Alaska-DLM Essential Elements and Instructional Examples for Mathematics

Sixth Grade

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AK-DLM ESSENTIAL ELEMENTS AND COMPLEXITY EXAMPLES FOR SIXTH GRADE

Sixth Grade Mathematics Standards: Ratios and Proportional Relationships

AK Grade-Level Clusters	AK-DLM Essential Elements	Instructional Examples
Understand ratio concepts and use ratio reasoning to solve problems. **6.RP.1.** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*	**EE6.RP.1.** Demonstrate a simple ratio relationship.	**Students will:** **EE6.RP.1.** Use a ratio to describe a relationship using numbers and objects. Ex. Given an even number of red and twice as many green beads, identify the ratio of green beads compared to red beads. Ex. While preparing a recipe, fill in a ratio of flour to sugar (e.g., one cup of sugar to four cups of flour). Ex. Compare the number of male students to female students. Ex. Given the quantity of materials available and the number of groups who will conduct a science experiment, use a ratio relationship to describe how much each group will receive. **Students will:** **EE6.RP.1.** Demonstrate a simple ratio relationship. Ex. Give a pen and a pencil to each classmate. Ex. After the teacher explains what materials each group needs, use an AAC to tell another student to get two cups for one table. **Students will:** **EE6.RP.1.** Complete a pattern given a simple ratio. Ex. Take two steps on a number line each time the teacher says "step." Ex. Give a ratio of two-to-one, complete an AABAABAAB pattern (e.g., jump, jump, clap; jump, jump, clap). **Students will:** **EE6.RP.1.** Identify a one-to-one relationship. Ex. Given a stack of napkins, give a napkin to each classmate. Ex. When sorting mail in the main office, place one copy of the school newsletter in each teacher's mailbox. Ex. Touch each object as teacher counts.

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Apply and extend previous understandings of multiplication and division to divide fractions by fractions. **6.NS.1.** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb. of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length*	**EE6.NS.1.** Compare the relationships between two unit fractions.	**Students will:** **EE6.NS.1.** Compare the relationships between the three unit fractions (1/2, 1/4, 1/8). Ex. Given three measuring cups filled to 1/2, 1/4, and 1/8 with water, compare fractional amounts to determine which is greater. Ex. Given pictorial representations of shaded pictures and/or fraction bars, compare fractions to determine which is a smaller or lesser amount. Ex. Using circle shaped fraction puzzles, compare a 1/2, 1/4, and 1/8 to determine which is greater. **Students will:** **EE6.NS.1.** Compare the relationships between two unit fractions. Ex. Given two measuring cups of 1/2 and 1/4 full of sand, compare the amounts in each of the measuring cups to a whole cup. Which is more? Ex. Given two measuring cups of 1/4 and 1/8 full of water, compare the amounts in each of the measuring cups to a whole cup. Which is more? Ex. When given a group of even-numbered objects that represents 1/2 and 1/4, determine which set is more or less. Ex. Split an even-numbered group of objects into two equal groups to show one half of the group; then split each group again to show fourths of the whole; and split each group again to show eighths of the whole. **Students will:** **EE6.NS.1.** Demonstrate an amount of 1/2. Ex. Fold one piece of paper in half to show two halves in every one whole. Ex. Shade a shape to show 1/2. Ex. Given a whole and a half, identify the half (e.g., a whole or half sandwich). Ex. Shown a glass that is full and a glass that is 1/2 (half) full, select the half-full glass. **Students will:**

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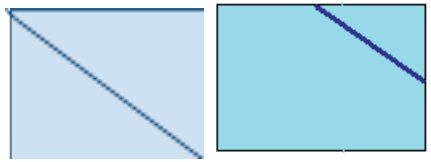
3/4 mi and area 1/2 square mi? Compute fluently with multi-digit numbers and find common factors and multiples.		**EE6.NS.1.** Distinguish between more or less. Ex. Given two groups of objects with significantly different amounts (three vs. 10), determine which group has more or less. Ex. Given a picture of a familiar symmetrical object cut in half, combine both halves to make a whole.
Compute fluently with multi-digit numbers and find common factors and multiples. **6.NS.2.** Fluently divide multi-digit numbers using the standard algorithm.	**EE6.NS.2**. Apply the concept of fair share and equal shares to divide.	**Students will:** **EE6.NS.2**. Solve a division problem using the concept of equal shares. Ex. Given a real-life division problem, solve the problem using manipulatives. Ex. Given a group of objects, determine what number to give each classmate to create equal shares. Ex. Divide students into four equal groups for a sports tournament. Ex. When planting seeds for a science experiment, divide the seeds into equal shares. **Students will:** **EE6.NS.2**. Apply the concept of fair share and equal shares to divide. Ex. When planting seeds for a science experiment, divide the seeds into 10 equal shares. Ex. Divide construction paper equally among classmates. Ex. Divide students in the classroom into two equal teams. Ex. Divide 10 one-dollar bills into two fair shares (e.g., “If I find 10 dollars and I divide it equally with someone, how much do we each get?”). **Students will:** **EE6.NS.2**. Identify the concept of division using fair and equal shares. Ex. Given a paper folded in half, identify whether they are equal shares.  Ex. Distribute cards in a card game, giving each student a fair share. Ex. Given a set of books, divide them into two buckets.

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		Ex. Given Ziploc baggies with an equal number of pencils in them, say the number of baggies and the number of pencils in each bag. **Students will:** **EE6.NS.2**. Replicate equal sets. Ex. Given a model, replicate equal sets using rings and pattern blocks. Ex. Given a model, place five different colors in equal sets.
6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.	**EE6.NS.3.** Solve two factor multiplication problems with products up to 50 using concrete objects and/or a calculator.	**Students will:** **EE6.NS.3.** Solve multiplication problems with whole number products to 50 using numerical representations. Ex. Given a set of multiplication problems in numerical form, find the product. Ex. Given a computer program with multiplication problems, find the product. Ex. Find the product of whole numbers to 20 via multiple algorithms (e.g., different ways to get to 20 = 10 x 2, 2 x 10, 10 + 10 or 5 + 5 + 5 + 5). Ex. Given a story problem, find the product and represent it numerically (e.g., If I have three shirts and two pair of paints how many outfits can one make? If I have five rows of desks and 10 desks in each row, how many desks will I have? If I babysat for five days and earned 10 dollars each day, how much money would I make?). **Students will:** **EE6.NS.2.** Solve two-factor multiplication problems with products up to 50 using concrete objects and/or calculators. Ex. Given a set of manipulatives, make three groups of three and then find the product. Ex. Given a 100s board, show 3 x 10, three sets of 10, and state the product. Ex. Given numbers paired with concrete representations, select the correct answer. **Students will:**

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		EE6.NS.2. Solve repeated addition problems where the addends are the same (e.g., 5 + 5 + 5 = 15 is equal to three groups of five) using concrete manipulatives and/or a calculator. Ex. Given a story problem, find the sum of a repeated addition problem using objects or their representations (e.g., If I have two rows of desks and three desks in each row how many desks will I have? If I babysat for three days and earned four dollars each day how much money would I make? [Given play money as a manipulative]). Ex. Given a picture of three groups of three pencils, represent and solve the repeated addition problem. Ex. Before starting an art project, gather two pieces each of five different colored papers and describe how many total pieces of paper are required. **Students will:** **EE6.NS.2.** Identify a group of a given quantity. Ex. Given a group of objects with no greater than three items, identify how many are in the group that matches the teacher's handheld numeric symbol (e.g., group of two, group of one, group of three--match to the numbers two, one, and three). Ex. Subitize sets of four (e.g., using a die). Ex. Given a set number of sounds, no greater than three, identify the quantity of sounds heard (e.g., indicating three dots or the number three). Do this twice and identify if the number of sounds are the same or different as the first round. Ex. When shown a repeating pattern of three objects, three objects, three objects, tell the teacher how many objects are in the repeated pattern.

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Apply and extend previous understandings of numbers to the system of rational numbers. **6.NS.5.** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of	**EE6.NS.5-8.** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero).	**Students will:** **EE6.NS.5-8.** Apply positive and negative numbers to a real-world context from greater than positive 10 and less than negative 10. Ex. Given three negative and positive temperatures on three thermometers, order the temperatures from least to greatest (e.g., -15, 0, 15). Ex. When given a thermometer reading -5 degrees, tell how much the temperature will have to rise to get to 15 degrees? Ex. Given three bank statements, order the statement balances from least to greatest. **Students will:** **EE6.NS.5-8.** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero). Ex. Given a number line and asked to show the number that is opposite of 5, select -5. Ex. Given two temperatures on two thermometers, one positive and one negative, determine which temperature is the coldest. Ex. Look at the records (wins/losses) of three baseball teams (positive numbers to indicate number of wins and negative numbers to indicate

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0 in each situation. **6.NS.6.** Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. f Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite. f Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related		number of losses) and then rank the teams in order from the greatest number of wins/least amount of losses. Ex. Look at a bank statement/checkbook register and tell if there is a positive or negative balance (i.e., do you have any money or do you owe the bank money?). **Students will:** **EE6.NS.5-8.** Order positive numbers from least to greatest. Ex. Given three temperatures above zero, put them in order from coldest to hottest. Ex. Sequence positive numbers correctly on a number line (e.g., temperatures). Ex. Look at three checkbook registers with positive balances and order the balances from least to greatest. Ex. Given temperatures from three seasons, put them in order from coldest to hottest. **Students will:** **EE6.NS.5-8.** Identify which is greater than and less than using fewer than 10. Ex. Given two sets of manipulatives, identify which has the greater amount or which has the lesser amount. Ex. In a science experiment growing plants, determine how many plants have lived and how many have died to determine if more lived or died. Ex. Joe has three marbles, Frank has six. Who has more? Ex. Farmer John has five cows and nine pigs. Are there more cows or pigs? Ex. Given a representation of a thermometer, indicate which direction implies a greater temperature. Ex. On a number line, which number is closer to zero: three or five? Ex. Given two temperatures above zero, indicate which is greater.

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by reflections across one or both axes. ƒ Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. **6.NS.7.** Understand ordering and absolute value of rational numbers. ƒ Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.* ƒ Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3° C > -7° C to*		

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express the fact that -3°C is warmer than -7°C. ƒ Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.* ƒ Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.* **6.NS.8.** Solve real-world and mathematical problems by graphing points in all four quadrants		

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of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.		

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Sixth Grade Mathematics Standards: Expressions and Equations

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Apply and extend previous understandings of arithmetic to algebraic expressions. **6.EE.1.** Write and evaluate numerical expressions involving whole-number exponents. **6.EE.2.** Write, read, and evaluate expressions in which letters stand for numbers. ƒ Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.* ƒ Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression*	**EE6.EE.1-2.** Identify equivalent number sentences.	**Students will:** **EE6.EE.1.** Generate a two-step math sentence using appropriate numbers and symbols. Ex. Given a two-step word problem, identify the numerical equivalent (e.g., "John has two apples, Mary has three. John ate one apple. How many apples are left?" Student produces the math sentence (2 + 3 – 1 =) or (2 – 1 + 3 =)). Ex. Given a two-step word problem, identify the numerical equivalent (e.g. "Trudy has three cakes. She was given one more. Frank has two cakes. Show who has the greater number of cakes." (3 + 1 > 2), (3 + 1 = 4, 4 > 2). **Students will:** **EE6.EE.1.** Identify equivalent number sentences. Ex. Given a word problem, identify the numerical equivalent (e.g. "John has one pencil. He is given five more. How many pencils does he have?" Student identifies 1 + 5 = as an equivalent to the statement.). Ex. Given a word problem, identify the numerical equivalent (e.g., Teacher places group of three pencils and a group of four pencils to the left of student. Teacher then places a second group of five pencils and two pencils to the right of the student and asks, "Does this group of pencils have the same amount as the other group of pencils?" (3 + 4 = 5 + 2). Ex. Given a number problem, select from choices an equivalent problem (e.g., 1 + 3 has the same result as 2 + 2). **Students will:** **EE6.EE.1.** Match number sentence with the correct picture representation. Ex. Given a picture showing single addition, identify correct number sentence. Ex. Given a picture and a correct and incorrect number sentence, choose one that is correct. **Students will:**

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2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms. ƒ Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.*		**EE6.EE.1.** Identify math symbol "=" as meaning equal to. Ex. Indicate the symbol in a math sentence. Ex. Given picture representations of two equal groups of objects with an equal sign between, responds that they are the same.
6.EE.3. Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the*	**EE6.EE.3.** Apply the properties of addition to identify equivalent numerical expressions.	**Students will:** **EE6.EE.3-4.** Solve equivalent expressions to illustrate that they are equivalent. Ex. Fill in the blank to make a true statement: 2 + 6 = 6 + ____. Ex. Fill in the blank to make a true statement: 3 + 5 = ____ + 3. Ex. Fill in the blank to make a true statement: 4 + ____ = 3 + 4.

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equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.		**Students will:** **EE6.EE.3-4.** Demonstrate understanding of equivalent expressions. Ex. Indicate that 2 + 3 is the same as 3 + 2. Ex. Answer yes or no when asked, "Is 2 + 3 equal to 3 + 2?" Ex. Answer yes or no when asked, "Is 2 + 3 equal to 4 + 2?" **Students will:** **EE6.EE.3-4.** Recognize different displays of the equal quantities. Ex. Given a model, create an expression using manipulatives (e.g., three blocks plus two blocks equals five blocks). Ex. Given a group of three objects, a group of four objects, and a group of seven objects, match to 3 + 4 = 7. **Students will:** **EE6.EE.3-4.** Match different displays of the same quantity. Ex. Match pictures of quantities of objects to their numerical equivalent (e.g., four balls matches to the number 4).
Reason about and solve one-variable equations and inequalities. **6.EE.5.** Understand solving an equation or inequality as a process of answering a question: which values	**EE6.EE.5-7.** Match an equation to a real-world problem in which variables are used to represent numbers.	**Students will:** **EE6.EE.2.** Using a variable, generate an equivalent equation that represents a real-world problem. Ex. Arrange symbols and numbers to show this equation: Joe has three cups and Sue has some more cups. If they have eight cups together, how would we write this? Answer: 3 + x = 8. Ex. Show how to write this equation: two students have apples, one student has five apples, the other student has more apples, and there are

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from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. **6.EE.6.** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **6.EE.7.** Solve real-world and mathematical problems by writing and solving equations of the form *x* + *p* = *q* and *px* = *q* for cases in which *p*, *q* and *x* are all nonnegative rational numbers.		12 apples altogether. How would you write this? Answer 5 + x = 12. Ex. Together Pete and Joe have five candies. Pete has two. How many does Joe have? Show the problem with manipulatives using x to represent the unknown, how would you write the equation using x. Answer: 2 + x = 7. **Students will:** **EE6.EE.2.** Match an equation to a real-world problem in which variables are used to represent numbers. Ex. Match an equation using x to represent how many Fred has: Fred and June have five apples. June has two. Show me this problem. Answer: 2 + x = 5. Ex. Tell that x means "how many" in 2 + =5 and insert x in the box. Ex. Match an equation to this word problem: I know Tommy has three tickets. How many more tickets will he need if he wants to take five friends to a movie? Answer: 3 + x = 5. **Students will:** **EE6.EE.2.** Determine what is unknown in an equation. Ex. After hearing a story problem, indicate what is unknown (the teacher labels that as x). Ex. Tell that x means "how many" in 2 + =5 and insert x in the box. Ex. Indicate the x when asked, "What number do I not know in this equation? **Students will:** **EE6.EE.2.** Identify the letter in a mathematical sentence. Ex. Point to or indicate the letter/fixed/variable. Ex. Indicate "x" in the equation when asked.

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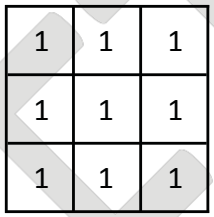
Solve real-world and mathematical problems involving area, surface area, and volume. **6.G.1.** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. **6.G.2.** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms	**EE6.G.1.** Solve real-world and mathematical problems and area using unit squares. **EE.6.G.2.** Solve real-world and mathematical problems about volume using unit cubes.	**Students will:** **EE6.G.1-2.** Find area. Ex. Determine how many tiles in a single layer are required to cover a rectangle.  3 + 3 + 3 = 9 tiles Ex. Determine how many cubes in a single layer are required to cover the bottom of a box and state the number required. **Students will:** **EE6.G.1-2.** Demonstrate area. Ex. Given two representations, identify which has area (e.g., line segment, angle, square). Ex. Use squares of colored paper to cover their desk or tray on a wheelchair. Ex. Tell which figure is larger inside. **Students will:** **EE6.G.1-2**. Determine what is the larger area. **Students will:** **EE6.G.1-2.** Indicate the inside of a space. Ex. Fill in the inside of a figure when the difference between the inside and outside is clear. Ex. Answer yes or no when asked, “Here is a basket. Here is a ball. Put the ball inside the basket. Is the ball inside or outside the basket?” Ex. Point around the room or spread arms when asked “Are we inside or

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with fractional edge lengths in the context of solving real-world and mathematical problems.		outside our classroom?” Ex. Point to the inside of a box or frame when asked, “Where is the inside?”

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Sixth Grade Mathematics Standards: Statistics and Probability

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Develop understanding of statistical variability. **6.SP.1.** Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.* **6.SP.2.** Understand that a set of data collected to answer a statistical question has a distribution, which can be described by its center, spread, and overall shape.	**EE6.SP.1-2.** Display data on a graph or table that shows variability in the data.	**Students will:** **EE6.SP.1-2.** Collect, display, and describe data on a graph or table. Ex. Collect data for a classroom experiment and chart height of plants, temperature of soil, etc. Ex. Collect data from a class survey of height and create a table showing the variance in height (e.g., shortest person is 4'6", the tallest person is 5'4"). Ex. Collect weather data and graph to show variance (e.g., five sunny days, three cloudy, two rainy). Ex. Describe data laid out on a graph showing a distribution of responses. For example, students have different heights, but there are many with similar heights, while some are much taller or shorter. **Students will:** **EE6.SP.1-2.** Display data on a graph or table that shows variability of data. Ex. Given weather data for the week, display it on a graph to show variance (e.g., five sunny days, three cloudy, two rainy). Ex. Given data about the ages of students in the class (e.g., 12, 13, and 14), display data in a table showing the variance in age (e.g., fewest are 12 years old, most are 13 years old). **Students will:** **EE6.SP.1-2.** Organize data. Ex. Survey students in the classroom concerning favorites among three choices and represent responses (e.g., how many pick each of three stories or each of three subjects). Ex. Given data, sort to determine how many (e.g., how many students have certain number of siblings). **Students will:** **EE6.SP.1-2.** Sort information into categories of same and different. Ex. After charting the weather for a week, identify if today's weather was

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		the same or different than yesterday. Ex. Given a graphic organizer with three categories of colors identified, sort seven discs of three different colors into the categories and place them in the appropriate place on the graphic organizer.
6.SP.5. Summarize numerical data sets in relation to their context, such as by: ƒ Reporting the number of observations. ƒ Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. ƒ Giving quantitative	**EE6.SP.5.** Summarize data distributions shown in graphs or tables.	**Students will:** **EE6.SP.5.** Summarize the data on a graph or table. Ex. When looking at a table of what students like to eat for lunch, summarize the data in multiple ways (e.g., chicken nuggets has the most, pizza has the least). Ex. When looking at a graph of temperatures from the week, summarize the data in multiple ways (e.g., three days were above 70 degrees, six days were between 60-70 degrees, and two days were 50-60 degrees). **Students will:** **EE6.SP.5.** Summarize data distributions on a graph or table. Ex. When looking at a graph of temperatures from the week, summarize the data in one way (e.g., three days were above 70 degrees).

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measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. *f* Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.		Ex. When looking at a table of what students like to eat for lunch, summarize the data in one way (e.g., chicken nuggets has the most; pizza has the least). **Students will:** **EE6.SP.5.** Use a graph to determine which category has the most. Ex. Looking at a bar graph on the students' favorite subject in school, identify which is the most preferred subject. Ex. Looking at a pictograph of the students' favorite sports teams, identify which is the most preferred team. **Students will:** **EE6.SP.5.** Identify which has more or less. Ex. Given two items on a bar graph, identify which has more or less. Ex. Given two towers of interlocking cubes, identify which has more or less.

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