REACH ACADEMY FOR GIRLS
GRADE 6
UNIT: RATIOS, RATES AND PROPORTIONS

Unit 2

Connections to Previous Learning:
The study of ratios and proportional relationships extends students' work in measurement and in multiplication and division from the elementary grades. It is expected that students will have prior knowledge and experience related to concepts and skills such as multiples, factors, and divisibility rules. This background knowledge about relationships and rules for multiplication and division of whole numbers connects to the understanding of how to complete tables to help support the development of ratio and rate reasoning.

Focus of this Unit:
Students learn that a ratio expresses the comparison between two quantities. Special types of ratios are rates, unit rates, measurement conversions, and percentages and are concepts that are applied to a variety of real world and mathematical situations. Students gain a deeper understanding of proportional reasoning through instruction and practice. They develop and use multiplicative thinking to develop a sense of proportional reasoning as they describe ratio relationships between two quantities.

Connections to Subsequent Learning:
Ratios and proportional relationships are foundational for further study in mathematics and science and useful in everyday life. Students use ratios in geometry and in algebra when they study similar figures and slopes of lines, and later when they study sine, cosine, tangent, and other trigonometric ratios in high school. Students use ratios when they work with situations involving constant rates of change, and later in calculus when they work with average and instantaneous rates of change of functions. An understanding of ratio is essential in the sciences to make sense of quantities that involve derived attributes such as speed, acceleration, density, surface tension, electric or magnetic field strength, and to understand percentages and ratios used in describing chemical solutions. Ratios and percentages are also useful in many situations in daily life, such as in cooking and in calculating tips, miles per gallon, taxes, and discounts. They are also involved in a variety of descriptive statistics, including demographic, economic, medical, meteorological, and agricultural statistics (e.g., birth rate, per capita income, body mass index, rain fall, and crop yield) and underlie a variety of measures, for example, in finance (exchange rate), medicine (dose for a given body weight), and technology (kilobits per second).

Established Goals:
This 4-5 week unit focuses on developing an understanding of ratio concepts and using ratio reasoning to solve problems. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Students learn to use ratio and rate language to describe relationships; expand the scope of problems for which they can use multiplication and division; connect ratios and fractions; and solve a wide variety of problems involving ratios and rates.

Common Core Learning Standards:
Understand ratio concepts and use ratio reasoning to solve problems.

- **6.RP.1** Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities.
- **6.RP.2** Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship.
- **6.RP.3** Use ratio and rate reasoning to solve real-world and mathematical problems, i.e., 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.

Represent and analyze quantitative relationships between dependent and independent variables.
6.EE.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent

Understandings: Students will understand that …	**Essential Questions:**
• A ratio expresses the comparison between two quantities. Special types of ratios are rates, unit rates, measurement conversions, and percent. • A ratio or a rate expresses the relationship between two quantities. Ratio and rate language is used to describe a relationship between two quantities (including unit rates.) • A rate is a type of ratio that represents a measure, quantity, or frequency, typically one measured against a different type of measure, quantity, or frequency. • Ratio and rate reasoning can be applied to many different types of mathematical and real-life problems (rate and unit rate problems, scaling, unit pricing, statistical analysis, etc.). • A ratio is a multiplicative comparison of two quantities, or it is a joining of two quantities in a composed unit. • Reasoning with ratios involves attending to and coordinating two quantities. • If one quantity in a ratio is multiplied or divided by a particular factor, then the other quantity must be multiplied by the same factor to maintain the proportional relationship. • Knowledge of equivalent fractions and equivalent ratios can be used to model ratio, rate and proportional reasoning grounded in sense making. • This knowledge can be generalized into algorithms for solving ratio, rate and proportion problems.	• How are ratios and rates related to fractions? • How can I use multiplication and division to solve ratio and rate problems? • What is the difference between a ratio and a rate? • How can I use tables of equivalent ratios, tape diagrams, double number line diagrams, or equations to compare rates of change? • What important elements do I need to know about proportional reasoning and when should I apply it? • When is it useful to be able to relate one quantity to another? • How are ratios and rates similar and different? • What is the connection between a ratio and a fraction?

Students will know…(Content knowledge)

Prior Knowledge:

- Fluency with multiplication and division of whole numbers
- Ability to generate factors and multiples
- Understanding of fractions and fraction equivalence
- Divisibility Rules
- Understanding Common Fractions

Ratio and Rate:

- Whole number multiplication and division
- "Scaling up" and "scaling down'
- Rate
- Unit Rate
- Speed
- Fractions
- Equivalent fractions
- Percent
- Problem solving
- Reasoning
- Tools:

Multiplication tables
Tables of equivalent ratios
Tape diagrams
Double number line diagrams
Equations

Proportion:

- Equivalent ratios
- Equivalent fractions
- Product of the means and extremes
- Problem Solving
- Reasoning

Coordinate Geometry and Algebra:*

- Coordinate plane
- Ordered pairs
- Plotting points

*Will be introduced in depth when Common Core are completely implemented.

<u>Vocabulary</u>

Ratio, rate, equivalent ratios, unit rate, per, percent, form, proportion, proportional relationships, scale, composed unit, unit price, constant speed, rate of change, multiplicative relationship, coordinate plane, x-axis, y-axis, origin, ordered pairs

Students will be able to…(Skills/Use continuum)

- **Apply** multiplicative reasoning to explain the concept of ratio
- Solve unit rate problems (including unit pricing and constant speed).
- Solve percent problems, including finding a percent of a quantity as a rate per 100 and finding the whole, given the part and the percent.
- Use variables to represent two quantities in a real-world problem that change in relationship to one another.
- Write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.
- Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
- **Use** ratio language to describe a ratio relationship between two quantities
- **Understand** and **apply** the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$
- **Use** rate language in the context of a ratio relationship.
- **Distinguish** the difference between rate and ratio
- **Apply** concepts of rate and ratio to solve real world problems, using tables of equivalent ratios, tape diagrams, double number line diagrams, or equations
- **Make** tables of equivalent ratios relating quantities with whole-number measurements
- **Create** equivalent fractions, given a fraction
- **Solve** unit rate problems, including those involving unit pricing and constant speed
- **Express** ratios in different forms
- Express equivalent ratios as a proportion
- Solve proportions using equivalent fractions
- Verify the proportionality of two ratios using the Cross Products Property ($a/b = c/d$ is true if $ad = bc$, $d \neq 0$)
- Read, write, and identify percents of a whole (0% to 100%)
- 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 percent, rate, and base
- Use tables to compare ratios.
- Use ratio reasoning to convert measurement units; manipulate and transform measurement
- Units appropriately when multiplying or dividing quantities.

Stage 2 – Assessment Evidence	
Performance Tasks: The Fraction Task – https://www.engageny.org/sites/default/files/resource/attachments/g7-m1-teacher-materials.pdf Cereal Task – Compare two cereals to determine the ratio of protein to cereal and which of the two cereals has a higher ratio of protein. https://www.engageny.org/resource/grade-6-mathematics Mixing Paint Task – Skill: Rates and Part to Part and Part to Whole Relationships Use ratios and percents to solve a practical problem involving the mixing of paint. http://noycefdn.org/documents/math/MARS/MARS2003/tft2003gr7.pdf#page=3 **Final Task:** Ratio and Proportion Relationship – – https://www.engageny.org/resource/grade-6-mathematics-module-1 **INSTRUCTIONAL RESOURCES AND TOOLS** • 100 grids (10 x 10) for modeling percent • Bar Models – for example, 4 red bars to 6 blue bars as a visual representation of a ratio and then expand the number of bars to show other equivalent ratios • Double Number Lines • Ratio tables – to use for proportional reasoning • Tape Diagrams	**Other Evidence (Tests & Quizzes)** Pretest: Ratio and Proportion Relationship – https://grade6commoncoremath.wikispaces.hcpss.org/Unit+1+Ratios+and+Proportional+Relationships
Stage 3 – Learning Plan	

PRETEST: Ratio and Proportion Relationship
At the beginning of the unit the teacher will give the class The 6th Grade Performance Assessment: **Ratio and Proportion Relationship**: https://grade6commoncoremath.wikispaces.hcpss.org/Unit+1+Ratios+and+Proportional+Relationships as a tool for inventory. It will be used at the end of unit to see how students have improved their thinking and mathematical skills over the course of the instructional unit.

INITIAL TASK: The Fraction Task
The Fraction Task is rich enough as it can be solved from a variety of approaches, thereby allowing students to make sense of it in natural ways. As the unit progresses, students should be able to move to more efficient or grade-level appropriate strategies. As the students learn new ideas or procedures, students and the teacher can reflect upon how these new ideas and procedures might apply to the Fractions Task.

Other Tasks:

The Fraction Task – https://www.engageny.org/sites/default/files/resource/attachments/g7-m1-teacher-materials.pdf

Cereal Task – Compare two cereals to determine the ratio of protein to cereal and which of the two cereals has a higher ratio of protein. https://www.engageny.org/resource/grade-6-mathematics

Mixing Paint Task -_Skill: Rates and Part to Part and Part to Whole Relationships - Use ratios and percent to solve a practical problem involving the mixing of paint. http://noycefdn.org/documents/math/MARS/MARS2003/tft2003gr7.pdf#page=3

Final Task: Ratio and Proportion Relationship – https://www.engageny.org/resource/grade-6-mathematics-module-1

PORTFOLIO TASK: Final Task: Ratio and Proportion Relationship (to check for growth) https://grade6commoncoremath.wikispaces.hcpss.org/Unit+1+Ratios+and+Proportional+Relationships

Sequence of Key Learning Events and Instruction

Lesson 1	Introduction to Ratios	1 session
Lesson 2	Writing Ratios	1 session
Lesson 3	Equivalent Ratios Part 1	1 session
Lesson 4	Equivalent Ratios Part 2	1 session
Lesson 5	Solving Mathematical and Real-Life Problems with Ratios	2 sessions
Lesson 6	Ratios: Review and Assessment	2 sessions
Lesson 7	Understanding Rates and Unit Rates	1 session
Lesson 8	Solving Problems with Unit Rates	1 session
Lesson 9	Using Rates / Unit Rates to Make Good Consumer Decisions	1 session
Lesson 10	Rates and Unit Rates Assessment	1 session
Lesson 11	What is a Percent?	1 session
Lesson 12	Percent and Tape Diagrams	1 session
Lesson 13	Solving Percent Problems: Missing Part, Missing Percent	1 session
Lesson 14	Solving Percent Problems: Missing Whole	2 sessions
Lesson 15	Curriculum-Embedded Performance Task	3-5 sessions

FINAL TASK: Ratio and Proportion Relationship
At the end of the unit the teacher should give the class The 6th Grade Performance Assessment: **Ratio and Proportion Relationship** to see how students have improved their thinking and mathematical skills over the course of the instructional unit.

Lesson 2: Writing Ratios

Brief Overview of Lesson:

Students practice writing part : part and part : whole ratios in three formats: 1to 4, 1:4, and ¼. They pay attention to the order of the quantities. For example, the ratio of 1 cup of sugar to 4 cups of flour should be written as 1:4, and not 4:1. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Multiplying fractions
- Finding equivalent fractions.

Estimated Time (minutes): 50 mins

Resources for Lesson:

- Pictures of objects in scattered arrangements (provided by teacher)
- Websites
- Lesson 2: In-Class Work
- Lesson 2: Homework

By the end of this lesson students will know and be able to:

By the end of this lesson students will know:

- A ratio expresses the relationship between two related quantities.
- Ratios can be represented in a variety of formats including 1 to 5, 1/5, 1:5..

By the end of this lesson, students will be able to:

- Write a ratio to express the relationship between two quantities.
- Use proper ratio notation and language to describe the relationship between two quantities.

Essential Question(s) addressed in this lesson:

- When is it useful to be able to relate one quantity to another?
- How are ratios used in everyday life?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

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 3 votes."

6.SMP.4 Model with mathematics. Students model real-life situations with mathematics.

Teacher Notes

In this lesson, the focus is on writing ratios that accurately represent mathematical, tabular, or pictorial situations. In the next lesson, students will be asked to express ratios in simplest form. Here are some additional technology resources for all students. These resources facilitate students model with mathematics (SMP.4) The first one may be very useful for students with disabilities or ELLs.

1. http://www.thinkingblocks.com/ThinkingBlocks_Ratios/ TB_Ratio_Main.html
   Interactive site where students are taught how to use blocks to model ratio problems. Problems may ask students to find one of the two quantities in the ratio, the difference between the two quantities, or the total. Provides a video with step-by-step clear, visual, auditory demonstration of using blocks to solve ratio problems. Teachers can use to guide instruction with block manipulatives , or students can virtually manipulate blocks.

2. http://illuminations.nctm.org/LessonDetail.aspx? id=L722
   Pairs (or groups) of students use a cup of beans to find ratios to express the number of marked beans in the cup compared to the total number of beans in the cup. Theoretically, each sample should be essentially the same. The decimal representation of each ratio confirms that ratios are, indeed, approximately equivalent.

Lesson 3: Equivalent Ratios

Brief Overview of Lesson:

Students make the connection between equivalent fractions and equivalent ratios. They find missing values in a table of equivalent ratios, establishing the multiplicative relationship first rather than looking for iterative patterns in the table. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

1. Students can create and complete tables.
2. Students can multiply multi-digit numbers.
3. Students understand that equivalent fractions are different names for the same quantity.
4. Students can use different strategies to find equivalent fractions.
5. Students understand that a fraction a/b is a multiple of 1/b.

Estimated Time (minutes): 50 mins

Resources for Lesson:

Equivalent ratios quiz printed out from http://www.math-aids.com/Ratios (See description below in Formative Assessment)
Lesson 3 Homework

Unit: Ratios, Rates, and Percents
Lesson 3: Equivalent Ratios
Time (minutes): 50 mins

By the end of this lesson students will know and be able to:

By the end of this lesson students will know: Mathematical strategies for solving problems involving ratios, including tables, and equivalent fractions.

By the end of this lesson, students will be able to:

- Make tables of equivalent ratios.
- Find missing values in tables of equivalent ratios.

Essential Question(s) addressed in this lesson:

- Are all fractions ratios? Why or why not?
- How can I use what I know about fractions to solve ratio problems?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

6.RP.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 lines, or equations.

a. Make tables of equivalent ratios relating quantities with whole-number measurements, and find missing values in the table.

Use tables to compare ratios.

6.MP.7 Look for and make use of structure.

Assumptions about what students know and are able to do coming into this lesson (including language needs):

- Students can create and complete tables.
- Students can multiply multi-digit numbers.
- Students understand that equivalent fractions are different names for the same quantity.
- Students can use different strategies to find equivalent fractions.
- Students understand that a fraction a/b is a multiple of 1/b.

Teacher Notes

Lesson 4: Equivalent Ratios

Brief Overview of Lesson:

Students plot values of equivalent ratios on the coordinate plane, and use these graphs to solve problems. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Students should understand that equivalent fractions are different names for the same quantity.
- They should be able to use different strategies to find equivalent fractions.
- They should be able to plot a point (x,y) on a coordinate plane.

Estimated Time (minutes): 50 mins

Resources for Lesson:

- Lesson 4: In-Class Work
- Lesson 4: Homework
- Websites
- Graph paper or coordinate plane paper

Unit: Ratios, Rates, and Percents
Lesson 4: Equivalent Ratios
Time (minutes): 50

By the end of this lesson students will know and be able to:

By the end of this lesson students will know: Mathematical strategies for solving problems involving ratios, including tables, equivalent fractions, and graphs.

By the end of this lesson, students will be able to: Plot pairs of values of the quantities being compared on the coordinate plane.

Essential Question(s) addressed in this lesson: How can the relationship between two quantities be represented visually?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

6.RP.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 lines, 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.

6.MP.7 Look for and make use of structure.

Teacher Notes

When equivalent ratios are graphed, the data points always form a straight line. The equation of the line is in the form $y = mx + b$, where m is the slope or the multiplicative factor. It can also be thought of as the rate of change. This will be taught in grade 8 (8.F.4). (b is the y-intercept, indicating where the line crosses the y axis when $x = 0$)

In advance, make graphs that can be shown on an overhead projector, document camera, etc. This will allow students to quickly check the accuracy of their work. There are many technology tools that can provide quick graphs. If students do not have correct values in their graphs, the lesson will be ineffective.

Remind students that information can be gained from comparing the different values in the tables. For example, here are three ways to look at a table comparing paint ratios.

Lesson 5
Solving Mathematical and Real-Life Problems with Ratios

Brief Overview of Lesson:
Students use multiple representations such as tables of equivalent fractions, graphs, tape diagrams, and double line diagrams to solve ratio problems, including measurement conversion problems. As you plan, consider the variability of learners in your class and make adaptations as necessary.

Prior Knowledge Required:

- Assumptions about what students know and are able to do coming into this lesson (including language needs):
- Students should know basic unit measurement conversions for length (e.g., 12 inches in a foot; 3 feet in a yard; 100 cm in a meter), mass (e.g. 1000 grams in a kilogram), and volume (e.g., 1000 ml in a liter). For students who are not secure in this knowledge, it is helpful to provide a chart of conversions.

Estimated Time (minutes): Two 50 minute lessons

Resources for Lesson:

- Lesson 5: In-Class Practice
- Top-Down Web

Unit: Ratios, Rates, and Percents
Lesson 5: Solving Mathematical and Real-Life Problems with Ratios
Time (minutes): Two 50 minute lessons

By the end of this lesson students will know and be able to:
By the end of this lesson students will know:

- When it is appropriate to use ratios to solve mathematical or real-world problems.
- Mathematical strategies for solving problems involving ratios, including tape diagrams and double line diagrams.

By the end of this lesson students will be able to:

- Use ratio reasoning to solve real-world and mathematical problems.
- Use multiple representations such as tape diagrams and double line diagrams to solve ratio problems.
- Convert measurement units using ratio reasoning

Essential Question(s) addressed in this lesson:

- How are ratios used in everyday life?
- What strategies can we use to solve ratio problems?
- What is the best way to communicate solutions of ratio problems?

Standard(s)/Unit Goal(s) to be addressed in this lesson:

6.RP.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 lines, 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.

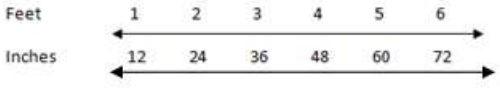
d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

6.SMP.4 Model with mathematics. (Students model a real-life situation using ratios.)

Teacher Notes

There is lots of new terminology in this lesson. Make sure that students understand and can apply the vocabulary.
It is important to recognize ratios in many different contexts. To beginners, each proportional reasoning situation presents a different kind of problem, even though they may understand the concept of ratios. More experienced students recognize that although ratios occur in many different settings, the same mathematical idea (multiplicative relationship) underlies all. These students have a toolbox of strategies for solving ratio problems.

Double line diagrams:
A double line diagram compares two quantities that have a multiplicative ratio.



Web Resources:
http://science.kennesaw.edu/~twatanab/DeKalb%20Title%20I%20Summit%202012.pdf
PowerPoint Presentation on Tape Diagrams & Double Number Line Graphs, designed by Dr. Tad Wattanabe (former Towson University professor).
http://illuminations.nctm.org/LessonDetail.aspx?ID=L515
NCTM Illuminations Lesson: Students measure the heights and shadows of familiar objects and use indirect measurement to find the heights of things that are much bigger in size, such as a flagpole, a school building or a tree.
http://www.uen.org/Lessonplan/preview?LPid=15425
Lesson: In this lesson, students will graph growing patterns using ordered pairs on a coordinate grid.
Illustrative Mathematics Tasks:
Mixing Concrete
Running at a Constant Speed, Assessment Variation
Walk-a-thon 1

Lesson 3: Homework

1. Michaela charges $6.50 per hour to babysit. Complete the table below to show how much she would earn.

Babysitting Earnings	
Hours Worked	**Amount Earned**
1	
2	
3	
4	
5	
6	

2. At birth, a baby blue whale weighs 5,000 pounds. The baby whale continues to gain 200 pounds per day. Make a table showing how much the baby whale gains in one week. Remember to include a title and label each column.

Day 0 (birth)	5000

3. What will the baby whale weigh at the end of 10 days? How did you find your answer?

Lesson 3: Homework ANSWER KEY

1. Michaela charges $6.50 per hour to babysit. Complete the table below to show how much she would earn.

Babysitting Earnings	
Hours Worked	**Amount Earned**
1	**$6.50**
2	**$13.00**
3	**$19.50**
4	**$26.00**
5	**$32.50**
6	**$39.00**

2. At birth, a baby blue whale weighs 5,000 pounds. The baby whale continues to gain 200 pounds per day. Make a table showing how much the baby whale gains in one week. Remember to include a title and label each column.

Weight Gain of a Baby Whale	
Days	**Pounds**
Day 0 (birth)	**5000**
Day 1	**5200**
Day 2	**5400**
Day 3	**5600**
Day 4	**5800**
Day 5	**6000**
Day 6	**6200**
Day 7	**6400**

3. What will the baby whale weigh at the end of 10 days? How did you find your answer?

7000 lbs. (Extend the table or multiple 200 by the number of days and add to 5000)

4. Explain how to determine how much the baby whale will weigh on any day. How could you find the weight on the 20th day and the 50th day?

20th day: 5000 + (200 x 20) = 9000 **50th day: 5000 + (200 x 50) = 15,000**

Assessment

Little Red Riding Hood's Grocery Trip

After spending some time phoning and texting with Granny, Little Red Riding Hood decided it was time to visit her beloved grandmother, who lived in the Far, Far Away Woods. She thought it would be nice if she brought some groceries and fixed lunch for her elderly, yet hip, Granny. She remembered that her Granny loved tacos and brownies, so she decided that she would make them for her as a surprise! She quickly made her grocery list. Red decided she needed to buy:

- soft taco shells
- shredded cheese
- ground beef
- salsa
- lettuce
- brownies (for dessert, of course!)

Little Red Riding Hood scanned recent grocery store flyers and found that two different stores, the Very Hungry Wolf's Food Store and the Strong, Brave Woodsman's Food Mart, had all of the ingredients that she needed. Red didn't have a lot of time to shop, so she decided to use the flyers to compare prices to help her decide which store had the best values. After comparing unit prices for each item, she totaled the unit prices and chose the store that would give her the best overall value.

Determine the unit price for each item at each grocery store. Put your answers in the place provided in the chart shown. You must show your work for each item. Once you have decided which grocery store will offer Red the best value for her money, explain why she should shop there. Give specific detail about how you decided whether she should shop at the Very Hungry Wolf's Food Mart or the Strong, Brave Woodsman's.

The Very Hungry Wolf's Food Store		
Grocery Item	**Price**	**Unit Price**
Soft Taco Shells	8 for $.96	
Shredded Cheese	7 oz. for $1.75	
Ground Beef	1 lb. for $2.50	
Salsa	22 oz. for $3.30	
Lettuce	1 head for $.89	
Brownies	12 for $3.60	

The Brave Woodsman's Food Mart		
Grocery Item	Price	Unit Price
Soft Taco Shells	12 for $1.68	
Shredded Cheese	1 lb. for $3.20	
Ground Beef	5 lbs. for $9.95	
Salsa	10 oz. for $1.98	
Lettuce	3 heads for $1.69	
Brownies	4 for $1.00	

Task Overview: Students must calculate various ratios and proportions when constructing a beaded bracelet and necklace. Additionally, students must perform calculations to determine the cost of the items and the possible amount of profit, given certain criteria.
Teacher Preparation/Resource Requirements: None
Student Task – Bead Bracelets
Your school is hosting an Arts and Crafts Fair to raise funds. Your class has been asked to help by designing and making jewelry for the fund raiser. In this task, you will be asked to design a bracelet, calculate ratios, make predictions, and calculate costs.
Part A – Designing a Bracelet
Your principal has purchased the materials to make the jewelry. The materials include:

- Three types of glass beads
- Three types of spacer beads (the beads used to separate sections of glass beads)
- Beading wire (the wire that holds the beads when making a bracelet or a necklace)
- Clasps (the fasteners that hold the ends of a bracelet or necklace together)

The cost of each type of bead is shown below.

Glass Beads	
Type A	$4.25 for a bag of 48 beads
Type B	$6.00 for a bag of 25 beads
Type C	$8.00 for a bag of 25 beads
Spacer Beads	
Type D	$4.00 for a bag of 25 beads
Type E	$8.00 for a bag of 24 beads
Type F	$7.00 for a bag of 300 beads

Design a bracelet using at least two types of glass beads and one type of spacer bead.

- Use between 8 and 12 glass beads.
- Use at least 6 spacer beads.
- Use no more than 25 total beads in your bracelet.

Write the type letter (A, B, C, D, E, or F) to represent each bead in your design. Use the blank spaces below to lay out the design for your bracelet.

_____

Write 5 ratios that can be used to mathematically describe the bracelet you designed. Make sure your ratios show each of the following:

- The relationship between one type of glass bead used and another type of glass bead used
- The relationship between one type of glass bead used and all the beads used
- The relationship between one type of glass bead used and a type of spacer bead used
- The relationship between all the glass beads used and all the spacer beads used
  The relationship between one type of spacer bead used and all the beads used

You have been given one bag of each type of bead that you have selected. Based on your design, how many complete bracelets can you make before you run out of one type of bead? Explain your answer using diagrams, mathematical expressions, and/or words.

Part B – Calculating the Costs
The cost of one clasp and enough beading wire to make a bracelet is $0.25. Using the information from Part A, determine the cost to create one of the bracelets you designed. Explain your answer using diagrams, mathematical expressions, and/or words.

List of Unit Resources

Lesson 8: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Lesson 9: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organize
Engage NY Ratio Module

Lesson 10: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Lesson 11: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Lesson 12: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Lesson 13: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Lesson 14: https://account.collegeboard.org/login/login?destinationpage=https%3A%2F%2Fbigfuture.collegeboard.org%2Fmy-organizer
Engage NY Ratio Module

Additional Resources

Tim's Tires, Raffle Ticket Sales, Library Books
Battle of Fractions, Decimals, and Percent
Grids for Battle of Fractions, Decimals, and Percent
10 x 10 Grids
100 Chart
Tape Diagrams
Double Line Diagrams

Grocery Trip Ratio Proportion Task Rubric

Standards for Mathematical Practices	**Question**	**Criterion**	**4**	**3**	**2**	**1**
Use appropriate tools strategically Make sense of problems and persevere in solving them.		**Topic development**	All parts of the project are answered	Most parts answered	Some parts are answered	Off topic or too brief
Attend to precision Use appropriate tools strategically	1	**Algorithms** (rules, laws, procedures, orders of operation)	Effectively selects and uses *given* rules, operations & procedures to carry out simple, familiar tasks	Uses *given* rules, operations & procedures to carry out simple, familiar tasks	Uses most *given* rules, operations & procedures to carry out simple, familiar tasks with prompting	Follows some *given* rules, operations or procedures in relation to simple, familiar tasks but only with prompting
Attend to precision. Use appropriate tools strategically	1 2	**Computation** (accurate calculations, use of calculators etc)	All computation is correct	Computational errors, but they do not interfere with understanding of the of concepts	Computational errors that influence the understanding of concepts or overly simplify the solution	Many computational errors
Look for and make use of structure. Make sense of problems and persevere in solving them. Model with mathematics	1 3 B	**Organization of ideas**	Well developed strategies with clear & logical sequencing that lead to a successful solution	Strategies are logical and clear but not always followed through. Consequently a solution can only be achieved with teacher input	Develops strategies with help but these strategies are not always followed through. The student has limited success in solving the problem	Little evidence of strategies that could be used to solve the problem
Model with mathematics. Reason abstractly & quantitatively	1	**Use of Representations** (drawings, diagrams, equations, graphs, tables charts etc)	Many appropriate details and representation are used that add to the readers understanding	Some details are used that help aid the understanding of the reader	Limited use of details or representations	Inappropriate or no details
Attend to precision.	3 B	**Mathematical terminology** (using correct math words to describe what you are doing)	All math terminology that is appropriate is used and in the correct context	Some math terminology is used	Limited use of math terminology	Inaccurate or no math terminology used
Construct viable arguments and critique the reasoning of others.	3 B	**Explaining**	Presents detailed explanations that are logically developed and explain the mathematics involved	Presents explanations that are logically developed and explain the mathematics involved	Presents responses that partially explain the mathematics involved	Limited responses that fail to explain the mathematics involved
Construct viable arguments and critique the reasoning of others.		**Literacy component**	Response is made using full sentences and conventional use of language	Response is generally made using full sentences and conventional use of language	Response has made some attempt to follow the conventional use of language	Little attempt to follow the conventions of language

Scoring Note: Each section is evaluated independently. The total number of points is determined by adding the point assigned for each task.

Scoring Rubric - *Part A*

6 points: Thorough understanding of ratio and proportional relationships. Thorough understanding of the given directions. The student correctly used one type of spacer bead and at least two types of glass beads. The student correctly used no more than 25 total beads and correctly used 8 to 12 glass beads and at least 6 spacer beads. The student correctly wrote a set of 5 ratios according to bulleted directions. The student correctly used mathematics to find the number of bracelets that can be made using *all* the different types of beads the student chose for the bracelet.

5 points: Thorough understanding of ratio and proportional relationships. Partial understanding of the given directions. The student correctly used one type of spacer bead and at least two types of glass beads. The student used a number of glass beads or spacer beads that were outside of directions. The student correctly wrote a set of 5 ratios according to bulleted directions. The student correctly used mathematics to find the number or bracelets that can be made using *all* the different types of beads the student chose for the bracelet. **OR** The student did everything else required, but only correctly wrote 4 of the 5 required ratios. **OR** The student did everything else required, but did not correctly determine the number of bracelets that could be made.

4 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 3 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 4 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 4 of the 5 required ratios. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and did not correctly determine the number of bracelets that could be made.

3 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 2 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 3 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 3 of the 5 required ratios. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 1 ratio, and did not correctly determine the number of bracelets that could be made.

2 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 1 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 2 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 2 of the 5 required ratios. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 2 ratios, and did not correctly determine the number of bracelets that could be made.

1 point: Limited understanding of ratio and proportional relationships. Limited understanding of the given directions. The student used a number of glass beads or spacer beads that were outside of directions, made an error with 3 or more ratios, and did not correctly determine the number of bracelets that could be made. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 4 or 5 ratios, but correctly determined the number of bracelets that could be made.

0 points: No understanding of ratio and proportional relationships. No understanding of the given directions. The student made errors in every section of Part A.

Part B

3 points: Thorough understanding of numbers and operations. Thorough understanding of solving real-world problems involving the cost of making bracelets. The student correctly

determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student correctly multiplies each individual cost by the number of each type of bead in the bracelet. The student correctly determines the cost of the total number of bracelets created from one bag of each style of bead by multiplying the number of bracelets that can be made and the cost of each individual bracelet.

2 points: Partial understanding of numbers and operations. Partial understanding of solving real-world problems involving the cost of making bracelets. The student correctly determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student correctly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.

1 point: Limited understanding of numbers and operations. Limited understanding of solving real-world problems involving the cost of making bracelets. The student correctly determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student incorrectly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created

from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.
0 points: No understand of numbers and operations. No understanding of solving real-world problems involving the cost of making bracelets. The student incorrectly determines the minimum cost of the bracelet when dividing the total cost of each package of beads by the number of beads in the package. Then the student incorrectly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.
Part C
4 points: Through understanding of ratio and proportions. Thorough understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student correctly determines the number of each type of bead that would be needed for the necklace.
3 points: Partial understanding of ratio and proportions. Partial understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student makes an error when determining the number of 1 type of bead that would be needed for the necklace. **OR** The student makes an error when determining the cost of the necklace, but correctly determines the number of each type of bead that would be needed for the necklace.
2 points: Partial understanding of ratio and proportions. Partial understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student makes an error when determining the number 2 types of bead that would be needed for the necklace. **OR** The student makes an error when determining the cost of the necklace and makes an error when determining the number of 1 type of bead that would be needed for the necklace.
1 point: Limited understanding of ratio and proportions. Limited understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student does make errors in determining the number of 3 or more of the bead types needed to make the necklace. **OR** The student makes an error when determining the cost of the necklace and makes an error when determining the number of 2 types of bead that would be needed for the necklace.
0 points: No understanding of ratio and proportions. No understanding of mathematical expressions and inequalities. The student does not correctly complete any section of Part C.
Part D
3 points: Thorough understanding of numbers and operations and the number system. The student correctly determines the profit of 60% by multiplying the cost of the bracelet by 1.6 and the cost of the necklace by 1.6. The student correctly determines the 40%

profit from selling a set of 3 bracelets by multiplying the cost of the bracelet by 3 and then multiplying that total by 1.4. The student correctly determines a total profit of $70.28.
2 points: Partial understanding of numbers and operations and the number system. The student makes an error in 1 of the 3 sections of Part D.
1 point: Limited understanding of numbers and operations and the number system. The student makes an error in 2 of the 3 sections of Part D.
0 points: Little or no understanding of numbers and operations and the number system. The student makes operations and the number system. The student makes errors in all 3 sections of Part D.