Utah Core Essential Elements and Range of Complexity Examples for Mathematics

High School

Excerpted from the full document located at:

http://schools.utah.gov/sars/Significant-Cognitive-Disabilities.aspx

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DYNAMIC LEARNING MAPS

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High School Mathematics Standards: Number and Quantity - The Real Number System

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Extend the properties of exponents to rational exponents. **N-RN.1.** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*	**EEN-RN.1.** Solve division problems with remainders using concrete objects.	**Students will:** **EEN-RN.1.** Illustrate concept of remainders using objects and numerical representations. Ex. Divide 15 objects into two groups of six and one group of three. Show representation and objects in numerical representation (e.g., 15/6 = 2 r 3). Ex. A group of six students sits down to have a snack. You have 25 cookies. How many cookies does each student get? Are there any leftover? (e.g., Write number sentence 25/6 = 4 r 1). Ex. If a pack of gum costs $0.49 and there are five sticks per pack, how much does each stick cost? Use real objects (gum and coins) to show division (e.g., 49/5 = 9 r 4). **Students will:** **EEN-RN.1.** Solve division problems with remainders using concrete objects. Ex. Divide 13 into equal groups (two groups of six with a remainder of one, three groups of four with a remainder of one, one group of 13, four groups of three with a remainder of one, six groups of two with a remainder of one, 13 groups of one). Ex. A group of six students sits down to have a snack. You have 15 cookies. How many cookies does each student get? Are there any leftover? Ex. A student has five quarters and wants to buy a soda that costs $1.00. How much money is left over? Ex. A class of seven students earns $20 doing a service project. How much does each student receive? (Solve using money, calculator, etc.) **Students will:** **EEN-RN.1.** Identify the difference between equal and not equal groups. Ex. Using drawings or groups of cubes, determine if the groups are equal

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		or not equal. Ex. When passing out 10 pencils to nine people, do you have one for each person? Are there some left over? Ex. Do 10 pennies = $0.10? Ex. Are two nickels equal to $0.11? Ex. Given two clocks, one shows 20 minutes after the hour and another shows 30 minutes after the hour. Which clock shows the later time? **Students will:** **EEN-RN.1.** Recognize that a whole can be divided into parts. Ex. Use models to represent quantities as parts of a whole. Ex. Given two sets of objects with one set divided into smaller groups, point to the quantities that have been divided when prompted.
N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	**EEN-RN.2.** N/A	
Use properties of rational and irrational numbers. **N-RN.3**. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	**EEN-RN.3**. N/A	

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High School Mathematics Standards: Number and Quantity–Quantities

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Reason quantitatively and use units to solve problems. **N-Q.1.** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **N-Q.2.** Define appropriate quantities for the purpose of descriptive modeling. **N-Q.3.** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**EEN-Q.1-3.** Express quantities to the appropriate precision of measurement.	**Students will:** **EEN-Q.1-3.** Express solutions to problems using the appropriate precision of measurements. Ex. Determine elapsed time (watch a TV show that starts at 8 p.m. and ends at 8:30 p.m.). Ex. Using a measuring tape, determine if a large item purchased in a store will fit in the car to take it home. Ex. If it takes 30 minutes to get home, will I be home by 6:00 p.m. if I leave at 5:45 p.m.? **Students will:** **EEN-Q.1-3.** Express quantities to the appropriate precision of measurement. Ex. Measure the length of an object to the nearest half and quarter of an inch. Ex. Measure time in hours (e.g., determine elapsed time when watching a TV show that starts at 8:00 p.m. and ends at 9:00 p.m.). Ex. Measure ingredients for a recipe accurately. **Students will:** **EEN-Q.1-3.** Select the appropriate type of unit as a measurement tool. Ex. What label would you use to describe the length of a football field (inches, yards, or miles)? Ex. When you want to know how much ground meat you have, what kind of measuring do you need to do? (Weight, length, and temperature.) Ex. What unit of measure would you use to measure the length of the room? (Length, weight, volume.) Ex. What unit of measurement would you use to measure produce at the grocery store? (Weight, volume, length.) Ex. Which is best to describe your weight – pounds or inches? Ex. Record the daily temperature for a week using degrees. Ex. Match a thermometer to two non-standard units of measurement.

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		Students will: **EEN-Q.1-3.** Identify measurement tools. Identify the attribute to be measured (weight, length, and temperature). Ex. Of these items, which is a measurement tool? (pencil, ruler, can) Ex. If I wanted to measure the desk, would I use a ruler or a pen? Ex. Match units of measurement to measurement tools (days and hours measure time, inches and feet measure length).

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High School Mathematics Standards: Number and Quantity–The Complex Number System

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Perform arithmetic operations with complex numbers. **N-CN.1**. Know there is a complex number *i* such that $i^2 = –1$, and every complex number has the form *a + bi* with *a* and *b* real.	**EEN-CN.1.** N/A	
N-CN.2. Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	**EEN-CN.2.** Use the operations of addition, subtraction, and multiplication with decimals (decimal value x whole number) in real world situations using money as the standard units ($20, $10, $5, $1, $0.25, $0.10, $0.05, and $0.01).	**Students will:** **EEN-CN.2.** Apply the operations of addition, subtraction, and multiplication in real world situations using money as the standard units ($50, $20, $10, $5, $1, $0.25, $0.10, $0.05, and $0.01). Ex. Using a checkbook register: $55.55 – 10.10 = _____. Ex. Using a checkbook register: $20 x 0.05 = _____. Ex. If you have $20, how much change will you receive if you spend $11.75? Ex. Calculate the cost of six movie tickets that are $7.50 each. Ex. If I have $4.20 cents and I buy an item for $3.50, how much change will I get? Ex. Jean earns $7.50 an hour. She worked six hours. How much did she earn? **Students will:** **EEN-CN.2.** Use the operations of addition, subtraction, and multiplication with decimals (decimal value x whole number) in real-world situations using money as the standard units ($20, $10, $5, $1, $0.25, $0.10, $0.05, and $0.01). Ex. Using a checkbook register: Add $6.50 + $3 (e.g., If you have $6.50 in your bank account and you receive a gift for $3.00, how much money do you have in your bank account?)

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Ex. Calculate the cost of two movie tickets that are $6.50 each. Ex. Find the cost of two pizzas if each pizza is $5.50. **Students will:** **EEN-CN.2.** Use the operations of addition, subtraction, and multiplication up to the tenths place with decimals. Ex. If I have a nickel and two dimes, how much money do I have? Ex. If I have $3.50 and I spend $2.50, how much money do I have? **Students will:** **EEN-CN.2.** Use the operations of addition, subtraction, multiplication, and multiplication with whole numbers less than 20. Ex. If Sam got three cats and they each cost $2, how much did he pay for all three cats (3 x 2 = 6). Ex. 4 + 36 = __. Ex. 67 – 33 = __. Ex. 20 x 3 = __. Ex. Mary got $2 from her uncle and $5 from her sister for her birthday, how much money did she receive?
Use complex numbers in polynomial identities and equations. **N-CN.7.** Solve quadratic equations with real coefficients that have complex solutions.	**EEN-CN.7.** N/A	

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High School Mathematics Standards: Algebra–Seeing Structure in Expressions

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Interpret the structure of expressions. **A-SSE.1.** Interpret expressions that represent a quantity in terms of its context. ▪ Interpret parts of an expression, such as terms, factors, and coefficients. ▪ Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*	**EEA-SSE.1.** Match an algebraic expression involving one operation to represent a given word expression with an illustration.	**Students will:** **EEA-SSE.1.** Write or match an algebraic expression for a given word expression involving more than one operation. Ex. Write an expression to represent the problem, six weeks minus two weeks plus four weeks, to find the total number of weeks you are working? Ex. How would you represent five dogs plus two cats plus one mouse to find the total number of animals in a pet store? Ex. Shown pictures representing two expressions, select the one for two drinks, plus three slices of pizza, plus two salads if *d* represents drinks, *s* represents salad, and *p* represents pizza? Ex. Match two dimes, three nickels, and four pennies to an expression when d represents dimes, n represents nickels, and p represents pennies. Ex. Match 2r + 3b + 4y with two red disks, three blue disks, and four yellow when given colored disks. **Students will:** **EEA-SSE.1.** Match an algebraic expression involving one operation to represent a given word expression with an illustration. Ex. Match the correct algebraic expression to a picture of three boys and two girls if *b* represents boys and *g* represents girls (3b + 4g) when asked, "Which is the correct way to express three boys and two girls if *b* represents the number of boys and *g* represents the number of girls in the classroom?" Ex. Shown a picture of three hamburgers at $4 each, match an expression to the picture given two expressions when asked, "Which is the correct way to express the cost of three hamburgers if each hamburger is $4.00?" (three hamburgers x $4) Ex. Shown two drinks plus three slices of pizza, match an expression to the picture given two expressions when asked, "Which one shows two drinks plus three slices of pizza if *d* represents drinks and *p* represents pizza?" Ex. Match two dimes and three nickels to an expression where *d*

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		represents dimes and *n* represents nickels. Ex. Match the expression of 2*r* + 3*b* with two red disks and three blue disks when given an assortment of colored disks. **Students will:** **EEA-SSE.1.** Identify the operation used for word expressions as indicated by an illustration. Ex. Nancy has 10 balloons. She gives three away to her friend. What operation (addition or subtraction) do you use to find how many are left as indicated by an illustration or manipulatives. Ex. Dave has 10 cookies. His friend gives him two more cookies. What operation (addition or subtraction) should Dave use to determine how many cookies he has in all as indicated by an illustration or manipulatives? Ex. Jose has three times as many baseball cards as his brother. What operation (addition or multiplication) do you use to find how many baseball cards Jose has as indicated by an illustration? Ex. One box has six books in it and another box only has two. How many books are there together? Ex. Match words (and, more, take away, times) to (addition, subtraction, multiplication). Ex. Given a word problem (June has four marbles and Cho has two marbles. How many marbles do they have all together?) Student will identify if they should add or subtract to find the answer as indicated by an illustration. Ex. When given a pictorial number sentence, complete an algebraic representation of the pictures by placing/drawing in the correct sign for the operation. **Students will:** **EEA-SSE.1.** Recognize the symbol for an operation. Ex. What does this mean? (+ means add) Ex. What does this mean? (– means subtract or take away)

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A-SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*	**EEA-SSE.2.** N/A	
Write expressions in equivalent forms to solve problems. **A-SSE.3.** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the*	**EEA-SSE.3.** Solve simple one-step equations (multiplication and division) with a variable.	**Students will:** **EEA-SSE.3.** Solve one-step equations (multiplication and division of two digits) with a variable. Ex. Solve the equation x ÷ 6 = 2. (If I buy two cakes and they were $6 each, how much money did I spend?) Ex. Solve the equation $8.00 x ___ = 24. (If a ticket to the movies costs $8, how many tickets did I buy if I spent 24 dollars?) Ex. Solve the equation 5 x __ = 45. (If I have five rows of desks and 45 desks total, how many desks are in each row?) **Students will:** **EEA-SSE.3.** Solve simple one-step equations (multiplication and division) with a variable. Ex. ___ seats ÷ 8 people = 2 cars Ex. 2 x *n* = 6 (box) Ex. 2 apples x ___ people = 16 apples **Students will:** **EEA-SSE.3.** Solve basic equations. Ex. 4 + 3 = ___ (If I have four cups and I get three more, I will have *n* cups). Ex. Adds on objects to "make one number into another." If I have five and I add two, I get seven. Ex. Use a number line to show how seven is made of many different combinations: 5 + 2, 6 + 1, etc. Ex. Solve picture problems: 2 balloons (picture) + 2 balloons.

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<table>
<tr><th>CCSS Grade-Level Clusters</th><th>Common Core Essential Elements</th><th>Range of Complexity Examples</th></tr>
<tr><td>expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</td><td></td><td>Ex. If you have $10 and spend $4, what will your change be?
Ex. Given pictures of monetary value, determine how much money they have altogether?
Ex. Given money, count how much they have.

Students will:
EEA-SSE.3. Identify quantity and match to the number.
Ex. Match number of objects to correct numerals.
Ex. Count objects (e.g., up to 10) and match the numerals.
Ex. Match five $1 to the number 5.
Ex. Count three tallies and match to the number 3.</td></tr>
<tr><td>A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.</td><td>EEA-SSE.4 Identify the missing part in any other equivalent ratio when given any ratio.</td><td>Students will:
EEA-SSE.4. Find the missing components when given various ratios that form proportions.
Ex. Complete ratios such as 2:5 is equivalent to <u>(4)</u>:10.

Ex. Complete the ratio table.<table><tr><td>3</td><td>3</td></tr><tr><td>?</td><td>4</td></tr><tr><td>9</td><td>6</td></tr></table>
Students will:
EEA-SSE.4. Identify the missing part in any other equivalent ratio when given any ratio.
Ex. If there are two worms for every bird, how many worms would three birds get?</td></tr>
</table>

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples

Worms	Birds
2	1
4	2
?	3
8	4

Ex. Complete a ratio table.

2	5
4	10
6	?

Ex. Complete the ratio table with symbols or objects.

|	|||
||	||| |||
|||	?

Students will:

EEA-SSE.4. Identify the missing part in the next ratio using concrete objects when given a ratio (1:_).

Ex. Find the pattern that exists between two-colored chips with the pattern of AABAABAABAAB.

Ex. A student has one red dot and two blue dots. If another red dot is given

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		to the student, the student will identify how many blue dots should be added to maintain the ratio of 1:2. Ex. Bead a necklace with a given ratio (three red beads, four yellow beads, three red beads, etc.). **Students will:** **EEA-SSE.4.** Identify or demonstrate a ratio relationship (see the recommendation for 6.RP.1 Level II). Ex. Set out 10 envelopes; match three pieces of correspondence to each envelope to complete task.

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High School Mathematics Standards: Algebra–Arithmetic with Polynomials and Rational Expressions

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Perform arithmetic operations on polynomials. **A-APR.1.** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	**EEA-APR.1** N/A	

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High School Mathematics Standards: Algebra--Creating Equations

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Create equations that describe numbers or relationships. **A-CED.1.** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	**EEA-CED.1.** Solve an algebraic expression using subtraction.	**Students will:** **EEA-CED.1.** Solve an algebraic expression with more than one variable. Ex. If I have two bills, one of them is a $5 and one of them is unknown. What is the value of the unknown bill if I have $10 total? Ex. If I have some money in my pocket and some money in the other pocket and I still need $3 more to buy the bird that cost $10, how much money is in my pockets? **Students will:** **EEA-SSE.3.** Solve an algebraic expression using subtraction. Ex. If I need $10 and I have $5, how much more money do I need? Ex. If I have two bills, one of them is a $5 and one of them is a $1, how much money do I need to have $10? **Students will:** **EEA-SSE.3.** Solve simple equations with unknown/missing values (without variables). Ex. If I have three dogs and one runs away, how many dogs are left? Ex. I walked to the store to buy a book. I gave the cashier $10 and she gives me back $7. How much was the book? Ex. If I have two pens in my backpack when I get to school and I left home with five pens, how many pens were given away on the trip from home to school? Ex. 5 – [__] = 2. Ex. [__] x 2 = 8. **Students will:** **EEA-SSE.3.** Identify what is unknown. Ex. John has three cats and some dogs. Do we know the number of dogs John has? Ex. Allen ate some apples. Do we know how many he ate?

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A-CED.3.** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **A-CED.4.** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	**EEA-CED.2-4.** Solve one-step inequalities.	**Students will:** **EEA-CED.2-4.** Solve two-step inequalities with a variable. Ex. If I buy two movie tickets for $5 each and two drinks at $4 each, will $15 be enough money? Ex. I walked to the store to buy a book. I gave the cashier $10. She said, "You need twice this amount." How much is the book? Ex. I went to the store to buy two items that cost x dollars each plus a $5 membership fee. The total cost is more than $25. How much must each item cost? 2x + 5 > 25. **Students will:** **EEA-CED.2-4.** Solve one-step inequalities. Ex. Sally wants to buy a shirt that costs $15. She has $10. How much more money does she need? Ex. Mike has six apples. Two of his friends are joining him for snack. Mike wants to share his apples with his friends. Does he have enough to give each friend two apples? **Students will:** **EEA-CED.2-4.** Verify the solution to an inequality with one variable. Ex. You have $10 and buy socks that cost $2. Will you get change? Ex. I walk to the store and buy a book. If I give the cashier $10 and she says I do not have enough money, is the book more or less than $10? Ex. You have $1 and your breakfast costs $2. Do you need more money? **Students will:** **EEA-CED.2-4.** Identify quantities that are greater than or less than a given quantity. Ex. Using a number line indicate greater than or less than a given number. Ex. Mike has five oranges and Mary has two oranges. Who has more oranges? Ex. Sarah has $50 and Cindy has $30. Who has more money? Ex. Is five more or less than three?

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Ex. If Sue has baseball cards and Tim has five, who has the most/fewest baseball cards?

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High School Mathematics Standards: Algebra - Reasoning with Equations and Inequalities

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Understand solving equations as a process of reasoning and explain the reasoning. **A-REI.1.** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **A-REI.2.** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	**EEA-REI.1-2.** N/A	
Solve equations and inequalities in one variable. **A-REI.3.** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	**EEA-REI.3.** N/A (See EEA-ECED.1-2.)	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
A-REI.4. Solve quadratic equations in one variable. ▪ Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. ▪ Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers *a* and *b*.		
Solve systems of equations. **A-REI.5.** Prove that, given a system of two equations in two variables, replacing one equation by the sum of	**EEA-REI.5.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
that equation and a multiple of the other produces a system with the same solutions.		
A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **A-REI.7.** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.	**EEA-REI.6-7.** N/A (See EEA-REI.10-12.)	
Represent and solve equations and inequalities graphically. **A-REI.10.** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	**EEA-REI.10.-12.** Determine the two pieces of information that are plotted on a graph of an equation with two variables that form a line when plotted.	**Students will:** **EEA-REI.10.** Make a prediction using the graph of an equation with two variables that form a line when plotted using the trend of the line. Ex. Given the graph of a linear function based on real-world situations (e.g., How much money do I earn (y) if I work a given number of hours (x) at $5 dollars per hour; (y = 5 x hours), use this information to make predictions (e.g., If you work six hours, how much will you make?). Ex. Given the graph of a linear function based on cost per pizza and the number of pizzas bought (e.g., If pizza is $5, then the total cost (y) = 5 x the number bought (x)), use this information to make predictions.

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A-REI.11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. **A-REI.12.** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.		**Students will:** **EEA-REI.10.** Determine the two pieces of information that are plotted on a graph of an equation with two variables that form a line when plotted. Ex. Follow the line on the graph to tell the two pieces of information in each point (total cost and Items bought). Ex. Given the graph of a linear function based on cost per pizza and the number of pizzas bought (e.g., number of pizzas bought and total price), follow the line on the graph to tell the two pieces of information at a given point. **Students will:** **A-REI.10.** Use a graph of two variables to find the answer to a real-world problem. Ex. Locate objects using a map with pictorial cues using two coordinates to find one position on a simple map. Ex. Gain basic information from a graph (total cost of two items). **Students will:** **A-REI.10.** Identify major parts of a graph. Ex. Point to the numbers that tell me how many items I bought. Ex. Point to the numbers that tell me how much the total cost is. Ex. Trace the line with your finger – show where the line would go if it continued.

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High School Mathematics Standards: Functions--Interpreting Functions

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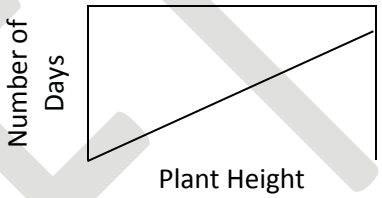
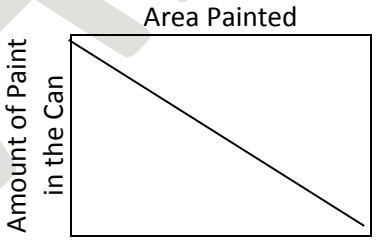
Understand the concept of a function and use function notation. **F-IF.1.** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). **F-IF.2**. Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **F-IF.3.** Recognize that sequences are functions, sometimes defined recursively, whose domain	**EEF-IF.1-3.** Use the concept of function to solve problems.	**Students will:** **EEF-IF.1-3.** Use the concept of functions to identify how the two variables are affected. Ex. Given a graph showing the growth of a plant over a period of one month, identify that, as the number of days increase, plant height increases.  Ex. Given a graph that shows the amount of paint in can and the area painted, identify that, as the area painted increases, the amount of paint in the can decreases.  Ex. Tell the cost of movie tickets for five people if movies tickets are $3 per ticket. Ex. The amount of change you get from a drink machine if each drink cost $0.65. The amount of change you receive will be a function of how much you put into the machine. **Students will:** **EEF-IF.1-3.** Use the concept of function to solve problems. Ex. Using a store scenario, one store charges students $2 more than another store for the same item. Tom purchases a caramel apple for $5.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*		What should Becky expect to pay for an identical apple at the more expensive store? Ex. Look at a graph to identify relationship between two variables (distance--time, cost--product, etc.) If every item cost $1 at a store, how much would five items cost? Ex. Determine the total distance traveled in 20 minutes using a table if you are traveling at a constant speed of one mile every 10 minutes. **Students will:** **EEF-IF.1-3.** Solve problems using a table that shows basic relationships (may not involve a true function). Ex. Look at a weather chart to identify relationships between the day of the week and the temperature. Ex. Determine the number of shoes worn by four people using a graph that incorporates picture representations. Ex. From a given table displaying the cost of movie tickets, determine the cost of one ticket, two tickets, and three tickets. Ex. From a five-day weather forecast, identify the weather for Wednesday. **Students will:** **EEF-IF.1-3.** Identify basic information located on graphs. Ex. Tell the day of the week on a graph/point to the activity on the graph. Ex. Identify a line on a line graph. Ex. Identify the highest bar on a bar graph. Ex. Recognize different types of graphs.
Interpret functions that arise in applications in terms of the context. **F-IF.4**. For a function that models a relationship between two quantities, interpret key features of	**EEF-IF.4-6.** Interpret rate of change (e.g., higher/lower, faster/slower).	**Students will:** **EEF-IF.4-6.** Evaluate key features of a graph (e.g., increasing, decreasing, constant.). Ex. Determine parts of graph illustrating an increase or decrease in speed. Ex. Using a graph illustrating change in temperature over a day, indicate times when the temperature increased, decreased, or stayed the same.

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graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*. **F-IF.5.** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* **F-IF.6.** Calculate and interpret the average rate of change of a function (presented symbolically or		**Students will:** **EEF-IF.4-6.** Interpret rate of change (e.g., higher/lower, faster/slower). Ex. Compare two graphs with different slopes to determine faster/slower rate Ex. Compare a bus schedule with two buses, look and determine if one bus runs more frequently than the next bus on the route. **Students will:** **EEF-IF.4-6.** Graph a simple linear equation represented by a table of values. Ex. Match the graph to its corresponding story. Ex. Plot the points from a table of values less than 10. **Students will:** **EEF-IF.4-6.** Read a table. Ex. From a given table, find information. Ex. Read a bus schedule. Ex. Given a daily schedule, determine the time of lunch during the school day.

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as a table) over a specified interval. Estimate the rate of change from a graph.		
Analyze functions using different representations. **F-IF.7.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph exponential and logarithmic functions, showing intercepts and	**EEF-IF.7.** N/A (See EEF-IF.1-3.)	

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end behavior, and trigonometric functions, showing period, midline, and amplitude.		
F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)t$, $y = (0.97)t$, $y = (1.01)12t$, $y = (1.2)t/10$, and classify them as representing exponential growth or decay.	**EEF-IF.8.** N/A	
F-IF.9. Compare properties of two functions each	**EEF-IF.9.** N/A	

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represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*		

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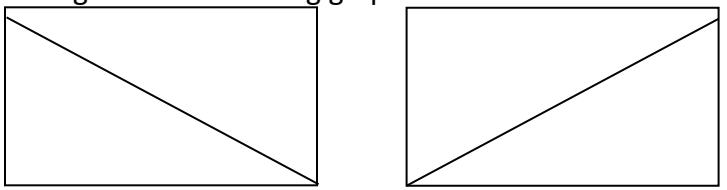
High School Mathematics Standards: Functions--Building Functions

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Build a function that models a relationship between two quantities. **F-BF.1.** Write a function that describes a relationship between two quantities. ▪ Determine an explicit expression, a recursive process, or steps for calculation from a context. ▪ Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	**EEF-BF.1.** Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change.	**Students will:** **EEF.BF.1.** Complete the appropriate graphical representation (first quadrant) given a situation involving constant rate of change. Ex. Given this scenario and a graphical representation with missing information: If I mow one lawn and I make $25 and if I mow three lawns and I make $75, how much will I make if I mow two lawns? Ex. Given this scenario and a graphical representation with missing information: If hamburgers are four for $1 and I buy four, it will cost $1; if I buy 12, it will cost $3 – complete the graph for eight hamburgers. **Students will:** **EEF-BF.1.** Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change. Ex. Given this scenario and two completed graphs, show me the graph that shows the following: If I mow one lawn, I make $25; if I mow two lawns, I will make $50; and if I mow three lawns I will make $75. Ex. Given this scenario and two completed graphs, show me the graph that depicts that there are two cookies for every student. **Students will:** **EEF-BF.1.** Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change where the difference is very clear. Ex. Every dog has one bone. Pick the graph that would represent this concept when given the following graphs. 

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Students will: **EEF-BF.1.** Identify the terms in a sequence. Ex. Identify an ABABABABAB pattern out of two different pattern sets of colored blocks using black (B) and white (W) and one set is BWBWBWBWBW and the other pattern set is BBWBBWBBWBBW. Ex. Place two pencils in front of each student in the classroom.
F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	**EEF-BF.2.** Build an arithmetic sequence when provided a recursive rule with whole numbers.	**Students will:** **EEF-BF.2.** Build an arithmetic sequence when provided a recursive rule with decreasing terms, decimals, or fractions. Ex. Starting at 100, subtract five each time to build a sequence. Ex. Starting at $5.50, add/subtract $0.50 each time to build a sequence. **Students will:** **EEF-FB.2.** Build an arithmetic sequence when provided a recursive rule with whole numbers. Ex. Starting at four, add four each time to build a sequence (e.g., If one dog has four legs, how many will two dogs have, three dogs, etc.). Ex. Starting at five, add seven each time to build a sequence (e.g., If I have $5 and I earn $7 each hour – how much money will I have in four hours?). **Students will:** **EEF-BF.2.** Identify a term in a sequence. Ex. Given a clear sequence (2, 4, 6, 8, . . .), identify the next number in the set. Ex. Given the sequence 4, 2, 5, 1, 3, N, identify what is the value of N. **Students will:** **EEF-BF.2.** Recognize a sequence. Ex. Given two lists of numbers or a set of manipulatives, identify the sequence in 5, 4, 3, 2, 1. Ex. Given two lists of numbers or a set of manipulatives, identify the sequence in 2, 4, 6, 8. Ex. Given a sequence, a picture of a ball, and a fraction, student can select the sequence.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Build new functions from existing functions. **F-BF.3**. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. **F-BF.4**. Find inverse functions. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) =2 x^3 or f(x) = (x+1)/(x–1) for $x \neq 1$.*	**EEF-BF.3-4.** N/A	

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High School Mathematics Standards: Functions--Linear, Quadratic, and Exponential Models

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Construct and compare linear, quadratic, and exponential models and solve problems. **F-LE.1.** Distinguish between situations that can be modeled with linear functions and with exponential functions. ▪ Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. ▪ Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. ▪ Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **F-LE.2**. Construct linear and exponential functions,	**EEF-LE.1.** Model a simple linear function such as *y = mx* to show functions grow by equal factors over equal intervals.	**Students will:** **EEF-LE.1.** Plot points using pictures in first quadrant on a graph using whole numbers and explain how *y* increases/decreases as *x* changes. Ex. If you go to the store where every item is one dollar, students should state *y = x* (the number of items I buy will tell me the cost). Students will then plot this on the graph. Ex. If I get two apples for every orange I buy, students should state that y = 2*x*, or for every orange I buy (x), I will get two apples (y), therefore *x* times two tells me the number of apples each time. Students should then plot this on the graph. **Student will:** **EEF-LE.1.** Model a simple linear function such as *y = mx* to show functions grow by equal factors over equal intervals. Ex. Determine a simple relationship of *y* to *x* by looking at the first quadrant of a graph. Ex. Identify the cost per item on a simple graph where every item in the store cost the same amount and state the relationship between *x* and *y*. Ex. Look at a graph that shows a constant ratio of boys to girls and state the relationship between *x* and *y*. **Students will:** **EEF-LE.1.** Identify a specific data point in the first quadrant and explain the meaning behind it. Ex. Given data points in the first quadrant, identify the named point and state the two pieces of information that one dot provides. Ex. When given a simple graph that shows the total cost of items purchased at a store where every item is $1, tell the cost of four items, the cost of two items, etc. **Students will:** **EEF-LE.1.** Interpret major ideas of a graph with linear functions.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **F-LE.3.** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. **F-LE.4**. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.		Ex. When shown two lines on a graph, tell which one is rising faster. Ex. When shown a graph of distance driven and gas left in tank, explain that the further one drives the less gas one has left.
Interpret expressions for functions in terms of the situation they model. **F-LE.5.** Interpret the parameters in a linear or	**EEF-LE.5.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
exponential function in terms of a context.		

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High School Mathematics Standards: Functions--Trigonometric Functions

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Extend the domain of trigonometric functions using the unit circle. **F-TF.1**. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F-TF.2**. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	**EEF-TF.1-2**. N/A	
Model periodic phenomena with trigonometric functions. **F-TF.5.** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**EEF-TF.5.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Prove and apply trigonometric identities. **F-TF.8**. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.	**EEF-TF.8**. N/A	

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High School Mathematics Standards: Geometry—Congruence

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Experiment with transformations in the plane. **G.CO.1**. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	**EEG-CO.1.** Know the attributes of perpendicular lines, parallel lines, and line segments, angles, and circles.	**Students will:** **EEG-CO.1.** Compare attributes of perpendicular lines, parallel lines, line segments, angles, and circles. Ex. Draw examples of perpendicular lines, parallel lines, and line segments, angles, and circles. Ex. How are lines and line segments different? Ex. How are lines and circles similar? **Students will:** **EEG-CO.1.** Know the attributes of perpendicular lines, parallel lines, and line segments, angles, and circles. Ex. How are parallel and perpendicular lines similar? How are they different? Ex. Given two examples, which of these is a(n) ____? Ex. Which is perpendicular? + || O Ex. Given a grid on a floor with masking tape, identify parallel lines. Ex. Given a map, identify a road that runs somewhat perpendicular to another road. **Students will:** **EEG-CO.1.** Know the attributes of lines, circles, and angles with equivalent measure. Ex. When shown the trajectory of movement of an object, predict where the object will go. Ex. Determine line, circle, and angles and describe them (e.g., circles are round). Ex. Put two objects next to each other and determine which is longer. Ex. Draw a line, circle, or angle. **Students will:** **EEG-CO.1.** Identify a line and a shape (e.g., circle, square, triangle).

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Ex. Point to a line. Ex. Align two objects side by side. Ex. Move an object in a straight line. Ex. Sort shapes into groups by name. Ex. Find objects in the environment that represent/model circles, squares, or triangles.
G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	**EEG-CO.2.** N/A	
G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**EEG-CO.3.** N/A	
G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles,	**EEG-CO.4-5.** Identify rotations, reflections, and slides.	**Students will:** **EEG-CO.4-5.** Demonstrate what happens when a figure is transformed. Ex. Show a rotation using an object. Ex. Using an object, show a slide (translation). Ex. Can form a picture where multiple shapes may need to be rotated to

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
perpendicular lines, parallel lines, and line segments. **G-CO.5.** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.		produce the given picture. **Students will:** **EEG-CO.4-5.** Identify rotations, reflections, and slides. Ex. Use pattern blocks or other manipulatives to produce or copy a design in which each shape is clearly identifiable. Ex. Given two pictures, determine if an object is rotated (arrow up, arrow right). Ex. Given two pictures, pick correct reflection, slide, or rotation. **Students will:** **EE.G-CO.4-5.** Recognize rotation, reflection, or slide (key terms, vocabulary, and movement). Ex. Use body to engage in activity to show rotation or slide (silhouette). Ex. Use objects, rotate, reflect, or slide. **Students will:** **EEG-CO.4-5.** Attend to movement demonstrating rotations, reflections, and slides. Ex. Teacher slides an object, follow with eyes. Ex. Teacher rotates an object, follow motion.
Understand congruence in terms of rigid motions. **G-CO.6.** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to	**EEG-CO.6-8.** Identify corresponding congruent (the same) parts of shapes.	**Students will:** **EEG-CO.6-8.** Demonstrate why shapes are congruent. Ex. Communicate why two given congruent shapes are congruent. Ex. Given two non-congruent shapes, communicate why the shapes are not congruent. **Students will:** **EEG-CO.6-8.** Identify corresponding congruent (the same) parts of shapes. Ex. Given two congruent triangles, identify the corresponding sides. Ex. Given two congruent items (stars, squares, etc.), identify the corresponding parts. Ex. Given two shapes that are not congruent but are similar, identify the

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
decide if they are congruent. **G-CO.7.** Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. **G-CO.8**. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.		similar parts. **Students will:** **EEG-CO.6-8.** Recognize congruent parts (angles and sides). Ex. Identify the congruent parts of a rectangle. Ex. Identify the congruent angles of an isosceles triangle. **Students will:** **EEG-CO.6-8.** Recognize shapes that are congruent. Ex. Given a shape, match a congruent shape. Ex. Given three shapes, pick the two that are congruent.
Prove geometric theorems **G-CO.9.** Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly*	**EEG-CO.9-11.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
those equidistant from the segment's endpoints. **G-CO.10.** Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.* **G-CO.11.** Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*		

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Make geometric constructions. **G-CO.12.** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* **G-CO.13.** Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	**EEG-CO.12-13.** N/A	

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High School Mathematics Standards: Geometry - Similarity, Right Triangles, and Trigonometry

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Understand similarity in terms of similarity transformations. **G-SRT.1.** Verify experimentally the properties of dilations given by a center and a scale factor: ▪ A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. ▪ The dilation of a line segment is longer or shorter in the ratio given by the scale factor. **G-SRT.2.** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs	**EEG-SRT.1-3.** N/A (See EEG-CO.6-8.)	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
of angles and the proportionality of all corresponding pairs of sides. **G-SRT.3.** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.		
Prove theorems involving similarity. **G-SRT.4.** Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* **G-SRT.5.** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**EEG-SRT.4-5.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Define trigonometric ratios and solve problems involving right triangles. **G-SRT.6.** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. **G-SRT.7.** Explain and use the relationship between the sine and cosine of complementary angles. **G-SRT.8.** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	**EEG-SRT.6-8.** N/A	

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High School Mathematics Standards: Geometry--Circles

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Understand and apply theorems about circles. **G-C.1.** Prove that all circles are similar. **G-C.2.** Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.* **G-C.3.** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	**EEG-C.1-3.** N/A	
Find arc lengths and areas of sectors of circles. **G-C.5**. Derive using similarity the fact that the	**EEG-C.5.** N/A	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.		

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High School Mathematics Standards: Geometry - Expressing Geometric Properties with Equations

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Translate between the geometric description and the equation for a conic section. **G-GPE.1.** Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	**EEG-GPE.1.** N/A	
G-GPE.2. Derive the equation of a parabola given a focus and directrix.	**EEG-GPE.2-4.** N/A	
Use coordinates to prove simple geometric theorems algebraically. **G-GPE.4.** Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*	**EEG-GPE.4.** N/A (See EEG-GPE.)	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
G-GPE.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). **G-GPE.6.** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	**EEG-GPE.5-6.** N/A (See EEG.CO.1.)	
G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	**EEG-GPE.7.** Find perimeter and area of squares and rectangles to solve real-world problems.	**Students will:** **EEG-GPE.7.** Use formulas to find perimeter and area of squares and rectangles to solve real-world problems. Ex. Find the perimeter using *p* = side + side + side + side. Ex. Find the area of the classroom floor using A = length *x* width. **Students will:** **EEG-GPE.7.** Find perimeter and area of squares and rectangles to solve real-world problems. Ex. Find the perimeter by adding the length of the sides to determine how much fence you will need to go around your garden. Ex. Find the area of a room on a grid to decide how many tiles (one grid each) you will need to cover the area of your room. Ex. Determine the number of one-foot-square sections needed to make a tabletop garden that is four feet by four feet square. **Students will:** **EEG-GPE.7.** Find perimeter or area by counting on a grid.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Ex. Find the perimeter of a small room on a grid. Ex. Draw a shape on a grid and find the perimeter. **Students will:** **EEG-CPE.7.** Identify inside, around, and outside of a closed figure. Ex. Identify position of a dog as inside or outside the fenced yard. Ex. Choose the term (inside, around, or outside) to describe position.

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High School Mathematics Standards: Geometry--Geometric Measurement and Dimension

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Explain volume formulas and use them to solve problems. **G-GMD.1.** Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* **G-GMD.3.** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	**EEG-GMD.1-3.** Make a prediction based on knowledge of volume to identify volume of common containers (cups, pints, gallons, etc.).	**Students will:** **EEG-GMD.1-3.** Apply knowledge of volume to make appropriate volumetric estimates. Ex. Select appropriate tool to fill a pitcher and estimate the number of proportions needed to fill a five-gallon bucket (teaspoon, cup, bucket). Ex. Select appropriate tool to measure flour for a cake – cup or bucket. Ex. Convert – how many cups in a pint – given cups and a pint container filled with water. **Students will:** **EEG-GMD.1-3.** Make a prediction based on knowledge of volume to identify volume of common containers (cups, pints, gallons, etc.). Ex. Which will hold more than three cups, a gallon or a pint? (Objects: cup, teaspoon, gallon) Ex. Which is a gallon? (Objects: teaspoon, cup, gallon) Ex. If I wanted to carry a gallon of water, would I use a bucket or a cup? **Students will:** **EEG-GMD.1-3.** Which is more or less? Ex. Which shaped peg can fit inside each sculpted hole? Ex. Which container has more marbles in it? Ex. Which container has less marbles in it? **Students will:** **EEG-GMD.1-3.** Experience volume. Ex. Point to the empty cup. Ex. Point to the full container. Ex. Indicate which container will hold more water (e.g., bucket or cup).
Visualize relationships between two-dimensional and three-dimensional objects.	**EEG-GMD.4.** Distinguish between two-dimensional and three-dimensional objects to solve real-world	**Students will:** **EEG-GMD.4.** Use the properties of two-dimensional and three-dimensional objects to solve real-world problems. Ex. Determine how much cereal a container can hold using standard

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
G-GMD.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	problems.	measurement. Ex. Using the dimensions of a shelf to determine how many boxes would fit. **Students will:** **EEG-GMD.4.** Distinguish between two-dimensional and three-dimensional objects to solve real-world problems. Ex. Build a floor and walls of a building using technology or blocks. Ex. Describe the differences between a map of the school and the model of the school. Ex. Identify height as a dimension of three-dimensional objects. Ex. Show use of spatial relationships by stacking boxes to specified dimensions (length, width, height). **Students will:** **EEG-GMD.4.** Distinguish between two-dimensional and three-dimensional Ex. Classify two-dimensional and three-dimensional objects by their use (e.g., Which of these can you use as a container, a box, or a square?). Ex. Given two examples, which is a cube and which is square? Ex. Given a picture of a silo, a square building, and a box, determine which three-dimensional object corresponds to a circle. Ex. Which can hold cereal: a square or a box? **Students will:** **EEG-GMD.4.** Identify two-dimensional shapes. Ex. Identify squares from non-squares. Ex. Choose polygons from line segments and angles.

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High School Mathematics Standards: Geometry--Modeling with Geometry

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Apply geometric concepts in modeling situations. **G-MG.1**. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **G-MG.2.** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). **G-MG.3.** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	**EEG-MG.1-3**. Use properties of geometric shapes to describe real-life objects.	**Students will:** **G-MG.1-3**. Apply geometric methods to solve design problems. Ex. Identify the two-dimensional shapes that create the three-dimensional figure (e.g., I can see four triangles in a pyramid; I can see six squares on the outside of a cube). Ex. Determine the least number of tiles needed to cover the outside of a cubed figure (glue tiles onto a box). Ex. How many cups of water will this cylinder hold? Ex. Determine the amount of materials needed to wrap a present. **Students will:** **EEG-MG.1-3**. Use properties of geometric shapes to describe real-life objects. Ex. Name everyday objects in terms of geometric shapes (can of soda is a cylinder, box of cereal is a rectangular prism). Ex. Describe the sides of a box of tissues (ends are squares, sides are rectangles). Ex. How many small square boxes (cubes)can I fit into a large cube? Ex. How many boxes (cubes) will fit on this shelf? Ex. Determine the dimensions of a classroom (length, width, and height.) **Students will:** **EEG-MG.1-3**. **Identify geometric shapes.** Ex. Find real-life objects that have similar characteristics to a sphere. Ex. Given a cube, determine what real-life object has similar characteristics to a cube. **Students will:** **EEG-MG.1-3.** Compare the capacity of three-dimensional objects. Ex. Which has the greatest capacity, a house or a school? Ex. Determine which holds more, a cup or a barrel?

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High School Mathematics Standards: Statistics and Probability--Interpreting Categorical and Quantitative Data

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Summarize, represent, and interpret data on a single count or measurement variable. **S-ID.1.** Represent data with plots on the real number line (dot plots, histograms, and box plots). **S-ID.2.** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	**EES-ID.1-2**. Given data, construct a simple graph (table, line, pie, bar, or picture) and answer questions about the data.	**Students will:** **EES-ID.1-2.** Collect and organize data in simple graphs and use findings to draw conclusions from the data. Ex. Ask 10 people how many hours of TV they watch a day. Put the findings into a graph and tell which person watches the most and least TV. Ex. Collect data on a given topic and tell what conclusions they draw from the data, such as most common weather in two cities, cheapest price of jeans, etc. **Students will:** **EES-ID.1-2.** Given data, construct a simple graph (table, line, pie, bar, or picture) and answer questions about the data. Ex. Given data about the cost of jeans at three stores, place the information on a graph (table, line, pie, bar, or picture) and answer questions about the graph. Ex. Read data from a given graph showing the weather for one week and determine how many days it was rainy. Ex. Given data from student surveys (e.g., favorite sport, subject, book) presented on a bar or pie graph and answer questions about the findings (most/least). Ex. Interpret weather data (e.g., temperature changes over time) presented in a line graph. **Students will:** **EES-ID.1-2.** Given a graph, answer simple questions. Ex. Identify the highest and lowest points on a graph (costs the most). Ex. Tell what the simple graph represents (graph about the weather, cell phone plans, or gas prices). Ex. Read data from a given graph showing the weather for one week to tell how many days was it rainy.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Students will: **EES-ID.1-2.** Identify any part of a simple graph. Ex. Point to and identify part of simple graph (such as the bar, line, title, labels on the graph). Ex. Point or indicate to answer, "Which is the tallest/highest bar?"
S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	**EES-ID.3.** Indicate general trends on a graph or chart.	**Students will:** **EES-ID.3.** Extend a graph or chart to make a prediction. Ex. If the weatherman says there is a 60% chance of rain, should you wear a rain coat? Ex. Show a graph, predict which direction the line will continue and answer predictive questions. Ex. Using a graph, estimate a future point when the trend of the line is not extremely clear. **Students will:** **EES-ID.3.** Indicate general trends on a graph or chart. Ex. Which chart shows an increase? A chart with an upward slope or a chart with a downward slope. Ex. Which chart shows a decrease? A chart with an upward slope or a chart with a downward slope. Ex. Using a graph, estimate a future point when the trend of the line is clear. **Students will:** **EES-ID.3.** Demonstrate increase and decrease over time. Ex. Is this point more or less than this point? Ex. Is this line (slope) increasing or decreasing? Ex. Collect data that has a trend possibility (e.g., growing plant, collecting money). Ex. Ordinate piles of money, items to show increase/decrease. Ex. When shown two graphs, determine which shows increase and which shows decrease.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
		Students will: **EES-ID.3.** Determine categories needed on a graph. Ex. We are charting plant growth. Should I put the length of the monkey's tail on the graph? Ex. Describe sample space – are we looking at oranges or apples? Ex. We are counting apples. Do shoes belong on this graph?
S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	**EES-ID.4.** Calculate the mean of a given data set (limit data points to less than five).	**Students will:** **EES-ID.4.** Calculate the mean of a given data set (more than five data points). Ex. Calculate the mean of price lists for a video in six different stores. Ex. Calculate the mean number of hours students spend watching TV over a week. **Students will:** **EES-ID.4.** Calculate the mean of a given data set (limit data points to less than five). Ex. Given rainfall amounts for four days, determine the average rainfall. Ex. Given the price of each pair, determine the average price of four pairs of shoes. **Students will:** **EES-ID.4** Identify the average between two consecutive numbers. Ex. Given two consecutive numbers on a number line, determine the mean value. (Determine the mean value of 2 and 3.) **Students will:** **EES-ID.4.** Identify the missing number between two data points. Ex. Given two consecutive even numbers or two consecutive odd numbers, determine the number in the middle.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Summarize, represent, and interpret data on two categorical and quantitative variables. **S-ID.5.** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. **S-ID.6.** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit	**EES-ID.5.** N/A (See EEF-IF.1. and EEA-REI.6-7.)	

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.		
Interpret linear models. **S-ID.7.** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	**EES-ID.7.** N/A (See EEF.IF.4-6.)	
S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. **S-ID.9.** Distinguish between correlation and causation.	**EES-ID.8-9.** N/A	

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High School Mathematics Standards: Statistics and Probability--Making Inferences and Justifying Conclusions

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Understand and evaluate random processes underlying statistical experiments. **S-IC.1.** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S-IC.2.** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	**EES-IC.1-2.** Determine the likelihood of an event occurring when the outcomes are equally likely to occur.	**Students will:** **EES-IC.1-2.** Determine the likelihood of an event occurring when the outcomes are not equally likely to occur. Ex. You have a bag of marbles with five red, four blue, six white, and five yellow marbles. What is the probability of choosing a white marble? Ex. Your drawer contains seven pairs of white socks and three pairs of black socks. What is the probability of choosing a white pair? **Students will:** **EES-IC.1-2.** Determine the likelihood of an event occurring when the outcomes are equally likely to occur. Ex. A spinner contains four colors: blue, red, green, and yellow. What is the probability of landing on red? Ex. A die is rolled. What is the probability of landing on a four? Ex. You have three blue candies, seven green candies, and four red candies in a bag. Which color are you most likely to draw out of the bag? **Students will:** **EES-IC.1-2.** Determine the possible outcomes of an event occurring. Ex. A spinner contains four colors (blue, red, green, and yellow). List all of the possible outcomes. Ex. What are the possible outcomes of rolling a die? Ex. What are the possible outcomes when flipping a coin? **Students will:** **EES-IC.1-2.** Identify one event or outcome of an event occurring. Ex. Given a spinner with four colors, identify one color as a possible outcome. Ex. Given a die, identify five as a possible outcome.

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Make inferences and justify conclusions from sample surveys, experiments, and observational studies. **S-IC.3.** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S-IC.4.** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **S-IC.5.** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S-IC.6.** Evaluate reports based on data.	**EES-IC.3-6.** N/A (See EES-ID.1-2.)	

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High School Mathematics Standards: Statistics and Probability--Conditional Probability and the Rules of Probability

CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
Understand independence and conditional probability and use them to interpret data. **S-CP.1.** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S-CP.2.** Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S-CP.3.** Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A*	**EES-CP.1-4.** Identify when events are independent or dependent.	**Students will:** **EES-CP.1-4.** Find the probability of an event after another event has occurred. Ex. Find the probability of the next coin flip after a succession of coin flips (e.g., If Joe flipped a coin four times in row and got heads each time, what is the probability of getting heads on the next flip?). Ex. Find the probability of drawing a particular color after a succession of draws (e.g., If Sam had three dice in a bag--one red, one blue, and one green--what is the probability of drawing and rolling a blue?). Ex. Find the probability of drawing a particular color after the color has been withdrawn (e.g., A bag contains four blue, three red, two yellow, and one black balls. Wes randomly selected the black ball. What is the probability he will select a yellow ball next if the black ball is not replaced in the bag?). **Students will:** **EES-CP.1-4.** Identify when events are independent or dependent. Ex. When asked if winning the lottery depends on the weather, reply no. Ex. When asked if the basketball game is likely to be canceled if it rains, reply no. Ex. When asked if the baseball game is likely to will be canceled if it rains, indicate likely. Ex. When asked whether catching the bus depends upon whether you get up on time, reply yes. **Students will:** **EES-CP.1-4.** Identify the outcomes of an event. Ex. What happens when an egg falls off the table? Ex. Two red and two blue balls are in a bag, two balls are taken out, what colors (two red, two blue, or red and blue) could the balls be?

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. **S-CP.4.** Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* **S-CP.5.** Recognize and explain the concepts of		**Students will:** **EES-CP.1-4.** Determine which event occurs first in a sequence. Ex. Which is put on first, socks or shoes? Ex. Using a daily schedule, what activity would come next?

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CCSS Grade-Level Clusters	Common Core Essential Elements	Range of Complexity Examples
conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*		
Use the rules of probability to compute probabilities of compound events in a uniform probability model. **S-CP.6.** Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. **S-CP.7.** Apply the Addition Rule, *P(A* or *B) = P(A) + P(B) – P(A* and *B)*, and interpret the answer in terms of the model.	**EES-CP.6-7.** N/A (See EES-IC.1-2.)	

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