

Grade Level:	7
Standard	KY.7.EE.1 Apply properties of operations as strategies to add, subtract, factor and expand linear expressions with rational coefficients.
SMP	MP.2, MP.3

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Linear expressions, coefficient, factor, expand, rational number, distributive property, commutative property, associative property.

2. Key Implementation Questions and Answers:

What is a rational number?
 What is the Distributive Property? Commutative Property? Associative Property?
 What does it mean for an expression to be simplified?
 What does it mean to expand? Factor?

Clarifications from KYStandards.org
 Students demonstrate understanding of applying the order of operations to an expression involving multiple operations, including using the distributive property and variables in the expression. Students apply the properties of commutative, associative and distributive fluently.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

- I am learning to apply the distributive property to factor linear expressions involving rational numbers.
- I am learning to apply the distributive property to expand linear expressions involving those with rational numbers.
- I am learning to use the order of operations to simplify linear expressions with rational numbers.
- I am learning to apply the commutative and associative properties to simplify linear expressions with rational numbers.

Note: KY.6.EE.3 uses the properties, but 7th grade includes rational numbers.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

- I will know that I learned it when I can write equivalent expressions with rational numbers using the commutative, associative, and distributive properties.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

- I am learning this because I will need these skills for solving equations.
- I am learning this because real-world problems use rational numbers (my career).

Grade Level:	7
Standard	KY.7.EE.2 Understand that rewriting an expression in different forms in a problem context can clarify the problem and how the quantities in it are related.
SMP	MP.7, MP.8

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Equivalent expression, distributive property, commutative property, associative property, variable, constant

2. Key Implementation Questions and Answers:

Where do we see parts of our expression in the context of the problem?
How can we use properties to rewrite expressions to clarify relationships between values?

Clarifications from KYStandards.org

Students apply mathematical properties in order to rewrite expressions and clarify the relationship of quantities in a problem. For Example: If Tom and Jim both get paid a wage of \$11 per hour, but Tom was paid an additional \$55 for overtime, the expression $11(T + J) + 55$ may be more clearly interpreted as $11T + 55 + 11J$ for purposes of understanding Tom's pay separated from Jim's pay.

3. Develop "Learning Intention" statements. Describe the standard and/or element(s) as statements of intended learning. **"I am learning"**

I am learning to connect linear expressions to real-world contexts.
I am learning to apply properties to rewrite linear expressions to show relationships within a real-world or mathematical context.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

I will know that I learned it when I can represent an expression in several ways.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

- Writing an expression in a different way will help me to make sense of the problem and solve it more efficiently.

Grade Level:	7
Standard	KY.7.EE.3 Solve real-life and mathematical problems posed with positive and negative rational numbers in any form, 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.
SMP	MP.1, MP.4, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Associative Property
 Commutative Property
 Distributive Property
 Equivalent forms, fraction, decimal, percent, rational number, benchmark, compatible numbers

2. Key Implementation Questions and Answers:

What criteria help me to decide if I should solve the problem using fractions or decimals?
 How can I use estimation to check the reasonableness of my answer?

Clarifications from KYStandards.org

Students solve multi-step real-world and mathematical problems containing integers, fractions and decimals, using previously acquired skills around converting fractions, decimals and percentages and use properties of operations to find equivalent forms of expressions when needed. Students solidify understanding by checking their solutions for reasonableness using estimation strategies such as rounding, compatible numbers and benchmark numbers.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

- I am learning to solve real-life problems by simplifying numerical expressions written with different number forms.
- I am learning to solve mathematical problems by simplifying numerical expressions written with different number forms.
- I am learning to use a calculator to simplify numerical expressions written with different number forms.
- I can apply properties to facilitate mental computations (12($\frac{1}{2}$) can be computed by dividing 12 by 6 first, then multiplying by 5)

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

- I will know that I learned it when I can convert among forms to make sense of a problem. For example, If a woman making \$25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or \$2.50, for a new salary of \$27.50.
- I will know that I learned it when I can solve problems with
 - Integers,
 - negative and positive fractions,
 - Negative and positive decimals,
 - Percents,
 - And a combination of any of these forms.
- I will know that I learned it when I can check reasonableness of answers using
 - Mental computation
 - Estimation strategies such as
 - Rounding
 - Benchmark numbers
 - Compatible numbers

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

I am learning this because real-life problems involve “messy” numbers. (rational numbers)

I am learning this because estimation will help me determine whether my solution is correct.

Grade Level:	7
Standard	<p>KY.7.EE.4 Use variables to represent quantities in a real-world or mathematical problem and construct equations and inequalities to solve problems by reasoning about the quantities.</p> <p>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. Graph the solution set of the equality and interpret it in context of the problem.</p> <p>b. Solve word problems leading to inequalities of the form $px + q > r, px + q < r, px + q \geq r, px + q \leq r$; where p, q and r are specific rational numbers. Graph the solution set of the inequality and interpret it in context of the problem.</p>
SMP	MP.2, MP.4
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Solve, equations, inequalities, solution Initial value
set, variables, quantities, graph,
coefficient,

2. Key Implementation Questions and Answers:

Students apply the properties of rational numbers in order to solve equations and inequalities. Students reason a solution to a real-life situation but may struggle with modeling the problems with an equation or inequality involving a variable. For example, “I buy 6 pencils and a \$3 pen for a total of \$12. How much did each pencil cost?” Students with an understanding of numbers, but not the idea of a variable, may create an equation of $p = (12-3)/6 = 1.50$. Students who successfully model with mathematics understand the variable represents the cost of one pencil and use it appropriately, $6p + 3 = 12$, which more accurately represents the problem presented.

Clarifications from KYStandards.org

- Interpret word problems in the form of the initial value as a one-time occurrence within the problem and the coefficient as the recurring event within the problem.
- Interpret word problems having one or more solutions that satisfy the conditions of the problem. Graph on a number line the solution set that satisfies the conditions of the problems

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning to...

- Write an equation from a real-world or mathematical problem.
- Solve multi-step equations, $px+q=r$ and $p(x+q)=r$, including those with fractional, decimal, and negative coefficients.
- Plot the solution to an equation on a number line and understand its meaning within the context of the problem.
- Solve multi-step equations, including those with fractional, decimal, and negative coefficients.
- Graph the solution to an inequality on a number line and understand its meaning within the context of the problem.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

I will know that I learned it when I can:

- Use variables for unknown values in the real world.
- Construct equations and inequalities from a word problem.
- Find the solution to equations/inequalities.
- Check the solution to determine if the answer to the equation/inequality is true.
- Graph the solution to equations/inequalities on a number line.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

I am learning this because it will help me solve for missing information in the real world. This standard will help me make sense of real world relationships, prepare for the future, and help me make good financial decisions.

Grade Level:	7
Standard	KY.7.G.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.
SMP	MP.1, MP.2, MP.5
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Scale factor
Actual

Scale drawing
Scale

2. Key Implementation Questions and Answers:

- Understand the relationships between geometrical figures on paper compared with the dimensions of the real figure using the scale factor.
- If the scale factor between two geometric figures is 5, what is the scale factor of their areas? (25)

Clarifications from KYStandards.org

Emphasis is on being able to convert values from one given measurement to another based on a given scale factor. For example, 1 inch on the scale drawing equals how many feet in real life based on the scale factor given. Students reproduce a given drawing based on a scale factor

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning to...

- Use scale drawings to calculate unknown lengths and areas in geometric figures.
- Reproduce a scale drawing at a different scale.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

I will know that I learned it when I can:

- Recognize corresponding parts of scaled figures and find the scale factor between the two geometric figures.
- Convert values from one given measurement to another based on a given scale factor.
- Compare the area of two figures when given their scale factor.
- Reproduce a given drawing based on a scale factor.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

I am learning this because this will be used when constructing things in the real world. This will also help me understand the actual size of objects when I see a diagram of the object on paper or screen.
This concept will be extended in future grades when working with proportional relationships with similar triangles and figures.

Grade Level:	7
Standard	KY.7.G.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.
SMP	MP.6, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Unique triangle
Protractor

Geometric Construction

2. Key Implementation Questions and Answers:

Can I construct geometric figures with the given angles/side lengths? If so, how many different ones could I make?

Clarifications from KYStandards.org

Emphasis is on taking given conditions and converting them to geometric shapes, constructing triangles with given angle measures and side lengths and determining when the given conditions do not meet the conditions of a triangle.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning to...

- Take given conditions and converting them to geometric shapes,
- Constructing triangles with given angle measures and side lengths and determining when the given conditions do not meet the conditions of a triangle.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

I will know that I learned it when...

- I can draw geometric shapes with a variety of tools, including technology, rulers, protractors, and free-hand.
- I can construct triangles given three sides or angles.
- I can determine when given three measures of these conditions result in one, more than one, or no triangle.
- I can solve missing angles in a triangle because the sum of the three angles is 180 degrees.
- When given two sides of a triangle, I can determine if the third side is possible because the sum of two side lengths of a triangle is always greater than the third side.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

I am learning this because it is used in architecture, drafting, autocad, and construction. The knowledge of these properties are needed to be successful in these

career fields.

I am laying the foundation for the concepts of congruence and similarity in grade 8, and for the practice of geometric deduction that will grow in importance throughout the high school course work.

Grade Level:	7
Standard	KY.7.G.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.
SMP	MP.5, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Cross sections, horizontal, vertical, parallel, perpendicular, oblique, right rectangular prisms, right rectangular pyramids

2. Key Implementation Questions and Answers:

What two-dimensional figure will be shown as a result of slicing a three-dimensional rectangular prism/pyramid? Was the slice parallel or perpendicular to the base? What possible shapes could be made by slicing this three-dimensional figure?

Clarifications from KYStandards.org
Cross sections may be taken from horizontal, vertical and oblique angles.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to...

- Identify and Describe the two-dimensional figure that results from slicing three-dimensional figures.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

I will know that I learned it when...

- I can identify and describe a cross-section of a three-dimensional figure.
- I can label the dimensions of the resulting cross section.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

Cross sections are used in architecture and engineering quite often. By understanding cross sections and how to cut a certain object to create the desired shape, we are able to construct amazing buildings and other inventions. Another common example of cross sections are the cross sections created when sawing wood.

Grade Level:	7
Standard	<p>KY.7.G.4 Use formulas for area and circumference of circles and their relationships.</p> <p>a. Apply the formulas for the area and circumference of a circle to solve real-world and mathematical problems.</p> <p>b. Explore and understand the relationship between the radius, diameter, circumference and area of a circle.</p>

SMP	MP.1, MP.2, MP.8
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Area
Radius

Circumference
Diameter

2. Key Implementation Questions and Answers:

Can students apply the formulas for area and circumference, not merely memorizing them and substituting?

A student who merely memorizes the area and circumference formulas for a circle or the area, volume and surface area formulas of other shapes does not have a deep, conceptual understanding of the basis for these equations.

Exploring the relationships between radius, diameter, area and circumference limits the confusion inherent in rote memorization, because students are given a context to the concepts.

Clarifications from KYStandards.org

Circle Formulas: $C=d\pi$ $C = 2\pi r$ $A=\pi r^2$ Note: Calculating the radius or diameter of a circle given its area is not expected, as finding the square root of a number is reserved for 8th grade. a. Both area and circumference are represented; students recognize when circumference is needed and when area is needed. b. Emphasis is on calculating area given diameter; finding circumference given radius or diameter; and finding radius or diameter given circumference. Special attention given to the relationship between diameter and circumference as a ratio that leads to pi.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to:

- use mathematics to understand the relationship between circumference and diameter of a circle.
- recognize when area is needed and when circumference is needed when solving real-world problems.
- use mathematics vocabulary (radius, circumference, diameter, and pi) appropriately when solving problems.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

I will be successful when I can:

- Accurately and precisely measure the diameter of a circle.
- Build a table of values consistently using the diameter as the independent variable and the circumference as the dependent variable.
- Find a constant of proportionality between the diameter of a circle and the circumference.
- Interpret the constant of proportionality and explain the significance of this value.
- Identify the formula needed to solve a real-world problem.
- Substitute and solve for the unknown value in the formula to solve a real-world problem.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

The circumference and area of a circle can be used in real-life situations such as;

- How large a circular disk is.
- How much distance is covered by a car wheel per cycle.
- The space available on the top of a cylindrical can.

How large a circular disk is can be determined by evaluating its area.

Additionally, the circumference of the car wheel provides a measure of the distance it

is able to cover in one cycle.

The area of a closed cylindrical can only be evaluated when the area of the top and bottom circle is known.

Grade Level:	7
Standard	KY.7.G.5 Apply properties of supplementary, complementary, vertical and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
SMP	MP.3, MP.6, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
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1. Critical vocabulary and questions as it relates to the standard.

Supplementary angles
Complementary angles

Vertical angles
Adjacent angles

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org
Emphasis is on the relationships between the various angles listed to find missing

angles based on the relationships and to write and solve equations to find unknown angles.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to...

- Write equations related to finding unknown angles in a real-world setting.
- Justify the solutions to problems involving angle relationships using precise mathematical language.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

I will know that I learned it when...

- I can identify the relationship between a pair of angles as complementary, supplementary, vertical, adjacent, or no relationship.
- I can use the properties of these relationships to write an equation and solve for the unknown quantity.
- I can justify the solutions to problems involving angle relationships using precise mathematical language.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

I am learning this because angle relationships are used in many careers and in real life situations of everyday life. Construction and architecture are two fields where these concepts will be used constantly. It is important to learn this concept even if you do not choose a career in one of these fields because it will be used when fixing things around the home, constructing things, etc.

Grade Level: 7

Standard	<p>KY.7.G.6 Solve problems involving area of two-dimensional objects and surface area and volume of three-dimensional objects.</p> <p>a. Solve real-world and mathematical problems involving area of two-dimensional objects composed of triangles, quadrilaterals and other polygons.</p> <p>b. Solve real-world and mathematical problems involving volume and surface area, using nets as needed, of three-dimensional objects including cubes, pyramids and right prisms.</p>
SMP	MP.3, MP.4, MP.5
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Area	3-dimensional objects
2-dimensional objects	Triangle
Surface area	Quadrilateral
Volume	Polygon
Net	Pyramid
Cube	Right Prism

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org
 Students calculate with appropriate units, using nets as a possible strategy for calculation as well as formulas for volume and surface area, where appropriate.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to...

- Find the area of composite shapes composed of triangles, quadrilaterals, and other polygons.
- Find the surface area of three-dimensional objects including cubes, pyramids and right prisms.
- Recognize the net for a three-dimensional figure and use it to help me find the surface area of three-dimensional objects.
- Find the volume of three-dimensional objects including cubes, pyramids and right prisms.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

I will know that I learned it when

- I can find the area of composite shapes by decomposing them into rectangles, triangles, parallelograms, and trapezoids.
- I can use the net to find the surface area of a cube, pyramid, and right prism.
- I can use the appropriate units (e.g., cm, cm², cm³) when finding the area or volume of solids.
- I can find the volume of a prism by multiplying the area of the base and the height. ($V=Bh$)
- I can find the volume of a pyramid by multiplying $\frac{1}{3}$, area of base, and height. ($V=\frac{1}{3}Bh$)
- When working on a real-world or mathematical problem, I know which type of calculation is appropriate (area, surface area, volume).

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

I am learning this because this is a skill that will likely be used by any home owner at some point in time. These concepts can be applied to remodeling a home such as replacing the flooring, painting walls, installing a/c unit (need to know volume of air), etc. This unit can be taught and practiced through looking at many of these real life examples.

Grade Level:	7
Standard	<p>KY.7.NS.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.</p> <ol style="list-style-type: none"> Describe situations in which opposite quantities combine to make 0. 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. 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. Apply properties of operations as strategies to add and subtract rational numbers.
SMP	MP.2, MP.4, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Rational numbers
Horizontal

Absolute value
Additive inverse

Vertical
Opposite

Distance

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org

a. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged. b. The sum of numbers is a directional movement from one number to another for a specified amount of spaces on the number line. The sum of opposites is 0 due to the fact that opposites have equivalent absolute values. c. Subtracting a positive number is the same as adding the positive number's opposite.

3. Develop "Learning Intention" statements. Describe the standard and/or element(s) as statements of intended learning. "I am learning"

- Generate a number line diagram that represents a given addition or subtraction problem of rational numbers.
- Add and subtract rational numbers.
- Create a real-world context to represent a given sum or difference of rational numbers.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. "I will know that I learned it when"

Strong Work

- I am learning to add and subtract rational numbers.
- I am learning to represent addition and subtraction on a horizontal or vertical number line
- I am learning what it means to combine opposites in real-world contexts to make 0. (credits/debits, gains/losses)
- I am learning to model addition on a number line.
- I am learning that subtracting is equivalent to adding the opposite
- I am learning that the distance between two numbers on a number line is the absolute value of their difference
- I am learning to fluently add and subtract rational numbers using properties of operations (commutative, associative, distributive)

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) "I am

learning this because”

Positive and negative numbers show up all of the time in life. We need to understand how to compute these numbers in order to make sense of the world.

Grade Level:	7
Standard	<p>KY.7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.</p> <ul style="list-style-type: none">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.
SMP	MP.2, MP.7, MP.8
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Rational numbers
Quotient
Divisor

Integers
Product
Distributive Property

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org

- a. Emphasis is on exploring and understanding how the rules for multiplying and dividing with negative numbers are connected to properties for the operations, rather than to think of them as arbitrary rules. They explain 4 times (-3) could be four days of golfing 3 under par and therefore, having an overall score of -12. The remaining operations are based on applying properties.
- b. Emphasis is on the equivalence relationship provided by the movement of one negative sign among the numerator, denominator, or in front of the entire fraction.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning to:

- Multiply and divide a wide variety of rational numbers.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

I will know that I learned it when I can...

- Find products of integers.
- Find quotients of integers.
- Convert between different forms of rational numbers.
- Find products of rational numbers.
- Find quotients of rational numbers.
- Interpret products and quotients of rational numbers by describing real world contexts.
- Apply properties of operations as strategies to multiply and divide rational numbers.
- Create a real-world context to represent a given product or quotient of rational

- numbers.
- Convert a rational number to a decimal using long division; know that the decimal form of rational

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

Positive and negative numbers show up all of the time in life. We need to understand how to compute these numbers in order to make sense of the world.

Grade Level:	7
Standard	KY.7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
SMP	MP.2, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Ratio Unit rate

2. Key Implementation Questions and Answers:

1. Why would you use a ratio? 2. What kinds of real-world relationships are rates? 3. How can you distinguish relationships that are proportional from relationships that are not proportional? 4. When is it most convenient to use percents? 5. How can you differentiate between a rate and unit rate? 6. How are scale drawing and models used in real life situations? 7. Why would I need to convert a decimal to a percent or a percent to a decimal? 8. Why would a business need to use percent increase and decrease? 9. Why does a retail shop use discounts and markups? 10. How can simple interest help you make money?

Clarifications from KYStandards.org

For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to:

- Write ratios to model situations involving fractional quantities measured in like or different units and use the ratio to determine a unit rate.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

- Write ratios to model situations involving fractional quantities measured in like or different units and use the ratio to determine a unit rate.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

It is important to understand what unit rates and ratios actually mean in real life situations. 60 miles per hour actually means 60 miles in one hour. Per = one. Ratios are a comparison of two different units.

Grade Level: 7

Standard	<p>KY.7.RP.2 Recognize and represent proportional relationships between quantities.</p> <p>a. Decide whether two quantities represent a proportional relationship 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. 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.</p>
SMP	MP.1, MP.2, MP.3
Also See	

Standard for Mathematical Practice (select and highlight)
<ol style="list-style-type: none"> 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 the structure 8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.	
Constant of Proportionality	Verbal descriptions
Proportional Relationships	Equation
Unit rate	Graph
Origin	Table
Verbal description	

2. Key Implementation Questions and Answers:
<p>Clarifications from KYStandards.org</p> <p>a. Students test for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.</p>

- b. Students understand finding the unit rate in a table or graph is equivalent to the constant of proportionality in an equation or verbal description.
- c. 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 $t = pnp$.
- d. Students describe points (x, y) in terms of the labels of the x and y -axes; students understand in a proportional relationship $(0, 0)$ is a valid point and $(1, r)$ represents the unit rate and the constant of proportionality for the relationship between the quantities.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning...

- To recognize a proportional relationship when given a table, graph, equation, or scenario.
- Represent a proportional relationship with a table, graph, and equation.
- To understand the importance of the constant of proportionality in a proportional relationship.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

- Identify the constant of proportionality (unit rate) from a wide variety of representations of a proportional relationship.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

It is imperative for students to understand that the constant of proportionality in any representation is one unit to a specified quantity or vice versa. This helps us make good financial decisions in life. This also helps us to understand the relationship between two quantities/variables in life.

Grade Level: 7

Standard	KY.7.RP.3 Use percents to solve mathematical and real-world problems. a. Find a percent of a quantity as a rate per 100; solve problems involving finding the whole, a part and a percent, given two of these. b. Use proportional relationships to solve multistep ratio and percent problems.
SMP	MP.5, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)
<ol style="list-style-type: none"> 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 the structure 8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.	
Percents Rate per 100 Whole	Proportional relationships Multistep ratio Part

2. Key Implementation Questions and Answers:
<p>Clarifications from KYStandards.org</p> <ol style="list-style-type: none"> a. For example, 30% of a quantity means 30/100 times the quantity. b. Could include but not limited to simple interest, tax, markups and markdowns, gratuities and commissions, percent increase and decrease, percent error

3. Develop “Learning Intention” statements. Describe the standard and/or

element(s) as statements of intended learning. ***“I am learning”***

I am learning to:

- Solve multi-step ratio and percent problems.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. *“I will know that I learned it when”*

Strong Work

Solve problems involving:

- simple interest
- tax
- markups and markdowns
- gratuities and commissions
- percent increase and decrease
- percent error

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) ***“I am learning this because”***

This 7th grade math concept is probably one that will be used in the real world more often than any other. These concepts are used everyday as a consumer. This concept is critical to many job sectors as well.

Grade Level:	7
Standard	KY.7.SP.0 Create displays, including circle graphs (pie charts), scaled pictographs and bar graphs, to compare and analyze distributions of categorical data from both matching and different-sized samples.
SMP	MP.2, MP.3, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Circle graphs
Scaled pictographs
Bar graphs

Distributions
Categorical data
Samples

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org

Students have been introduced to pictographs and bar graphs in grades 2 and 3; Circle graphs are new and connect to the grade 7 focus on percents. Also, students' knowledge of rates mean they can approach scaled pictographs in a more sophisticated manner. An important aspect of doing statistics is selecting an appropriate data display for the question under investigation. Students need to be asked, "Which data display fits this data set and why?" The circle graph focuses more on the relative values of the clustering of data, whereas the bar and pictographs add a dimension of quantity. The choice of which data display (and how categories are set up within each display) will result in different pictures of the shape of data. Finally students are comparing two distributions. When comparing two different distributions, circle graphs lend to comparing different sized samples, because circle graphs are based on percentages.

3. Develop "Learning Intention" statements. Describe the standard and/or element(s) as statements of intended learning. "I am learning"

I am learning..

- To choose and create appropriate data displays to compare data sets.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s).

Identify common misconceptions. ***“I will know that I learned it when”***

Strong Work

- Create a circle graph, bar graph, or pictograph from a given set of data.
- Determine which graph best displays the data in the most appropriate way.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) ***“I am learning this because”***

This concept helps us to make sense of data that is presented to us in the real world. It is important to understand that percentages do not show us the quantity of the data.

Grade Level:	7
Standard	KY.7.SP.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.
SMP	MP.3, MP.6
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Understand
Statistics
Examine
Generalizations
Valid

Random sampling
Valid inferences

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org
Recognize what makes a valid and non-valid sample of a population. Recognize the size of the sample holds importance to the accuracy of the sample.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning..

- That a sample can be used to make a generalization about the population.
- How to determine when the sample is representative of the population.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

- Determine if a sample is representative of a population.
- Determine if a sample is biased.
- Identify factors that would contribute to bias.
- Generate random samples that are representative of a larger population.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

There is a lot of information that will be given to you in your life and you should judge the validity of that information based on how representative/biased the information is. Statistics can be used to spread information that could be accurate to the truth, or not, based on how representative the sample is.

Grade Level:	7
Standard	<p>KY.7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest.</p> <p>a. Generate multiple samples of categorical data of the same size to gauge the variation in estimates or predictions.</p> <p>b. Generate multiple samples (or simulated samples) of numerical data to gauge the variation in estimates or predictions.</p> <p>c. Gauge how far off an estimate or prediction might be related to a population character of interest.</p>
SMP	MP.2, MP.3, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Data	Simulated samples
Inference	Numerical data
Random sample	Variation
Categorical data	Population

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org
Emphasis is on the sample size and how this affects the validity of the estimate or

prediction. Examples: a. Randomly sample 6th, 7th and 8th graders about who their favorite superhero is to generate samples of data that are roughly the same size, looking specifically at patterns, if any. b. 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.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning...

- To generate samples and use them to make a prediction about the population.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

- Recognize that increasing sample size affects sampling variability.
- Make inferences and generalizations about a population using data from random samples.
- Justify inferences and generalizations using appropriate mathematical vocabulary.
- Recognize how sample variations affect the accuracy of predictions.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

This is very important to understand in order to make good decisions in life. If you can make accurate inferences about a population as a whole, then you should make accurate predictions about them. This concept is used in many different sectors of society.

Grade Level: 7

Standard	KY.7.SP.3 Describe the degree of visual overlap (and separation) from the graphical representations of two numerical data distributions (box plots, dot plots) with similar variabilities with similar contexts (same variable), measuring the difference between the centers (medians or means) by expressing this difference as a multiple of a measure of variability (interquartile range when comparing medians or the mean absolute deviation when comparing means).
SMP	MP.1, MP.5, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)
<ol style="list-style-type: none"> 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 the structure 8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.										
<table> <tr> <td>Visual overlap</td> <td>Interquartile Range</td> </tr> <tr> <td>Box plot</td> <td>Mean Absolute Deviation</td> </tr> <tr> <td>Dot plot</td> <td>Measures of Center</td> </tr> <tr> <td>Variabilities</td> <td>Mean</td> </tr> <tr> <td>Median</td> <td></td> </tr> </table>	Visual overlap	Interquartile Range	Box plot	Mean Absolute Deviation	Dot plot	Measures of Center	Variabilities	Mean	Median	
Visual overlap	Interquartile Range									
Box plot	Mean Absolute Deviation									
Dot plot	Measures of Center									
Variabilities	Mean									
Median										

2. Key Implementation Questions and Answers:
<p>Clarifications from KYStandards.org 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.</p>

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning to

- Consider two numerical distributions with similar interquartile ranges, to compare the differences between the medians as a multiple of the interquartile range.
- Consider two numerical distributions with similar mean absolute deviations, to compare the differences between the means as a multiple of the standard deviation.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

- Compare the graphs of two data sets with similar variability to determine the degree of overlap.
- Recognize that an increase in variability can increase the overlap in data.
- Model and compare two real-world data sets by measuring the difference between their centers and expressing it as a multiple of a measure of variability.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

Knowing how to organize data in picture form helps us to understand the data easier and faster. Box plots help show us the middle of the numbers, the range, and the spread of the numbers all at a glance. Dot plots help show us the shape of the distribution.

Grade Level: 7

Standard

KY.7.SP.4 Calculate and use measures of center (mean and median) and measures of variability (interquartile range when comparing medians and mean absolute deviation when comparing means) for numerical data from random samples to draw informal comparative inferences about two populations.

SMP	MP.2, MP.5, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Calculate	Numerical data
Use measures	Random samples
Center	Draw
Variability	Comparative inferences
Interquartile Range	Populations

2. Key Implementation Questions and Answers:

Clarifications from KYStandards.org
 For example, decide whether the words in a chapter of a grade seven science book are generally longer than the words in a chapter of a grade four science book.

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to

Calculate and use measures of center and measures of variability to compare two data sets.

4. Establish success criteria by identifying strong and weak work. *Identify the*

characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. "I will know that I learned it when"

Strong Work

- Determine the appropriate measure of center or variability for comparing two data sets.
- Draw valid comparative inferences about two populations using measures of center.
- Draw valid comparative inferences about two populations using measures of variability.
- Identify valid inferences related to the comparison of two data sets.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *"I am learning this because"*

This helps to make sense of real world data. A load of data doesn't make a lot of sense until you start making inferences about the data as a whole.

Grade Level:	7
Standard	KY.7.SP.5 Describe the probability of a chance event is a number between 0 and 1, which tells how likely the event is, from impossible (0) to certain (1). 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.
SMP	MP.5, MP.6, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
- 8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Describe	Indicates
Probability	Likely
Chance event	Indicates
Impossible to certain	

2. Key Implementation Questions and Answers:

Emphasis is on descriptive language used to describe numerical probabilities; impossible event, unlikely event, equally likely event, likely event, certain event. Students understand all probabilities must fall between 0 and 1.

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

- I am learning
- To interpret a probability as being the likelihood of an event occurring.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

- Recognize that the probability of a chance event can be represented as a rational number from 0 to 1.
- Recognize relative frequency as the observed number of successful events for a finite sample of trials.
- Determine whether an event is likely, unlikely, neither likely or unlikely, certain, or impossible.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

It will help me make real life decisions based on the likelihood of something happening. As an adult, this helps you become a good planner for things to come.

Grade Level:	7
Standard	KY.7.SP.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.
SMP	MP.1, MP.2
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Approximate	Predict
Data	Long-run relative frequency
Probability	Collect
Chance event	

2. Key Implementation Questions and Answers:

Example: I can use a sample of m&ms to find the probability of a red, then use it to make a prediction about the percentage of red in the entire bag of m&ms.

Clarifications from KYStandards.org

Estimate the likelihood of an event, test the estimate by trial and collect data. Students observe accuracy of the estimate will increase with the frequency of repeated trials

3. Develop “Learning Intention” statements. *Describe the standard and/or element(s) as statements of intended learning. “I am learning”*

I am learning to...

- Use collected data to approximate the probability and use it to help me make predictions.

4. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”*

Strong Work

- Collect data on chance events by conducting experiments and approximate the relative frequency of an event given the probability.
- Differentiate between relative frequency and theoretical probability.
- Determine theoretical probability and relative frequency in real-world situations.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) *“I am learning this because”*

I will know that the more times I try an experiment in real life, the closer the outcome will match what should happen in theory. This will help me understand current and future outcomes.

Grade Level: 7

Standard

KY.7.SP.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. b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
SMP	MP.4, MP.7, MP.8
Also See	

Standard for Mathematical Practice (select and highlight)
<ol style="list-style-type: none"> 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 the structure 8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.	
Probability (theoretical or experimental)	Non-uniform Probability Model (not equally-likely)
Uniform Probability Model (equally-likely)	Outcome
Observed Frequency (experimental)	Chance process
Discrepancy	Event

2. Key Implementation Questions and Answers:
<p>In addition to recognizing discrepancies between probability models and observed frequencies, students at this level should be able to explain any discrepancies orally and in writing using precise mathematical vocabulary. Students should have multiple opportunities to perform experiments, comparing the relative frequency to the known theoretical probabilities. In comparing the two, students should engage in discourse around the significance of the discrepancy. Students should be able to explain that small differences in the relative frequency and theoretical probability does not indicate an error. For example, when conducting 20 trials a relative frequency of $\frac{9}{20}$ is close to $\frac{1}{2}$ and does not indicate an error. In the event there is a true discrepancy, students should be expected to provide reasons for the discrepancy. One possible reason could be that there were not enough trials conducted in the experiment. A student at</p>

this level should be able to explain why more trials are needed and conduct those trials to show how the discrepancy could be resolved.

Examples:

- a. If a student is selected at random from a class, find the probability Jane will be selected and the probability a girl will be selected.
- b. Find the approximate probability a spinning penny will land heads up or 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?

Note: Although this standard is addressing theoretical and experimental probability, these words are not mentioned in the standard. Be intentional on using vocabulary from the standard.

Clarifications from KYStandards.org

For example: a. If a student is selected at random from a class, find the probability Jane will be selected and the probability a girl will be selected. b. Find the approximate probability a spinning penny will land heads up or 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?

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. **“I am learning”**

I am learning..

- To differentiate between probabilities from a model and observed probabilities and explain any discrepancies between the two.
- To develop a uniform and non-uniform probability model.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. **“I will know that I learned it when”**

Strong Work

- Develop appropriate probability models to find probabilities of events with equally likely outcomes.
- Develop appropriate probability models to find probabilities of events with outcomes that are not equally likely.
- Compare probability models to observed frequencies and explain any discrepancies between the model and observed frequencies.
- Recognize when discrepancies between theoretical probability and relative

frequency indicate an error.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) “I am learning this because”

- It helps me to understand the world I live in.
- It helps to make predictions about future outcomes.
- I will understand the likelihood of real life events and be able to make decisions based upon the data.

Grade Level:	7
Standard	<p>KY.7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams and simulation.</p> <p>a. Explain 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.</p> <p>b. Represent sample spaces for compound events described in everyday language using methods such as organized lists, tables and tree diagrams.</p> <p>c. Design and use a simulation to generate frequencies for compound events.</p>
SMP	MP.2, MP.4, MP.7
Also See	

Standard for Mathematical Practice (select and highlight)

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 the structure
8. Look for and express regularity in repeated reasoning

1. Critical vocabulary and questions as it relates to the standard.

Probabilities
Compound events
Organized lists
Simulation
Frequency

Sample space
Tree diagram
Simple events
Table

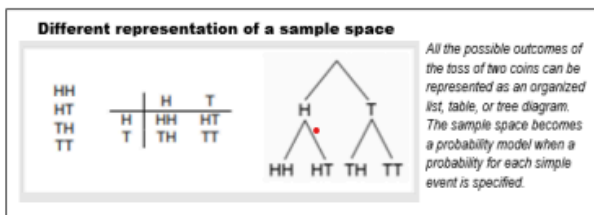
2. Key Implementation Questions and Answers:

Compound probability is the focus of this standard and it may be more difficult for students to understand; tree diagrams, lists, etc. may help students understand the concept. Difficult to understand compound events may necessitate a simulation tool, for example a random digit generator, coin flip simulator, and/or and spinner simulator.

Clarifications from KYStandards.org

Example: a. If the probability of heads occurring on a coin is $\frac{1}{2}$, then the probability of three heads in a row is $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$.

b. For a simulation of tossing two fair coins:



c. 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 it will take at least 4 donors to find one with type A blood?

3. Develop “Learning Intention” statements. Describe the standard and/or element(s) as statements of intended learning. “I am learning”

I am learning...

- to find probabilities of compound events.

4. Establish success criteria by identifying strong and weak work. Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions. “I will know that I learned it when”

Strong Work

I will be successful when I can...

- write the probability of a compound event
- determine the sample space of a compound event using tables, organized lists, or tree diagrams.
- generate frequencies of compound events using simulations.

5. Ideas for Relevance (Authentic Work with a Connection to Real-World) ***"I am learning this because"***

- It helps me to understand the world I live in.
- It helps to make predictions about future outcomes.
- I will understand the likelihood of real life events and be able to make decisions based upon the data.