Standard 1 : Understand ratio concepts and use ratio reasoning to solve problems. (Major Cluster)

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Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Number: MAFS.6.RP.1	**Title:** Understand ratio concepts and use ratio reasoning to solve problems. (Major Cluster)
Type: Cluster	**Subject:** Mathematics
Grade: 6	**Domain-Subdomain:** Ratios & Proportional Relationships

Related Standards

Code	Description
MAFS.6.RP.1.1	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."*
MAFS.6.RP.1.2	Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*
MAFS.6.RP.1.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. e. Understand the concept of Pi as the ratio of the circumference of a circle to its diameter. ([1]See Table 2 Common Multiplication and Division Situations) **Remarks/Examples:** **Examples of Opportunities for In-Depth Focus** When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.

Related Access Points

Access Point

Access Point Number	Access Point Title
	<!--[if gte mso 9]> <w:WordDocument> <w:View>Normal</w:View> <w:Zoom>0</w:Zoom> <w:TrackMoves/> <w:TrackFormatting/> <w:PunctuationKerning/> <w:ValidateAgainstSchemas/> <w:SaveIfXMLInvalid>false</w:SaveIfXMLInvalid> <w:IgnoreMixedContent>false</w:IgnoreMixedContent> <w:AlwaysShowPlaceholderText>false</w:AlwaysShowPlaceholderText> <w:DoNotPromoteQF/> <w:LidThemeOther>EN-US</w:LidThemeOther> <w:LidThemeAsian>X-NONE</w:LidThemeAsian> <w:LidThemeComplexScript>X-NONE</w:LidThemeComplexScript> <w:Compatibility> <w:BreakWrappedTables/> <w:SnapToGridInCell/> <w:WrapTextWithPunct/> <w:UseAsianBreakRules/> <w:DontGrowAutofit/> <w:SplitPgBreakAndParaMark/> <w:EnableOpenTypeKerning/> <w:DontFlipMirrorIndents/> <w:OverrideTableStyleHps/> </w:Compatibility> <m:mathPr> <m:mathFont m:val="Cambria Math"/> <m:brkBin m:val="before"/> <m:brkBinSub m:val="--"/> <m:smallFrac m:val="off"/> <m:dispDef/> <m:lMargin m:val="0"/> <m:rMargin m:val="0"/> <m:defJc m:val="centerGroup"/> <m:wrapIndent m:val="1440"/> <m:intLim

:	m:val="subSup"/> <m:naryLim m:val="undOvr"/> </m:mathPr></w:WordDocument> <![endif]--><!--[if gte mso 9]> <w:LatentStyles DefLockedState="false" DefUnhideWhenUsed="true" DefSemiHidden="true" DefQFormat="false" DefPriority="99" LatentStyleCount="267"> <w:LsdException Locked="false" Priority="0" SemiHidden="false" UnhideWhenUsed="false" QFormat="true" Name="Normal"/> <w:LsdException Locked="false" Priority="9" SemiHidden="false" UnhideWhenUsed="false" QFormat="true" Name="heading 1"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 2"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 3"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 4"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 5"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 6"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 7"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 8"/> <w:LsdException Locked="false" Priority="9" QFormat="true" Name="heading 9"/> <w:LsdException Locked="false" Priority="39" Name="toc 1"/> <w:LsdException Locked="false" Priority="39" Name="toc 2"/> <w:LsdException Locked="false" Priority="39" Name="toc 3"/> <w:LsdException Locked="false" Priority="39" Name="toc 4"/> <w:LsdException Locked="fal
:	Write or select a ratio to match a given statement and representation.
MAFS.6.RP.1.AP.1a:	Write or select a ratio to match a given statement and representation.
MAFS.6.RP.1.AP.1b:	Describe the ratio relationship between two quantities for a given situation using visual representations.

:	Describe the ratio relationship between two quantities for a given situation.
	• **Concrete:**
	  ◦ Match/identify a simple ratio (1:X) to the relationship between two quantities.
	• **Representation:**
	  ◦ Recognize the meaning of the placement of numbers in a ratio for a given situation.
	  ◦ Show a ratio in three ways: number to number (1 to 2) expressed as a fraction (1/2), or using a colon (1:2).
	  ◦ Represent the ratio of objects (e.g., red hats) to the total number of objects [red and green hats]; part-to-whole).
	  ◦ Represent the ratio of the number of one object (red hats) to the number of other objects (green hats) from a set of objects (red and green hats); part-to-part.
	  ◦ Understand concept and vocabulary: ratio, rate, proportion, prices, portions per person.

:	Complete a statement that describes the ratio relationship between two quantities.
:	Represent proportional relationships on a line graph.
:	Determine the unit rate in a variety of contextual situations.
MAFS.6.RP.1.AP.2a:	Determine the unit rate in a variety of contextual situations.
MAFS.6.RP.1.AP.3a:	Use ratios and reasoning to solve real-world mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).
MAFS.6.RP.1.AP.3b:	Solve unit rate problems involving unit pricing using whole numbers.
MAFS.6.RP.1.AP.3c:	Solve one-step real-world measurement problems involving whole number unit rates when given the unit rate ("Three inches of snow falls per hour, how much falls in six hours?").
MAFS.6.RP.1.AP.3d:	Calculate a percentage of a quantity as rate per 100 using models (e.g., percent bars or 10 x 10 grids).

:	Calculate a percent of a quantity as rate per 100.
	• **Concrete:**
	  ◦ State a relationship to a quantity out of 100.
	  ◦ These will need to be very small concrete numbers (e.g., selects three from an object bundle of 100).
	• **Representation:**
	  ◦ Understand that a fraction is expressed as a percentage by converting it to an equivalent fraction with a denominator of 100.
	  ◦ Express a percent as a fraction (a/100).
	  ◦ Understand that hundreds (base-ten fractions) and percentages are the same, though the symbolic notation is different.
	  ◦ Understand concepts, symbols, and vocabulary: ratio, equivalent, percent, percentage.

:	Complete a conversion table for length, mass, time, volume.
:	Analyze table to answer questions.
:	Analyze table to answer questions.

Related Resources

Lesson Plan

Name	Description
"Analyzing Wordless Stories" An Introduction to Solving Unit Rates:	In this lesson, students will apply their understanding of ratios and prior knowledge of division to determine the unit rate for a given ratio. After some initial instruction on unit rates, students will determine unit rates from diagrams with teacher guidance, and they will determine unit rates from narrative descriptions independently.
"My Favorite Recipe." An introduction to ratios and rates.:	This lesson shows how ratios can be indicated in words such as "to", "for every", "out of every." In grade 6, rates mean "for each 1," "for each," and "per." The students will use diagrams and tables to build their ability to use proportional thinking. At the end of the lesson, the students will increase or decrease recipes they find in cookbooks.
All "Tired" Up:	In this lesson students will utilize mathematical computation skills involving percentages and critical thinking skills to select the best tire deals advertised.
	Students will create a working model that can determine the best regolith to binder solution for a settlement on Mars.

Ares Habitation Corporation and the Search for Lunarcrete:	The students are contacted by a company that requests their services. Students will read about, study and create their own lunarcrete (moon concrete). Students will work as a team to evaluate the provided data and determine which solution is most effective. Finally students will write a letter to the company defending their process giving reasons and data.
Best Day Care Center for William:	This MEA requires students to formulate a comparison-based solution to a problem involving choosing the BEST daycare based upon safety, playground equipment, meals, teacher to student ratio, cost, holiday availability and toilet training availability. Students are provided the context of the problem, a request letter from a client asking them to provide a recommendation, and data relevant to the situation. Students utilize the data to create a defensible model solution to present to the client. Students will receive practice on calculating a discount, finding the sum of the discounts, working with ratios and ranking day cares based on the data given.
Best Day Care Center in the Neighborhood:	This MEA requires students to formulate a comparison-based solution to a problem involving choosing the best day care center in the neighborhood for the residents of Dream Living Housing Community. Students are provided the context of the problem, a request letter from a client asking them to provide a recommendation, and data relevant to the situation. Students utilize the data to create a defensible model solution to present to the client.
Best School for Kevin:	In this MEA, the students will compare data to decide which school would be the best for a couple's son who is transferring into the county.
Better Buy: 75 fl oz or 150 fl oz?:	The students will clip out items from ads or by using a PowerPoint to determine the better buy between small quantities and large quantities. The students will answer the question, "Which item costs less per unit?" and demonstrate fluency in dividing with decimals.
Build Me a Beach House:	This is a multi-day activity that reinforces science, math, and technology skills by taking the students through the design process. Students will be tasked with designing and building a structure that could withstand high winds and water as would be found close to the seashore.
But Mom, I Really Want an iPad!!!!! Part 1:	In this lesson, students are asked to find how long it will take for a girl to raise the money needed to buy an iPad. Students explore various solution strategies, including making tables of equivalent ratios and writing an equation to find equivalent ratios. A situational story is used to capture the students' interest and to help students create a visual for the relationship between quantities in a ratio.
But Mom, I Really Want an iPad!!!!!! Part 2:	This is the 2nd Lesson where students are asked to solve a problem concerning the purchase of an iPad. Please see But Mom, I Really Want an iPad !! Part 1 (Resource 47500) for Lesson 1. Students are encouraged to use strategies to find equivalent ratios in their solutions.
Can You Stand the Wind and Rain?:	In this lesson, students will: - Investigate how natural disasters have affected human life in Florida. - Add, subtract, and multiply multi-digit decimals using the standard algorithm. - Find a percent of a quantity as a rate per 100 and then solve problems involving finding the whole given a part and the percent.
Catapult a Rate:	This lesson uses student created data to find the unit rate of distance per time. Students catapult three different coins, measure time and distance to find the rate of flight for each coin.
Champion Volleyball Team:	Students will help create a championship volleyball team by selecting 4 volleyball players to be added to open positions on the team. The students will use quantitative (ratios and decimals) and qualitative data to make their decisions.
Coding Geometry Challenge # 12 & 13:	This set of geometry challenges focuses on creating circles and calculating area/circumference as students problem solve and think as they learn to code using block coding software. Student will need to use their knowledge of the attributes of polygons and mathematical principals of geometry to accomplish the given challenges. The challenges start out fairly simple and move to more complex situations in which students can explore at their own pace or work as a team. Computer Science standards are seamlessly intertwined with the math standards while providing "Step it up!" and "Jump it up!" opportunities to increase rigor
Cosmic Nose Cones:	Students will design specific nose cones for a water bottle rocket. They will test them to find out and rate which one is most effective in terms of accuracy, speed, distance, and cost effectiveness. This information will be used as criteria for a company that designs nose cones for orbitary missions.
Don't Chase a Car! There is a better way...:	In this lesson, students will learn to solve a real world problem by using rates and ratios to calculate their running speed in MPH. - This is an activity that generates student interest because they get to go outside to generate and collect their own data to use in their calculations. - It's also a good collaborative project because students work in pairs or teams to collect their partners' times and rely on each other for accurate data.
Education and the Economy:	Students will learn about how investing in education affects the economy by interpreting data and writing a persuasive letter to the Chamber of Commerce.
Equivalent Fractions and Percents:	This lesson is designed to give students their very first experience with the concept and representation of percents. The activities seeks to lay a conceptual foundation for later problem solving with percents (MAFS.6.RP.1.3c) by building on students' prior knowledge of fractions with denominators of 10 or 100 and finding equivalent ratios. Throughout the lesson they use art to show the visual connection between fractions and percents. Students develop the knowledge that a percent is a part/whole ratio where the whole is measured in hundredths. The lesson gives students the opportunity to visually represent fractions and percents on a 10 x 10 grid, along with an enrichment activity if the teacher wants in expand to include decimal conversions and finding.
Genetics can be a Monster!:	In this lesson, students will use Punnett squares to calculate the probabilities of different genotypes and phenotypes produced by genetic crosses.

Happy Lawns: Lawn Care Service MEA:	This Model Eliciting Activity (MEA) is written at a 6th grade level. This MEA asks the students to decide on a lawn mower that will provide the Happy Lawns: Lawn Care Service with the best value for their money. Students are asked to rank order the lawn mowers in term of gas tank capacity, customer rating, speed, amount of time the mower takes to cut an acre of grass, shipping, and cost of the lawn mower. Students must provide a "Best Value" lawn mower to the company owner and explain how they arrived at their solution.
How Smooth Smoothie:	Students will analyze data to decide what blender to use, what size cups for adults, total ingredients needed, and create a variable that supports how many amounts and the total ounces of smoothies made.
Is It Fair?:	In this lesson students will use their understanding of ratios and unit rate to solve problems where they must decide whether various situations are fair.
It's Carnival Time!:	This lesson uses a carnival theme that challenges students to calculate unit rates and make measurement conversions to determine the best values for food. The students will use mathematical practices as they analyze and compute math problems and explain their own process for arriving at their solutions.
Lilys Cola TV Commercial:	Given a tight budget, students need to find the number of people that can be hired to film a soda commercial. Students will make the selection using a table that contains information about two types of extras. The union extra earns more money per hour than the non-union extra; however, the non-union extra needs more time to shoot the commercial than the union extra. In addition, students will select the design that would be used for the commercial taking into account the area that needs to be covered and the aesthetic factor.
Money: How to know where it is all going?:	This lesson will help students learn the importance of budgeting and the role percentages play in creating one, as well as how they apply to our daily living.
Neighborhood Hunt:	This MEA requires students to formulate a comparison-based solution to a problem involving choosing the best neighborhood for Ms. Jasmine to purchase a house. Students are provided the context of the problem, a request letter from a client asking them to provide a recommendation, and data relevant to the situation. Students utilize the data to create a defensible model solution to present to the client.
Orange Juice Conversion:	In this MEA, the students will be able to convert measurements within systems and between systems. They will be able to use problem solving skills to create a process for ranking orange juices for a Bed and Breakfast.
Pancakes over a Campfire!:	In this activity, students will learn how to set up ratios and calculate unit rates using a recipe.
Paper Route Logic:	The main problem students will need to solve is helping Lily Rae Wridenhoud find a route that will afford her the quickest time, least distance and highest customer satisfaction rating. Students will be given a map of all the streets leading around the neighborhood and customer rating (smiley faces). Students will need to use a ruler to figure out distances as well as decide elevation numbers on the topographic map. Then they will write out the route they have chosen to give Lily, and write a short explanation as to why this is the quickest and least distance traveled. Students will then be asked to look over their findings and be informed that some of the old clients have canceled the paper delivery and a few new paper clients have signed on. Does their new route still fit their findings?
PROFITS BY PROPORTIONS:	Students will use proportions to determine how much to charge for a ticket to their concert performance. They will justify the price of tickets based upon the cost of facility rental and the number of tickets they anticipate being able to sell.
Rate Your Local Produce Market:	The students will rank the local produce markets by using qualitative and quantitative data. The students will have to calculate unit rates and compare and order them.
RATIOS: Compare This!:	Students will explore ratios with models; express ratios in fraction form (simplest form), by use of a colon, and with words as a relationship between two quantities.
Real Estate Rental Agency MEA:	Students will choose the best location for a family relocating and will consider all of the factors to make the best decision.
Recognizing Proportional Relationships to Develop Sense of Scale:	This 90-minute lesson (15-minute pre-lesson, 60-minute lesson and 15-minute follow up lesson or homework) asks students to analyze proportional relationships to solve real world and mathematical problems. The examples use recipes, paint, and buildings. Students begin by working individually, then in pairs or threes, and then as a whole class. Student will need calculators, large sheets of paper to make a poster and the lesson materials.
Savvy Shopper:	This a culminating activity for unit rates that has students apply knowledge to purchasing groceries. Specifically how knowledge of unit rates can help save money over time.
Selecting a Car for Display/Ratio:	Teacher will use students' responses to their selection of the most efficient car to create and introduce ratio concepts and reasoning. The activities can be completed as a whole group, a few groups, or individually. The teacher may also alternate so that certain parts of the activities can be whole group, few groups, or individually according to the classrooms functional, behavioral, and academic levels.
Storm-Chasers: Weather & Climate:	In this MEA, students will use their knowledge of weather and climate to select a location for a camera crew to visit in order to get high quality video footage of severe weather such as thunderstorms, blizzards, tornadoes, or hurricanes. The decision will be made using data about important weather factors such as air pressure, humidity, temperature, wind direction, and wind speed.
Summer Road Trip:	Students will go on a "road trip" with a partner. Using the map scale they find out how far they traveled, how much gas they used, and how much the gas costs.
Teen Cell Phone Plans:	The purpose of this lesson is to solve real-world and mathematical problems using ratio and rate reasoning. Students will also use equivalent forms of decimals, percent applications to solve problems. They will write arguments to support claims with clear reasons and relevant evidence. Students will engage effectively in a range of collaborative discussions.
The Best Domestic Car:	In this MEA students will use problem-solving strategies to determine which car to recommend to Americans living in India.

The Concept of Ratios:	This lesson introduces students to the term ratio, its meaning and use, and the various ways in which a ratio can be presented.
The Price is Right:	In this lesson, students practice finding the unit price of pre-selected items from local grocery store ads to decide which store has the best prices. (from Beacon Learning Center)
Using Ratios and Reasoning to Calculate Cost of School Travel:	In this 80 minute lesson, students use a real world scenario of the cost of traveling to school to make sense of ratio concepts and use ratio reasoning. This lesson has several correct approaches and uses proportional relationships. The lesson starts as independent work, involves an 80 minute lesson, and a 20 minute follow-up lesson that can also be assigned as homework.
Using Security Camera Angles to Find Area and Calculate Percentages:	In this lesson, students work individually and then collectively using a real world situation to construct sight lines to see which areas are visible from a security camera. Students then find and compare the area of triangles and quadrilaterals and compare and calculate the percentages and/or fractions of areas.
Water, Water Everywhere!:	This lesson addresses current events regarding flooding in St. Petersburg, Florida. Students will create a water removal device from materials provided then use a 3D scanner to 3D print their devices.
What Does a Ratio Look Like?:	The class will use a PowerPoint presentation to take a stroll down the beach for some ice cream. The students must investigate how to write the number of ice cream cones in relation to the cost of ice cream.

Perspectives Video: Professional/Enthusiast

Name	Description
Amping Up Violin Tuning with Math:	Kyle Dunn, a Tallahassee-based luthier and owner of Stringfest, discusses how math is related to music.
Bicycle Mathematics: Selecting Gear Ratios for Performance:	Don't let math derail you. Learn how bicycle gears use ratios to help you ride comfortably on all kinds of terrain.
Coffee Mathematics: Ratios and Total Dissolvable Solids:	Math - the secret ingredient for an excellent cup of coffee!
Gear Heads and Gear Ratios:	Have a need for speed? Get out your spreadsheet! Race car drivers use algebraic formulas and spreadsheets to optimize car performance.
Isotopes and Paleoclimates:	Let this researcher explain how studying fossils and isotopes can help us understand ancient climate conditions!
KROS Pacific Ocean Kayak Journey: Calories, Distance, and Rowing Rates:	Food is fuel, especially important when your body is powering a boat across the ocean. Related Resources: KROS Pacific Ocean Kayak Journey: GPS Data Set[.XLSX] KROS Pacific Ocean Kayak Journey: Path Visualization for Google Earth[.KML]
KROS Pacific Ocean Kayak Journey: Kites, Wind, and Speed:	Lofty ideas about kites helped power a kayak from California to Hawaii. Related Resources: KROS Pacific Ocean Kayak Journey: GPS Data Set[.XLSX] KROS Pacific Ocean Kayak Journey: Path Visualization for Google Earth[.KML]
Mathematical Thinking for Ceramic 3D Printing:	In this video, Matthew Lawrence describes how mathematical thinking is important for 3D printing with ceramic materials.
Motorcycle Mathematics: Tuning Compression Ratios for Performance:	Get revved up about math when this motorcycle mechanic explains compression ratios.
Pizza Pi: Area, Circumference & Unit Rate:	How many times larger is the area of a large pizza compared to a small pizza? Which pizza is the better deal? Michael McKinnon of Gaines Street Pies talks about how the area, circumference and price per square inch is different depending on the size of the pizza.
Ratios of Horse Feed:	An equestrian describes, nay, explains mathematics principles applied to feeding a horse!
The Science and Math Behind Sour Fizzy Candy:	Master candymaker Wes Raley describes the process and science behind making sour fizzy candy.
Unit Rate and Florida Cave Formation:	How long does it take to form speleothems in the caves at Florida Caverns State Parks?
Unit Rate: Spring Water Bottling:	Nestle Waters discusses the importance of unit rate in the manufacturing process of bottling spring water.
Unit Rates in Swimming:	In this video, David Fermin demonstrates real-time estimates for monitoring swimming performance and physiology.

Problem-Solving Task

Name	Description
Anna in D.C.:	The purpose of this task is to give students an opportunity to solve a challenging multistep percentage problem that can be approached in several different ways. Students are asked to find the cost of a meal before tax and tip when given the total cost of the meal. The task can illustrate multiple standards depending on the prior knowledge of the students and the approach used to solve the problem.
Converting Square Units:	The purpose of this task is converting square units. Use the information provided to answer the questions posed. Since this task asks students to critique Jada's reasoning, it provides an opportunity to work on Standard for Mathematical Practice MAFS.K12.MP.3.1 - Construct Viable Arguments and Critique the Reasoning of Others.
Currency Exchange:	The purpose of this task is to have students convert multiple currencies to answer the problem. Students may find the CDN abbreviation for Canada confusing. Teachers may need to explain the fact that money in Canada is also called dollars, so to distinguish them, we call them Canadian dollars.

Dana's House:	Use the information provided to find out what percentage of Dana's lot won't be covered by the house.
Data Transfer:	This task asks the students to solve a real-world problem involving unit rates (data per unit time) using units that many teens and pre-teens have heard of but may not know the definition for. While the computations involved are not particularly complex, the units will be abstract for many students. The first solution relies more on reasoning about the meaning of multiplication and division, while the second solution uses units to help keep track of the steps in the solution process.
Friends Meeting on Bicycles:	Students are asked to use knowledge of rates and ratios to answer a series of questions involving time, distance, and speed.
Games at Recess:	Students are asked to write complete sentences to describe ratios for the context.
Jim and Jesse's Money:	Students are asked to use a ratio to determine how much money Jim and Jesse had at the start of their trip.
Kendall's Vase - Tax:	This problem asks the student to find a 3% sales tax on a vase valued at $450.
Lifting a Lion:	"Students will work in groups to solve a real-world problem presented by the book: How Do You Lift A Lion? Using a toy lion and a lever, students will discover how much work is needed to raise the toy lion. They will use proportions to determine the force needed to lift a real lion" from TI World Math.
Mangos for Sale:	Students are asked to determine if two different ratios are both appropriate for the same context.
Mixing Concrete:	Given a ratio, students are asked to determine how much of each ingredient is needed to make concrete.
Overlapping Squares:	This problem provides an interesting geometric context to work on the notion of percent. Two different methods for analyzing the geometry are provided: the first places the two squares next to one another and then moves one so that they overlap. The second solution sets up an equation to find the overlap in terms of given information which reflects the mathematical ideas described in cluster MAFS.6.EE.2 - Reason about and solve one-variable equations and inequalities.
Pennies to Heaven:	The goal of this task is to give students a context to investigate large numbers and measurements. Students need to fluently convert units with very large numbers in order to successfully complete this task. The total number of pennies minted either in a single year or for the last century is phenomenally large and difficult to grasp. One way to assess how large this number is would be to consider how far all of these pennies would reach if we were able to stack them one on top of another: this is another phenomenally large number but just how large may well come as a surprise.
Price Per Pound and Pounds Per Dollar:	Students are asked to use a given ratio to determine if two different interpretations of the ratio are correct and to determine the maximum quantity that could be purchased within a given context.
Ratio - Make Some Chocolate Crispies:	In this activity students calculate the ratio of chocolate to cereal when making a cake. Students then use that ratio to calculate to amount of chocolate and cereal necessary to make 21 cakes.
Ratio of Boys to Girls:	Use the information provided to find the ratio of boys to girls. Tasks like these help build appropriate connections between ratios and fractions. Students often write ratios as fractions, but in fact we reserve fractions to represent numbers or quantities rather than relationships between quantities. In some textbooks, a distinction is made between a ratio, which is assumed to have a common unit for both quantities, and a rate, which is defined to be a quotient of two quantities with different units (e.g. a ratio of the number of miles to the number of hours). No such distinction is made in the standards and hence, the two quantities in a ratio may or may not have a common unit.
Running at a Constant Speed:	Students are asked apply knowledge of ratios to answer several questions regarding speed, distance and time.
Running at a Constant Speed, Assessment Variation:	In this assessment, students are asked questions involving distance, rate, and time. Students will use and analyze concepts of ratio, unit rate, proportion, and proportional units.
Security Camera:	Students are asked to determine the percent of the area of a store covered by a security camera. Then, students are asked to determine the "best" place to position the camera and support their answer.
Shirt Sale:	Use the information provided to find out the original price of Selina's shirt. There are several different ways to reason through this problem; two approaches are shown.
Space Math - Comparing Planets Orbiting Other Stars:	This NASA lesson utilizes real world data about the size of planets orbiting other stars. Students are asked to use this data to compare the size of the planets to Earth and Jupiter. Lesson includes a visual representation and an answer key.
The Escalator, Assessment Variation:	Students are provided seven choices and are asked to determine the ratios that are correct for the given context.
Voting for Three, Variation 1:	This problem is the fifth in a series of seven about ratios. At first glance the problem may look to be beyond MAFS.6.RP.1.3, which limits itself to "describe a ratio relationship between two quantities." However, even though there are three quantities (the number of each candidates' votes), they are only considered two at a time.
Voting for Three, Variation 2:	This is the sixth problem in a series of seven that use the context of a classroom election. While it still deals with simple ratios and easily managed numbers, the mathematics surrounding the ratios are increasingly complex. In this problem, the students are asked to determine the difference in votes received by two of the three candidates.
Voting for Three, Variation 3:	This is the last problem of seven in a series about ratios set in the context of a classroom election. Since the number of voters is not known, the problem is quite abstract and requires a deep understanding of ratios and their relationship to fractions.
Voting for Two, Variation 1:	This is the first and most basic problem in a series of seven problems, all set in the context of a classroom election. Students are given a ratio and total number of voters and are asked to determine the number of votes received by each candidate.
	This is the second in a series of tasks that are set in the context of a classroom election. It requires students to

Voting for Two, Variation 2:	understand what ratios are and apply them in a context. The simple version of this question just asked how many votes each gets. This has the extra step of asking for the difference between the votes.
Voting for Two, Variation 3:	This problem is the third in a series of tasks set in the context of a class election. Students are given a ratio and total number of voters and are asked to determine the difference between the winning number of votes received and the number of votes needed for victory.
Voting for Two, Variation 4:	This is the fourth in a series of tasks about ratios set in the context of a classroom election. Given only a ratio, students are asked to determine the fractional difference between votes received and votes required.

Video/Audio/Animation

Name	Description
Atlantean Dodge Ball (An entetaining look at appropriate use of ratios and proportions):	Ratio errors confuse one of the coaches as two teams face off in an epic dodgeball tournament. See how mathematical techniques such as tables, graphs, measurements and equations help to find the missing part of a proportion. Atlantean Dodgeball addresses number and operations standards, the algebra standard, and the process standard, as established by the National Council of Teachers of Mathematics (NCTM). It guides students in: • Understanding and using ratios and proportions to represent quantitative relationships. • Relating and comparing different forms of representation for a relationship. • Developing, analyzing, and explaining methods for solving problems involving proportions, such as scaling and finding equivalent ratios. • Representing, analyzing, and generalizing a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
Bad Date (A Real World Application of Ratios):	In this video from Math Snacks, a women goes on three dates, after which she analyzes the ratio of how many words she speaks compared to the number of words her date speaks. By attaining a 1:1 ratio of words, she attains her "Happily Ever After." (Apparently, in her eyes, this is the only desirable quality in a man that really matters.) A learner's guide, teachers guide, and transcript of the video is included.
Understanding Percentages:	Percentages are one method of describing a fraction of a quantity. the percent is the numerator of a fraction whose denominator is understood to be one-hundred.

Teaching Idea

Name	Description
Baby Whale Formula-SeaWorld Classroom Activity:	In this problem solving activity, students will practice measuring and making calculations in the context of providing nutrients to a baby whale that was rescued.
Space Math: Estimating the Speed of a Tsunami:	Students use real-world data from the 2011 Pacific Ocean earthquake and tsunami to estimate the speed of the tsunami as it crossed the Pacific Ocean. Students will also need to work through the issue of time zones and the International Date Line.

Formative Assessment

Name	Description
Bargain Breakfast:	Students are given the prices of three different quantities of cereal and are asked to determine which is the best buy.
Book Rates:	Students write and explain the meaning of a ratio and corresponding unit rate in the context of a word problem.
Comparing Rates:	Students are asked to solve rate problems given the time it takes each of two animals to run different distances.
Comparing Rectangles:	Students are asked to determine which of three given comparisons contains a correctly computed ratio in a context involving rectangles.
Comparing Time:	Students are given a scenario involving an additive comparison of two quantities, asked to write a ratio, and explain its meaning.
Explaining Rates:	Students are asked to explain the meaning of given rates and identify any that are unit rates.
Finding the Whole:	Students are asked to find the whole given a part and a percent.
Homework Time:	Students are asked to convert a given rate to an equivalent rate out of 100.
Identifying Unit Rates:	Students are asked to decide if given statements express unit rates.
Interpreting Ratios:	Students are asked to explain the meaning of ratios in the context of problems.
Making Coffee:	Students are asked to write ratios equivalent to a given ratio.
Measurement Conversion:	Students are asked to make unit conversions.
Party Punch - Compare Ratios:	Students are asked to compare ratios given in two different tables.
Sara's Hike:	Students are asked to solve a problem involving ratios.
The Meaning of Pi:	Students are asked to explain the relationship between the circumference and diameter of a circle in terms of pi.
Writing Ratios:	Students are asked to write part-to-part and part-to-whole ratios using values given in a table.
Writing Unit Rates:	Students are given verbal descriptions of rates and asked to write them as unit rates.

Perspectives Video: Teaching Idea

Name	Description
Bicycle Mathematics: Speed and Distance Calculations:	Cycling involves a lot of real-time math when you use an on-board computer. Learn about lesson ideas and how computers help with understanding performance.
Robot Mathematics: Gearing Ratio Calculations for Performance:	A science teacher demonstrates stepwise calculations involving multiple variables for designing robots with desired characteristics.
Sling Psychrometers for Measuring Relative Humidity!:	Dave Rodriguez demonstrates the use of a sling psychrometer to compare wet and dry-bulb temperatures to determine relative humidity.

Tutorial

Name	Description
Converting Speed Units:	In this lesson, students will be viewing a Khan Academy video that will show how to convert ratios using speed units.
Finding a Percent:	You are asked to find the percent when given the part and the whole.
Percent of a Whole Number:	This video demonstrates how to find percent of a whole number.
Percent word problem example 2:	It's nice to practice conversion problems, but how about applying our new knowledge of percentages to a real life problem like recycling? Hint: don't forget your long division!
Percent Word Problem Example 3:	You're asked to find the whole when given the part and the percent.
Ratio word problem: boys to girls:	In this example, we are given a ratio and then asked to apply that ratio to solve a problem. No problem!
Ratio word problem: centimeters to kilometers:	Let's solve this word problem using what we know about equivalent ratios.
Solving Unit Price Problem:	This video demonstrates solving a unit price problem using equivalent ratios.
Solving Unit Rate Problem:	This video demonstrates solving a unit rate problem using equivalent ratios.
The Meaning of Percent:	This video talks about what percent really means by looking at a 10 by 10 grid.

Virtual Manipulative

Name	Description
Converting Units Through Dimensional Analysis:	Using this virtual manipulative, students apply dimensional analysis (AKA factor-label method or unit-factor method) to solve unit conversion problems. There is also the opportunity to create your own unit conversion problems.
Mixtures:	In this online activity, students apply their understanding of proportional relationships by adding circles, either colored or not, to two different piles then combine the piles to produce a required percentage of colored circles. Students can play in four modes: exploration, unknown part, unknown whole, or unknown percent. This activity also includes supplemental materials in tabs above the applet, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the Java applet.
Percentages:	This virtual manipulative allows the student to enter any two of the three quantities involved in percentage computation: the whole, a part and the percent. This manipulative can also be used for the discussions of relations among fractions, decimals, ratios and percentages.
Planet Size Comparison: Ratio:	Images of two planets selected on two drop-down menus with a display of their respective diameters and the applicable ratio.

Student Center Activity

Name	Description
Edcite: Mathematics Grade 6:	Students can practice answering mathematics questions on a variety of topics. With an account, students can save their work and send it to their teacher when complete.

Educational Game

Name	Description
Flower Power: An Ordering of Rational Numbers Game:	This is a fun and interactive game that helps students practice ordering rational numbers, including decimals, fractions, and percents. You are planting and harvesting flowers for cash. Allow the bee to pollinate, and you can multiply your crops and cash rewards!
Fractions Decimals Percents Jeopardy Game:	In this interactive Jeopardy game, students convert fractions to decimals and percents and convert percents to fractions and decimals. Up to four teams or individuals can play the game, and members of each team or individuals can pick which category and amount they would like to answer in order to score the most points.
Ice Ice Maybe: An Operations Estimation Game:	This fun and interactive game helps practice estimation skills, using various operations of choice, including addition, subtraction, multiplication, division, using decimals, fractions, and percents. Various levels of difficulty make this game appropriate for multiple age and ability levels. Addition/Subtraction: The addition and subtraction of whole numbers, the addition and subtraction of decimals. Multiplication/Division: The multiplication and addition of fractions and decimals.

Percentages: Identify the percentage of a whole number.

Fractions: Multiply and divde a whole number by a fraction, as well as apply properties of operations.

Unit/Lesson Sequence

Name	Description
Functions-Day Trips (National Security Agency):	In this 3-lesson unit, Students explore functions as they use their knowledge of patterns and number operations to analyze function tables and graph them. Using tables and graphs, students determine which items are the best deals.

Original Student Tutorial

Name	Description
	Learn how to identify explicit evidence and understand implicit meaning in a text.
Helping Chef Ratio:	You will be able to organize information in a table and write ratios equivalent to a given ratio in order to solve real-world and mathematical problems.

Text Resource

Name	Description
Hitting Streaks Spread Success:	This informational text resource is intended to support reading in the content area. Although scientists haven't determined a specific reason why one baseball player's hitting streak improves his whole team's performance, they have observed a very real mathematical pattern. There may be many reasons for the phenomenon, but no one has found them out yet.

Worksheet

Name	Description
Ratios and Rates - Using Ratio Tables to Make Comparisons:	This resource is made up of a sequence of worksheets and is useful for a different look at how ratios work. It uses ratio tables extensively and is good for open discussion with classes. This resource might work well for struggling students. This was developed by Dr. Stephan and Mr. McManus at LCMS.
Shopping and Conversion Word Problems:	This ready-to-print worksheet presents students with three shopping problems that challenge students to convert between smaller and larger measurement units and use all four mathematical operations. There are a total of seven questions involving these three problems, and the conversions which students must undertake involve dollars and cents, pounds and ounces, grams and kilograms, and centimeters and meters.
Splash of Math - SeaWorld Classroom Activity:	This resource allows students to assume the role of an ethologist provide 4 activities that challenge students to apply mathematics to solve complex real-life problems: • **Activity A: Watch the Whales** - Determine average speed, distance, and percentage of time at the surface of gray whales. • **Activity B: Time Tally** - From observations of a dolphin determine total time and percentage of time of certain behaviors. • **Activity C: Deep Divers** - Determine average dive depth, diving time, and surface time of an elephant seal. • **Activity D: Breaches of the Humpback** - Graph data and make a prediction from the graph. In this activity, the students will practice problem solving skills to solve complex real-life problems.

Assessment

Name	Description
Sample 1 - Sixth Grade Math State Interim Assessment:	This is a State Interim Assessment for sixth grade.
Sample 2 - Sixth Grade Math State Interim Assessment:	This is a State Interim Assessment for sixth grade.
Sample 3 - Sixth Grade Math State Interim Assessment:	This is a State Interim Assessment for sixth grade.
Sample 4 - Sixth Grade Math State Interim Assessment:	This is a State Interim Assessment for sixth grade.

Perspectives Video: Expert

Name	Description
Statistical Sampling Results in setting Legal Catch Rate :	Fish Ecologist, Dean Grubbs, discusses how using statistical sampling can help determine legal catch rates for fish that may be endangered.

Student Resources

Title	Description
Anna in D.C.:	The purpose of this task is to give students an opportunity to solve a challenging multistep percentage problem that can be approached in several different ways. Students are asked to find the cost of a meal before tax and tip when given the total cost of the meal. The task can illustrate multiple standards depending on the prior knowledge of the students and the approach used to solve the problem.
	Ratio errors confuse one of the coaches as two teams face off in an epic dodgeball tournament. See how mathematical techniques such as tables, graphs, measurements and equations help to find the missing part of a

	proportion.
Atlantean Dodge Ball (An entetaining look at appropriate use of ratios and proportions):	Atlantean Dodgeball addresses number and operations standards, the algebra standard, and the process standard, as established by the National Council of Teachers of Mathematics (NCTM). It guides students in: • Understanding and using ratios and proportions to represent quantitative relationships. • Relating and comparing different forms of representation for a relationship. • Developing, analyzing, and explaining methods for solving problems involving proportions, such as scaling and finding equivalent ratios. • Representing, analyzing, and generalizing a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
Converting Speed Units:	In this lesson, students will be viewing a Khan Academy video that will show how to convert ratios using speed units.
Converting Square Units:	The purpose of this task is converting square units. Use the information provided to answer the questions posed. Since this task asks students to critique Jada's reasoning, it provides an opportunity to work on Standard for Mathematical Practice MAFS.K12.MP.3.1 - Construct Viable Arguments and Critique the Reasoning of Others.
Converting Units Through Dimensional Analysis:	Using this virtual manipulative, students apply dimensional analysis (AKA factor-label method or unit-factor method) to solve unit conversion problems. There is also the opportunity to create your own unit conversion problems.
Currency Exchange:	The purpose of this task is to have students convert multiple currencies to answer the problem. Students may find the CDN abbreviation for Canada confusing. Teachers may need to explain the fact that money in Canada is also called dollars, so to distinguish them, we call them Canadian dollars.
Dana's House:	Use the information provided to find out what percentage of Dana's lot won't be covered by the house.
Data Transfer:	This task asks the students to solve a real-world problem involving unit rates (data per unit time) using units that many teens and pre-teens have heard of but may not know the definition for. While the computations involved are not particularly complex, the units will be abstract for many students. The first solution relies more on reasoning about the meaning of multiplication and division, while the second solution uses units to help keep track of the steps in the solution process.
Edcite: Mathematics Grade 6:	Students can practice answering mathematics questions on a variety of topics. With an account, students can save their work and send it to their teacher when complete.
Finding a Percent:	You are asked to find the percent when given the part and the whole.
Flower Power: An Ordering of Rational Numbers Game:	This is a fun and interactive game that helps students practice ordering rational numbers, including decimals, fractions, and percents. You are planting and harvesting flowers for cash. Allow the bee to pollinate, and you can multiply your crops and cash rewards!
Friends Meeting on Bicycles:	Students are asked to use knowledge of rates and ratios to answer a series of questions involving time, distance, and speed.
Games at Recess:	Students are asked to write complete sentences to describe ratios for the context.
Helping Chef Ratio:	Learn how to identify explicit evidence and understand implicit meaning in a text. You will be able to organize information in a table and write ratios equivalent to a given ratio in order to solve real-world and mathematical problems.
Ice Ice Maybe: An Operations Estimation Game:	This fun and interactive game helps practice estimation skills, using various operations of choice, including addition, subtraction, multiplication, division, using decimals, fractions, and percents. Various levels of difficulty make this game appropriate for multiple age and ability levels. Addition/Subtraction: The addition and subtraction of whole numbers, the addition and subtraction of decimals. Multiplication/Division: The multiplication and addition of fractions and decimals. Percentages: Identify the percentage of a whole number. Fractions: Multiply and divde a whole number by a fraction, as well as apply properties of operations.
Jim and Jesse's Money:	Students are asked to use a ratio to determine how much money Jim and Jesse had at the start of their trip.
Kendall's Vase - Tax:	This problem asks the student to find a 3% sales tax on a vase valued at $450.
Mangos for Sale:	Students are asked to determine if two different ratios are both appropriate for the same context.
Mixing Concrete:	Given a ratio, students are asked to determine how much of each ingredient is needed to make concrete.
Mixtures:	In this online activity, students apply their understanding of proportional relationships by adding circles, either colored or not, to two different piles then combine the piles to produce a required percentage of colored circles. Students can play in four modes: exploration, unknown part, unknown whole, or unknown percent. This activity also includes supplemental materials in tabs above the applet, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the Java applet.
Overlapping Squares:	This problem provides an interesting geometric context to work on the notion of percent. Two different methods for analyzing the geometry are provided: the first places the two squares next to one another and then moves one so that they overlap. The second solution sets up an equation to find the overlap in terms of given information which reflects the mathematical ideas described in cluster MAFS.6.EE.2 - Reason about and solve one-variable equations and inequalities.

Pennies to Heaven:	The goal of this task is to give students a context to investigate large numbers and measurements. Students need to fluently convert units with very large numbers in order to successfully complete this task. The total number of pennies minted either in a single year or for the last century is phenomenally large and difficult to grasp. One way to assess how large this number is would be to consider how far all of these pennies would reach if we were able to stack them one on top of another: this is another phenomenally large number but just how large may well come as a surprise.
Percent of a Whole Number:	This video demonstrates how to find percent of a whole number.
Percent word problem example 2:	It's nice to practice conversion problems, but how about applying our new knowledge of percentages to a real life problem like recycling? Hint: don't forget your long division!
Percent Word Problem Example 3:	You're asked to find the whole when given the part and the percent.
Percentages:	This virtual manipulative allows the student to enter any two of the three quantities involved in percentage computation: the whole, a part and the percent. This manipulative can also be used for the discussions of relations among fractions, decimals, ratios and percentages.
Price Per Pound and Pounds Per Dollar:	Students are asked to use a given ratio to determine if two different interpretations of the ratio are correct and to determine the maximum quantity that could be purchased within a given context.
Ratio word problem: boys to girls:	In this example, we are given a ratio and then asked to apply that ratio to solve a problem. No problem!
Ratio word problem: centimeters to kilometers:	Let's solve this word problem using what we know about equivalent ratios.
Running at a Constant Speed:	Students are asked apply knowledge of ratios to answer several questions regarding speed, distance and time.
Security Camera:	Students are asked to determine the percent of the area of a store covered by a security camera. Then, students are asked to determine the "best" place to position the camera and support their answer.
Shirt Sale:	Use the information provided to find out the original price of Selina's shirt. There are several different ways to reason through this problem; two approaches are shown.
Solving Unit Price Problem:	This video demonstrates solving a unit price problem using equivalent ratios.
The Meaning of Percent:	This video talks about what percent really means by looking at a 10 by 10 grid.
Understanding Percentages:	Percentages are one method of describing a fraction of a quantity. the percent is the numerator of a fraction whose denominator is understood to be one-hundred.
Voting for Three, Variation 1:	This problem is the fifth in a series of seven about ratios. At first glance the problem may look to be beyond MAFS.6.RP.1.3, which limits itself to "describe a ratio relationship between two quantities." However, even though there are three quantities (the number of each candidates' votes), they are only considered two at a time.
Voting for Three, Variation 2:	This is the sixth problem in a series of seven that use the context of a classroom election. While it still deals with simple ratios and easily managed numbers, the mathematics surrounding the ratios are increasingly complex. In this problem, the students are asked to determine the difference in votes received by two of the three candidates.
Voting for Three, Variation 3:	This is the last problem of seven in a series about ratios set in the context of a classroom election. Since the number of voters is not known, the problem is quite abstract and requires a deep understanding of ratios and their relationship to fractions.
Voting for Two, Variation 1:	This is the first and most basic problem in a series of seven problems, all set in the context of a classroom election. Students are given a ratio and total number of voters and are asked to determine the number of votes received by each candidate.
Voting for Two, Variation 2:	This is the second in a series of tasks that are set in the context of a classroom election. It requires students to understand what ratios are and apply them in a context. The simple version of this question just asked how many votes each gets. This has the extra step of asking for the difference between the votes.
Voting for Two, Variation 3:	This problem is the third in a series of tasks set in the context of a class election. Students are given a ratio and total number of voters and are asked to determine the difference between the winning number of votes received and the number of votes needed for victory.
Voting for Two, Variation 4:	This is the fourth in a series of tasks about ratios set in the context of a classroom election. Given only a ratio, students are asked to determine the fractional difference between votes received and votes required.

Parent Resources

Title	Description
Anna in D.C.:	The purpose of this task is to give students an opportunity to solve a challenging multistep percentage problem that can be approached in several different ways. Students are asked to find the cost of a meal before tax and tip when given the total cost of the meal. The task can illustrate multiple standards depending on the prior knowledge of the students and the approach used to solve the problem.
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Mangos for Sale:	Students are asked to determine if two different ratios are both appropriate for the same context.
Mixing Concrete:	Given a ratio, students are asked to determine how much of each ingredient is needed to make concrete.
Overlapping Squares:	This problem provides an interesting geometric context to work on the notion of percent. Two different methods for analyzing the geometry are provided: the first places the two squares next to one another and then moves one so that they overlap. The second solution sets up an equation to find the overlap in terms of given information which reflects the mathematical ideas described in cluster MAFS.6.EE.2 - Reason about and solve one-variable equations and inequalities.
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Percentages:	This virtual manipulative allows the student to enter any two of the three quantities involved in percentage computation: the whole, a part and the percent. This manipulative can also be used for the discussions of relations among fractions, decimals, ratios and percentages.
Price Per Pound and Pounds Per Dollar:	Students are asked to use a given ratio to determine if two different interpretations of the ratio are correct and to determine the maximum quantity that could be purchased within a given context.
Ratio - Make Some Chocolate Crispies:	In this activity students calculate the ratio of chocolate to cereal when making a cake. Students then use that ratio to calculate to amount of chocolate and cereal necessary to make 21 cakes.
Running at a Constant Speed:	Students are asked apply knowledge of ratios to answer several questions regarding speed, distance and time.
Security Camera:	Students are asked to determine the percent of the area of a store covered by a security camera. Then, students are asked to determine the "best" place to position the camera and support their answer.
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Voting for Three, Variation 2:	This is the sixth problem in a series of seven that use the context of a classroom election. While it still deals with simple ratios and easily managed numbers, the mathematics surrounding the ratios are increasingly complex. In this problem, the students are asked to determine the difference in votes received by two of the three candidates.
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[Voting for Two, Variation 4:](#)	This is the fourth in a series of tasks about ratios set in the context of a classroom election. Given only a ratio, students are asked to determine the fractional difference between votes received and votes required.