device (mira) to explore relationships among the measures of angles formed by intersecting lines. • Draw two intersecting lines. Measure one angle and find the measures of the others without measuring. • Provide explicit examples of supplementary, complementary, vertical, and adjacent angles and demonstrate their relationships, including adjacent angles that are neither supplementary nor complementary.	• *Exploring Geometry with The Geometer's Sketchpad*® - Angles Formed by Intersecting Lines activity

Sample Formative Assessment Tasks	
Skill-based Task Solve for x and y. $(x + 18)^o$ 112° $(2y)^o$	**Problem Task** If $m\angle B = 102°$ and $m\angle L = 120°$, find every other angle measure, explaining how you found each. A D B C E F H G M L J K

Core Content

Cluster Title: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
Standard 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.
Concepts and Skills to Master
• Find the areas of triangles, quadrilaterals, polygons, and composite figures, including those founds in real-world contexts.   • Find surface areas of cubes, right prisms, and right pyramids whose faces are triangles, quadrilaterals, and polygons, including those found in real-world contexts.   • Find volumes of cubes, right prisms, and composite polyhedra including those found in real-world contexts.

Supports for Teachers

Critical Background Knowledge
• Find area of rectangles (4.MD.3), special quadrilaterals (6.G.1),and triangles (6.G.1)   • Find the volume of rectangular prisms (5.MD.5)   • Find surface area using nets (6.G.4)
Academic Vocabulary
Area, surface area, volume, slant height, base, altitude, height

Suggested Instructional Strategies	Resources
• Have students design a way to determine the volume of various containers. Students can use their method to determine the volume of several containers and compare volumes. Test their hypotheses regarding the relative size of the containers by filling them with rice or beans.	• Geometric Solids and Nets manipulatives
Sample Formative Assessment Tasks	

Skill-based Task	Problem Task
Find the total volume for the house if the base of the house is 20 ft. X 50 ft. with side walls that are 10 ft. high and the peak of the house is 15 ft. from the ground.	Design a container that will hold at least 300 ft^3 of water, but that has a lateral surface area of less than 310 ft^2.

7.G.6

Core Content

Cluster Title: Use random sampling to draw inferences about a population.
Standard 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.
Concepts and Skills to Master
• Understand that representative samples can be used to make valid inferences about a population. • Understand that a random sample increases the likelihood of obtaining a representative sample of a population.

Supports for Teachers

Critical Background Knowledge
• None
Academic Vocabulary
• Inference, sample, random sample, population

Suggested Instructional Strategies	Resources
• Given a population, have students analyze various sample groups as being representative or not. • Discuss means of obtaining a random sample. • Use a random number generator to create a random sample.	Random Number Generator (ex. Calculator, Websites, Excel/Number)

Sample Formative Assessment Tasks	
Skill-based Task Find three examples in the media that demonstrate the use of samples to make a statement about the population.	**Problem Task** Design a method of gathering a random sample from the student body to determine the favorite NFL team.

7.SP.1

Core Content

Cluster Title: Use random sampling to draw inferences about a population.
Standard 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.*
Concepts and Skills to Master
• Make inferences about a population based on a sample. • Explore the variation in estimates or predictions based on multiple samples of the same data.

Supports for Teachers

Critical Background Knowledge
• Summarize quantitative data using quantitative measures of center and variability.(6.SP.5) • How to obtain a random sample.
Academic Vocabulary
Variation, inference, prediction, sampling error

Suggested Instructional Strategies	Resources
• Obtain multiple samples of the same size for a given population and explore variability and differences in estimates of measures of central tendency.	

Sample Formative Assessment Tasks	
Skill-based Task Students asked 10 of their peers their favorite music. The results are show below. Student 1: 4 Pop, 6 Country, Student 2: 1 Pop, 9 Country, Student 3: 6 Pop, 4 Country. What would student 1 say about the proportion of students who prefer Pop? If, in fact, 75% of the student body prefers Pop, what is the error in each student's estimate?	**Problem Task** Given the first name of all students in your grade. Predict the most common name in the U.S. for 7th graders. How good an estimate do you think your sample provides? Explain your reasoning.

7.SP.2

Core Content

Cluster Title: Draw informal comparative inferences about two populations.
Standard 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.*
Concepts and Skills to Master
• The measure of mean is independent of the measure of variability.   • Use visual representations to compare and contrast numerical data from two populations using measures of variability and center.

Supports for Teachers

Critical Background Knowledge
• Number Line Graphs including dot plots, histograms, and box plots.   • Calculate the measures of center (median and/or mean) and the measures of variability (interquartile range and/or mean absolute deviation)
Academic Vocabulary
Variability

Suggested Instructional Strategies	Resources
• Use measures of center and spread to compare temperatures in Honolulu, HI and Los Angeles, CA, observing visual overlap in a dot plot.	

Sample Formative Assessment Tasks	
Skill-based Task The average temperature in City 1 is 70 degrees and in City 2 it is 80 degrees. The mean absolute deviation of City 1 is 5 degrees and in City 2 it is 5 degrees. Compare the data using measures of center and spread.	**Problem Task** Measure the heights of the girls versus boys in your class. Calculate the measures of center and measures of variability for each group. Describe the similarities and differences.

7.SP.3

Core Content

Cluster Title: Draw Informal comparative inferences about two populations.
Standard 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.*

Concepts and Skills to Master
• Make comparative inferences about two populations using measures of center and variability.

Supports for Teachers

Critical Background Knowledge
• Measures of Center (median and/or mean)
• Measures of Variability (interquartile range and/or mean absolute deviation)

Academic Vocabulary
Inference

Suggested Instructional Strategies	Resources
• In small groups, compare and contrast similar data from two populations to make inferences.	

Sample Formative Assessment Tasks	
Skill-based Task Measure the heights of the girls versus boys in your class. Calculate the measures of center and measures of variability for each group. What inferences can you make about the height of girls versus boys? Will these inferences be the same your Senior year? Support your answer with a description of the overlap of the two distributions and numerical calculations for means and variability.	**Problem Task** Decide whether girls or boys take longer to get ready for school in the morning. Justify your answer using measures of center and spread.

7.SP.4

Core Content

Cluster Title: Investigate chance processes and develop, use, and evaluate probability models.
Standard 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.
Concepts and Skills to Master
(This is students' first exposure to probability in the Common Core.) • Represent the probability of an event as a fraction or decimal from 0 to 1 or percent from 0% to 100%. • Understand that a probability of 0 is impossible. • Understand that probabilities near 0 are unlikely to occur. • Understand that probabilities of .5 are equally likely and unlikely. • Understand that probabilities near 1 are more likely to occur. • Understand that a probability of 1 is certain.

Supports for Teachers

Critical Background Knowledge	
• Understand that 1 = 100% • Recognize when a number is close to 0, close to ½, or close to 1.	
Academic Vocabulary	
Probability, event, chance event, likelihood, outcome	
Suggested Instructional Strategies	**Resources**
• Brainstorm possible events that fit on the continuum from impossible to certain.	
Sample Formative Assessment Tasks	
Skill-based Task The weatherman said that there is a 90% chance of snow today. Describe the likelihood of it snowing today.	**Problem Task** Using a six-sided number cube, have students create events that are impossible, unlikely, as likely as unlikely, likely, and certain.

7.SP.5

Core Content

Cluster Title: Investigate chance processes and develop, use, and evaluate probability models.
Standard 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.*
Concepts and Skills to Master
- Perform an experiment and collect data on a chance event.   - Relate the results of an experiment to the theoretical relative frequency of an event.   - Use the results of an experiment to estimate the probability of an event.   - Estimate the long-run relative frequency of an event given the probability of the event.

Supports for Teachers

Critical Background Knowledge
- Summarize numerical data sets by reporting the number of observations. (6.SP.5)   - Understand the probability of a chance event as a number between 0 and 1 that expresses likelihood. (7.SP.5)
Academic Vocabulary
Theoretical probability, experimental probability, relative frequency

Suggested Instructional Strategies	Resources
Have students compare experimental and theoretical probability using coins, dice, or spinners.	- Web Simulations - Coins, number cubes, spinners, cards
Sample Formative Assessment Tasks	

Skill-based Task	Problem Task
You roll a fair die 200 times. How many outcomes should be even?	If Portia were to flip a coin one hundred times could the outcomes be 80 heads and 20 tails? Explain your reasoning.

Core Content

Cluster Title: Investigate chance processes and develop, use, and evaluate probability models.
Standard 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?*
Concepts and Skills to Master
• Use theoretical probabilities to create a probability model (e.g. table showing the potential outcomes of an experiment or random process with their corresponding probabilities) in which all outcomes are equally likely (uniform).
• Use observed frequencies to create a probability model for the data generated from a chance process.
• Use probability models to find probabilities of events.
• Compare theoretical and experimental probability.

Supports for Teachers

Critical Background Knowledge
• Theoretical and experimental probability
Academic Vocabulary
Probability model, uniform probability, discrepancy, sample space, event

Suggested Instructional Strategies	Resources
• Create a game based on a model, predict the winner, play the game. Compare observed frequencies with the prediction and explain discrepancies.	

Sample Formative Assessment Tasks	
Skill-based Task	**Problem Task**
Juan rolled 15 fours when rolling a fair die 60 times. Would you expect this result? Justify your answer.	The results of a spinner experiment are 50% red, 10% blue, 20% yellow, and 20% green. Draw the spinner.

Core Content

Cluster Title: Investigate chance processes and develop, use, and evaluate probability models.
Standard 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?*
Concepts and Skills to Master
• Represent probabilities of simple and compound events as a fraction, decimal, or percent.   • Find the sample space of a compound event.   • Create organized lists, tables, tree diagrams, and simulations to determine the probability of compound events.   • Generate frequencies for compound events using random number generators (e.g. tables, calculators, manipulatives).

Supports for Teachers

Critical Background Knowledge
• Compute the probability of a simple event.   • Use lists and tables to organize data.
Academic Vocabulary
Simple event, compound events, tree diagram, simulation, sample space

Suggested Instructional Strategies	Resources
• Use playing cards to simulate the results of compound events. (e.g. use 4 hearts and 6 clubs to simulate 40% of donors with type A blood)	• Random Number Generator

Sample Formative Assessment Tasks	
Skill-based Task What is the probability of a family with five children having exactly two boys?	**Problem Task** Create a tree diagram for illustrating the outcomes for a car that has two or four doors and is red, black, or silver. Create questions that can be answered based on the diagram.

Honors Core Content

Cluster Title: Number Systems
Standard: Research and analyze ancient number systems.

Concepts and Skills to Master
• Explore the benefits and limitations of a variety of ancient number systems within their historical context, including Egyptian, Roman, Babylonian, Chinese, or Mayan numerals.   • Perform a variety of computations using different number systems.   • Compare and contrast ancient number systems and modern number systems.

Guiding Instructional Questions
• How did early civilizations keep track of numerical information?   • How did the needs of a civilization influence the development of its mathematics?   • What similarities and differences exist in the way different civilizations represented their numbers?   • How did changes in representation allow for more complex mathematics?   • How did ancient civilizations represent negative numbers and how was that concept developed?   • Has mathematics always existed and people discovered it or did people create it?   • Which ancient number system(s) most influenced our current number systems?   • What happens to mathematics when civilizations meet?

Instructional Strategies
• Write a paper that compares and contrasts two number systems.   • Write an argument that supports the influence of an ancient numbering system on our current system.   • Research and present how ancient civilizations represented and used mathematics.   • Create a unique numbering system and support its benefits.

7.H.1

Honors Core Content

Cluster Title: Number Bases
Standard: Understand number systems using different bases and their applications.

Concepts and Skills to Master
• Research the use of number systems with different bases by different cultures. • Understand the modern applications of number systems with different bases. • Compare and contrast the benefits and limitations of number systems with different bases. • Compute using different bases.

Guiding Instructional Questions
• Why do you think humans use a base ten system and what base system might a spider or other creature use? • Why do computers use base 2? • What applications are there for other bases such as 8, 12, and 16? • How do the calendars of various cultures relate to the base systems in their mathematics? • Which computations are made easier in different number systems? • How are different number system revealed in nature?

Instructional Strategies
• Perform computations in various number bases and compare and contrast the results. • Research and present applications of various number bases. • Bring in a guest speaker from a field that uses different bases (e.g. computer engineer) and explore the use of different bases in careers. • Write an argument for or against converting to a base-ten system for time.

7.H.2

Honors Core Content

Cluster Title: Codes
Standard: Examine the use of mathematics in creating codes.

Concepts and Skills to Master
• Explore codes used in everyday life such as zip codes, area codes, license plates, and social security numbers. • Explore codes used in commerce such as check digits, UPC codes, and bank numbers. • Explore various codes used in cryptography.

Guiding Instructional Questions
• How does the use of codes facilitate commerce and other aspects of everyday life? • Why do stores scan your receipt when you return an item? • How does the use of codes protect our identity? • How have codes been used throughout history? • How do codes facilitate the collection of information?

Instructional Strategies
• Create codes to send messages to other students. • Investigate your own ID numbers and determine how they reveal information about you. • Research the use of codes during World War II and present your findings. • Collect a variety of UPCs and compare the codes to investigate product information. • Give students coded information to decode.

7.H.3

Honors Core Content

Cluster Title: Patterns
Standards: Recognize and appreciate patterns in nature, art, and mathematics.

Concepts and Skills to Master
- Understand the origin of the Fibonacci Sequence, compute consecutive terms in the sequence, and be able to identify the sequence in nature and art.   - Recognize where the Golden Ratio is found in nature and art.   - Create wallpaper patterns and tessellations using mathematical principles.   - Understand fractals as iterations of a process, recognize fractals in nature and art, and recreate basic fractals.   - Study the patterns found in Pascal's Triangle.   - Research the use of patterns in a variety of cultures.

Guiding Instructional questions
- What happens when you color the multiples of 3 (or other factors) on Pascal's Triangle?   - How do cultures use symbols to identify themselves and how do they use these patterns in art?   - How do manufacturers use patterns to create and market products?   - How would you use the Golden Ratio to market a product?   - How is the Golden Ratio used in photography?

Instructional Strategies
- Identify patterns in art and nature.   - Use the principles of a particular pattern to create a work of art.   - Explore patterns created by student-generated rules.

7.H.4