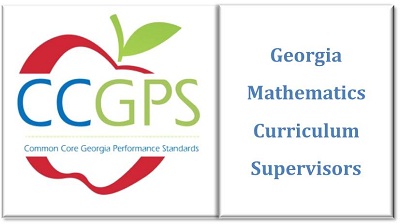
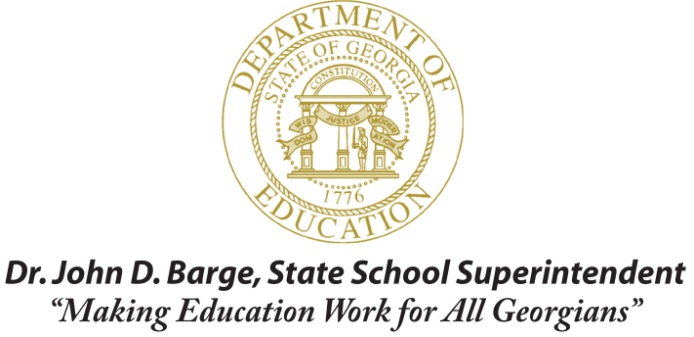
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**CCGPS**

**Frameworks**

**Student Edition**

**Mathematics**



**Unit 3**

**Ratios and Proportional Relationships**

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**OVERVIEW**

The units in this instructional framework emphasize key standards that assist students to develop a deeper understanding of numbers. They learn to express different representations of rational numbers (e.g., fractions, decimals, and percent’s), discover how to identify and explain the constant of proportionality, and represent proportional relationships and scale drawings within real-world contexts. The Big Ideas that are expressed in this unit are integrated with such routine topics as estimation, mental and basic computation.  All of these concepts need to be reviewed throughout the year.

The Evidence of Learning will tell you what your students will learn in this unit.  Take what you need from the tasks and modify as required.  These tasks are suggestions, something that you can use as a resource for your classroom.

**STANDARDS ADDRESSED IN THIS UNIT**

**KEY STANDARDS**

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units*. For example, if a person walks   
 mile in each hour, compute the unit rate as the complex fraction miles per hour, equivalently 2 miles per hour.*

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations. For example, if total cost *t* is proportional to the number *n* of items purchased at a constant price *p*, the relationship between the total cost and the number of items can be expressed as *t = pn*.

**MCC7.RP.2d** Explain what a point (*x*, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

**MCC7.G.1** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

**RELATED STANDARDS**

**MCC7.EE.3** Solve multi‐step real‐life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations as strategies to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar* 9 *inches long in the center of a door that is* 27 *inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

**MCC7.NS.1** Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

**MCC7.NS.1a** Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*

**MCC7.NS.1b** Understand *p + q* as the number located a distance |*q*| from *p*, in the positive or negative direction depending on whether *q* is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real‐world contexts.

**MCC7.NS.1c** Understand subtraction of rational numbers as adding the additive inverse, *p – q = p + (-q)*. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real‐world contexts.

**MCC7.NS.1d** Apply properties of operations as strategies to add and subtract rational numbers.

**MCC7.NS.2** Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

**MCC7.NS.2a** Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real‐world contexts.

**MCC7.NS.2b** Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non‐zero divisor) is a rational number. If *p* and *q* are integers then – *(p/q) = (-p)/q = p/(-q)*. Interpret quotients of rational numbers by describing real‐world contexts.

**MCC7.NS.2c** Apply properties of operations as strategies to multiply and divide rational numbers.

**MCC7.NS.2d** Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0’s or eventually repeats.

**MCC7.NS.3** Solve real‐world and mathematical problems involving the four operations with rational numbers.

**STANDARDS FOR MATHEMATICAL PRACTICE**

**(Practices to be explicitly emphasized in this unit are indicated with an \*.)**

**\*1. Make sense of problems and persevere in solving them.** Students make sense of ratio and unit rates in real-world contexts. They persevere by selecting and using appropriate representations for the given contexts.

**\*2. Reason abstractly and quantitatively.** Students will reason about the value of the rational number in relation the models that are created to represent them.

**3. Construct viable arguments and critique the reasoning of others.** Students use arguments to justify their reasoning when creating and solving proportions used in real-world contexts.

**\*4. Model with mathematics.** Students create models using tape diagrams, double number lines, manipulatives, tables and graphs to represent real-world and mathematical situations involving ratios and proportions. For example, students will examine the relationships between slopes of lines and ratio tables in the context of given situations.

**5. Use appropriate tools strategically.** Students use visual representations such as the coordinate plane to show the constant of proportionality.

**\*6. Attend to precision.** Students attend to the ratio and rate language studied in grade 6 to represent and solve problems involving rates and ratios.

**7. Look for and make use of structure.** Students look for patterns that exist in ratio tables in order to make connections between the constant of proportionality in a table with the slope of a graph.

**8. Look for and express regularity in repeated reasoning.** Students formally begin to make connections between covariance, rates, and representations showing the relationships between quantities.

**ENDURING UNDERSTANDINGS**

* Fractions, decimals, and percents can be used interchangeably
* Ratios use division to represent relationships between two quantities
* The constant of proportionality is also considered to be the unit rate

**CONCEPTS AND SKILLS TO MAINTAIN**

It is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

* number sense
* computation with whole numbers and decimals, including application of order of operations
* knowledge of equivalent fractions
* addition and subtraction of common fractions with like denominators
* measuring length and finding perimeter and area of rectangles and squares
* characteristics of 2-D and 3-D shapes

**SELECTED TERMS AND SYMBOLS**

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The definitions below are for teacher reference only and are not to be memorized by the students**.** Students should explore these concepts using models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

The websites below are interactive and include a math glossary suitable for middle school students. **Note – Different sources use different definitions. Please preview any website for alignment to the definitions given in the frameworks.** The definitions below are from the CCSS glossary <http://www.corestandards.org/Math/Content/mathematics-glossary/glossary>, when applicable.

Visit [http://intermath.coe.uga.edu](http://intermath.coe.uga.edu/) or [http://mathworld.wolfram.com](http://mathworld.wolfram.com/) to see additional definitions and specific examples of many terms and symbols used in grade 7 mathematics.

* **Constant of Proportionality:** Constant value of the ratio of proportional quantities x and y. Written as y = kx, k is the constant of proportionality when the graph passes through the origin. Constant of proportionality can never be zero.
* **Equivalent Fractions:** Two fractions that have the same value but have different numerators and denominators; Equivalent fractions simplify to the same fraction.
* **Fraction**: A number expressed in the form *a*/*b* where *a* is a whole number and *b* is a positive whole number.
* **Multiplicative inverse**: Two numbers whose product is 1r. Example: and are multiplicative inverses of one another because × = × = 1.
* **Percent rate of change**: A rate of change expressed as a percent. Example: if a population grows from 50 to 55 in a year, it grows by = 10% per year
* **Proportion**: An equation stating that two ratios are equivalent.
* **Ratio**: A comparison of two numbers using division. The ratio of a to b (where b ≠ 0) can be written as a to b, as , or as a:b.
* **Similar Figures:** figures that have the same shape but the sizes are proportional
* **Unit Rate:** Ratio in which the second term, or denominator, is 1
* **Scale factor**: A ratio between two sets of measurements.

**SE What is the Unit Rate?**

****

**Selecting the Appropriate Unit Rate** Sheet 2

Based on your understanding of the models given from sheet 1, how would you explain or define a unit rate?

At Ralph’s fruit stand 3 apples cost 90 cents. You want to buy 7 apples. How much will they cost?

1. What are the two possible rates for this problem?
2. Show each rate as a unit rate.
3. What does each unit rate tell you?
4. Which unit rate will help you solve the problem?
5. If it costs 30 cents to buy 1 apple, how much will 2 apples cost? 4 apples? Complete the table below. Then, describe the pattern you see in the chart.

|  |  |
| --- | --- |
| APPLES | COST IN CENTS |
| 1 | 30 |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

1. Since you know the unit price, write a number sentence for the cost of seven apples. Write an equation for the cost of any number of apples.

**SE Analyzing and Applying Unit Rate**

**Finding and interpreting the unit rate Sheet 1**

In each problem record both possible rates, use division to find the unit rates, than write a short sentence explaining each unit rate.

1. 6 bags of flour weigh 30 pounds.

|  |  |  |
| --- | --- | --- |
| RATE | UNIT RATE | INTERPRETATION |
|  |  |  |
|  |  |  |

1. 9 tennis balls come in 3 cans.

|  |  |  |
| --- | --- | --- |
| RATE | UNIT RATE | INTERPRETATION |
|  |  |  |
|  |  |  |

1. 5 gallons of gas cost $6.50.

|  |  |  |
| --- | --- | --- |
| RATE | UNIT RATE | INTERPRETATION |
|  |  |  |
|  |  |  |

1. In 25 minutes Jenny can run 10 laps

|  |  |  |
| --- | --- | --- |
| RATE | UNIT RATE | INTERPRETATION |
|  |  |  |
|  |  |  |

**Applying the Unit Rate Approach Sheet 2**

In each problem, record the rate appropriate for the question asked, find the corresponding unit rate, write a short sentence interpreting the unit rate, and use this rate to find the solution to the problem.

1. Anne is painting her house light blue. To make the color she wants, she must add 3 cans of white paint to every 2 cans of blue paint. How many cans of white paint will she need to mix with 6 cans of blue?

Rate needed (white/ blue) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit Rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Interpretation of unit rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solution:

1. Ryan is making a fruit drink. The directions say to mix 5 cups of water with 2 scoops of powdered fruit mix. How many cups of water should he use with 9 scoops of fruit mix?

Rate needed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit Rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Interpretation of Unit Rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solution:

1. Donna is running around a track. It takes her 10 minutes to run 6 laps. If she keeps running at the same speed, how long will it take her to run 5 laps?

Rate needed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Interpretation of unit rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solution:

1. Mark’s model train can go 12 laps around its track in 4 minutes. If it runs at the same speed, how many laps can the train go in 9 minutes?

Rate needed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit Rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Interpretation of Unit Rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solution:

**SE Learning Task: Orange Fizz Experiment**

1. **Introductory Problems**

A useful way to compare numbers is to form ratios. Talk to your classmates about what is the same and what is different about these ratio statements.

1. The ratio of boys to girls in Ms. Dade’s class is 12 boys to 18 girls.
2. Write the ratio in the problem in multiple ways
3. Write an equivalent ratio
4. Compare each pair of ratios- what is alike or different about each?
5. The ratio of boys to the class in Mr. Hill’s class is 14 boys to 30 students.
   1. Write the ratio in the problem in multiple ways
   2. Write an equivalent ratio
   3. Compare each pair of ratios- what is alike or different about each?
6. The ratio of cats to dogs in our house is.
   1. Write the ratio in the problem in multiple ways
   2. Write an equivalent ratio
   3. Compare each pair of ratios- what is alike or different about each?
7. The ratio of cats to animals in Darla’s house is 2:6.
   1. Write the ratio in the problem in multiple ways
   2. Write an equivalent ratio
   3. Compare each pair of ratios- what is alike or different about each?

**II. Orange Fizz Experiment**

A famous cola company is trying to decide how to change their drink formulas to produce the best tasting soda drinks on the market. The company has three different types of formulas to test with the public. The formula consists of two ingredients: orange juice concentrate and carbonated water.

You are a scientist working for this company, and you will get paid a large commission if you can find the right formula that will sell the best. Your job is to find out which of the formulas cost the most based upon their concentration, as well as which one is the best tasting of the flavors.

Using the company’s new formulas, you must follow the recipe to the strict guidelines:

**Formula A**: 1 tablespoons of orange concentrate to 2 tablespoons of carbonated water

**Formula B:** 2 tablespoons of orange concentrate to 5 tablespoons of carbonated water

**Formula C:** 2 tablespoons of orange concentrate to 3 tablespoons of carbonated water

Part A: *Using part-to-whole comparison*

1. Which formula will make a drink that has the *strongest* orange taste? Show your work and explain your choice.

2. Which formula has the highest percentage of carbonated water in the mixture? Estimations may be used. Show your work and justify your answer.

Part B: *Using part-to-part comparison*

1. For researchers to test their product, they will need to produce enough of each of the three drink formulas to take to various locations around the area for taste testing. Researchers would like for *at least 100* *people* to sample each formula.

Each sample will contain 1 of a cup of liquid.

Formula A: 1 cup of concentrate to 2 cups of carbonated water

Formula B: 2 cups of concentrate to 5 cups of carbonated water

Formula C: 2 cups of concentrate to 3 cups of carbonated water

*Fill in the table to determine the least amount of concentrate and carbonated water that you would have to use to serve 1 cup servings to 100 people.*

|  |  |  |
| --- | --- | --- |
| **Formula A:** | | |
| Orange Concentrate (cups) | Carbonated Water  (cups) | Total Amount  (cups/servings) |
| 1 | 2 | 3 cups (3 servings) |
| 2 | 4 | 6 cups (6 servings) |
| 3 | 6 | 9 cups (9 servings) |
| … | … | ,,, |
| 17 | 34 | 51 cups (51 servings) |
| … | … | … |
| 33 | 66 | \_\_\_\_ cups (\_\_\_\_ servings) |
| 34 |  | \_\_\_\_ cups (\_\_\_\_ servings) |
|  | 70 | \_\_\_\_ cups (\_\_\_\_ servings) |

I. How much orange concentrate and carbonated water is needed to serve at least 100 people?

a. Orange Concentrate-

b. Carbonated Water-

|  |  |  |
| --- | --- | --- |
| **Formula B:** | | |
| Concentrate  (cups) | Carbonated Water  (cups) | Total Amount  (cups/servings) |
| 2 | 5 | 7 cups (7 servings) |
| 4 | 10 | 14 cups (14 servings) |
| 8 |  | 28 cups (28 servings) |
| … | … | ,,, |
|  | 35 | \_\_\_\_\_cups (49 servings) |
| … | … | … |
| 26 |  | \_\_\_\_\_ cups (\_\_\_\_ servings) |
|  |  | 98 cups (98 servings) |
|  |  | \_\_\_\_\_cups ( servings) |

II. How much orange concentrate and carbonated water is needed to serve at least 100 people?

c. Orange Concentrate-

d. Carbonated Water

|  |  |  |
| --- | --- | --- |
| **Formula C:** | | |
| Orange Concentrate  (cups) | Carbonated Water  (cups) | Total Amount (cups/servings) |
| 2 | 3 | 5 cups (5 servings) |
| 4 | 6 | 10 cups (10 servings) |
|  |  |  |
| … | … | ,,, |
| 20 |  | \_\_\_\_ cups (\_\_\_\_ servings) |
| … | … | … |
| 36 |  | \_\_\_\_ cups (\_\_\_\_ servings) |
|  | 57 | \_\_\_\_ cups (\_\_\_\_ servings) |
|  |  | \_\_\_\_ cups (\_\_\_\_ servings) |

III. How much orange concentrate and carbonated water is needed to serve at least 100 people?

e. Orange Concentrate

f. Carbonated Water

1. Your lab technicians will be bringing you all of the supplies that you will need in order to make the formulas at the sites

|  |  |  |
| --- | --- | --- |
|  | **Orange Concentrate** | **Carbonated Water** |
| Formula A |  |  |
| Formula B |  |  |
| Formula C |  |  |
| Total (cups) |  |  |

1. Your lab technician calls you that he only has gallon jugs. (Hint: one gallon=16 cups)
2. How many gallons of orange concentrate do you need to make Formula A? Justify your answer.
3. How many gallons of carbonated water do you need to make Formula B? Justify your answer.

**FORMATIVE ASSESSMENT LESSON: Proportion and Non-Proportion Situations**

(Concept Development)

*This lesson unit is intended to help you assess whether students are able to identify when two quantities vary in direct proportion to each other, distinguish between direct proportion and other functional relationships, and solve proportionality problems using efficient methods.*

*Source: Formative Assessment Lesson Materials from Mathematics Assessment Project*

<http://map.mathshell.org/materials/download.php?fileid=1356>

**STANDARDS ADDRESSED IN THIS TASK**

**Analyze proportional relationships and use them to solve real-world and mathematical problems.**

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations.

**MCC7.RP.2d** Explain what a point on the graph of a proportional relationship means in terms of the situation, with special attention to the points and where the unit rate is.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

**STANDARDS FOR MATHEMATICAL PRACTICE**

This lesson uses all of the practices with emphasis on:

1. Make sense of problems and persevere in solving them

8. Look for and express regularity in repeated reasoning.

**ESSENTIAL QUESTIONS**

* How do I verify if two quantities are directly proportional?
* How do I solve real-world problems using equivalent ratios?

**TASK COMMENTS**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=formative>

The task, *Proportion and Non-Proportion Situations*, is a Formative Assessment Lesson (FAL) that can be found at the website: <http://map.mathshell.org/materials/lessons.php?taskid=483&subpage=concept>

The FAL document provides a clear lesson design, from the opening of the lesson to the closing of the lesson.

The PDF version of the task can be found at the link below:

<http://map.mathshell.org/materials/download.php?fileid=1356>

Student Guide 3-1

Name: Project Due Date:

C:\Documents and Settings\chapman.kerri\Local Settings\Temporary Internet Files\Content.IE5\Q1HV8HQN\MC900130253[1].wmf

**SE Creating A Scale Map**

**Situation/Problem**

You and your partner(s) are to create a scale map of a familiar place such as your school, school grounds, or the yard of your home.

**Possible Strategies**

1. Accurately measure distances (rounding to the nearest foot, yard, or meter).
2. Note landmarks. In case of a yard, this might include things like trees, woodpiles, sheds, etc. You might include such things in a legend on your map.
3. Create a rough sketch of your map before drawing a final copy. A “rough sketch” will help you to visualize perspectives and landmarks.

**Special Considerations**

* Use a measuring tape, yardstick, meter stick or trundle wheel for measuring distances.
* Use a pad and pencil to record distances. Don’t try to remember the distances; this may cause mistakes in your map and your scale.
* As you record distances, sketch your map, placing landmarks “about” where they would be. Record the distances in feet, yards, or meters. It’s a good idea to locate landmarks using the measurements from two boundaries.
* Use a compass to find directions. Be sure to label the directions correctly on your map.
* Consult Student Guide 3-2 for information about working with scale drawings.
* Be sure the final copy of your map is accurate. Label distances and landmarks, add color, and include a legend and directions. You may want to compare your map to the original area and check it for accuracy.

**To Be Submitted**

1. Your scale map
2. Your records of measurements and calculations

Student Guide 3-2

Name: Project Due Date:

C:\Documents and Settings\chapman.kerri\Local Settings\Temporary Internet Files\Content.IE5\Q1HV8HQN\MC900130253[1].wmf

**SE How To Make A Map**

1. Decide upon the boundaries of your map.
2. Make a sketch of the area you will include on your map. Note the approximate position of any landmarks. In a school, land marks might include stairwells, display cases, or water fountains. Landmarks in a yard might include trees, flowerbeds, decks, sheds, or woodpiles.
3. Accurately measure the boundaries (length and width) of the area. Locate the position of landmarks by obtaining at least two measurements from boundaries.
4. Select the scale by considering your longest measurement, and how to “fit” it on the paper. Remember that the scale should be as long as possible so that your map will look good on the paper.
5. To choose the best scale, divide the longest length of your paper in inches (or centimeters) by the longest dimension of the boundary in feet (or meters).

* Round your quotient down to the nearest quarter or eighth inch (or centimeter). Here’s an example: The longest boundary (longest length) on your map is 80 feet. The longest dimension of your paper is 28 inches. . Since .35 is between .25 (one fourth inch) and 0.375 (three-eighths inch), you must round down so that your scale will be inch = 1 foot.
* Now take the other dimension of the boundary and the other dimension of the paper, and divide the length of the paper by the length of the boundary.
* Round your quotient down to the nearest quarter or eighth inch (or centimeter).
* Compare the scales. If they are the same, great! If they are different, use the smaller scale.

1. To place items on your map, use your measurements and the scale you have chosen. For example, suppose an apple tree is 21 feet from the fence on the eastern side of the yard, and 16 feet from the fence on the northern side. If your scale is inch = 1 foot, multiply the number of inches by the number of feet to determine the number of inches the actual distance would be on your map. Note the example of the math below.

Place the tree inches from the fence on the eastern side, and 4 inches from the northern side.

Student Guide 3-5

Name: Project Due Date:

MC900237772[1]

**SE: Which Is The Better Deal**

**Situation/Problem**

You and your partner(s) are to select a product, and compare the size of package and price (three different sizes/prices). You are to trying to determine which is the best deal by finding their unit price. After you have reached your conclusions, design a chart to support your findings and present your data to the class through an oral report.

**Possible Strategies**

1. Look in sales papers for groceries/retail stores.
2. Brainstorm with your partner(s) which products you might like to compare.

**Special Considerations**

* After selecting your product, decide which size or quantity in a package you will compare. Write these categories on a sheet of paper, then compare the price.
* After obtaining your data, analyze it and make decisions comparing quantity/size to price. Compute the unit rate.
* Create a chart illustrating your results. Sketch a rough copy of your chart first. This enables you to revise the chart before starting the final copy. Arrange the design so it presents the data clearly. List your products by brand name and show your comparison of quantity/size to price. If there is room on your chart, you may wish to provide a brief summary of your results and why you chose that quantity/size product for that price.
* Before presenting your findings to the class, write notes so that you don’t forget to mention any important information. Rehearse your presentation.

**To Be Submitted**

1. Research/Comparison Notes
2. Chart

Student Data Sheet 3-6

Name: Project Due Date:

MC900237772[1]

**Which Is The Better Deal**

Popular products are compared regularly. Many educated consumers rely on unit pricing to make sure they are getting the best deal to fit their needs and budgets.

Some products and quantity/size to compare:

* Soda
* Potato Chips
* Ice Cream
* Milk
* Paper products
* Snack crackers

Any product that is packaged in more than one size can be compared. For example, you could compare the unit price of a 6-pack of Coke to the unit price of a 6-pack of Pepsi.

**FORMATIVE ASSESMENT LESSON** **Developing a Sense of Scale**

(Problem Solving)

*This lesson unit is intended to help you assess whether students recognize relationships of direct proportion and how well they solve problems that involve proportional reasoning.*

*Source: Formative Assessment Lesson Materials from Mathematics Assessment Project*

<http://map.mathshell.org/materials/download.php?fileid=1306>

**STANDARDS ADDRESSED IN THIS TASK**

Analyze proportional relationships and use them to solve real-world and mathematical problems.

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations.

**MCC7.RP.2d** Explain what a point on the graph of a proportional relationship means in terms of the situation, with special attention to the points and where is the unit rate.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

**STANDARDS FOR MATHEMATICAL PRACTICE**

This lesson uses all of the practices with emphasis on

2. Reason abstractly and quantitatively.

8. Look for and express regularity in repeated reasoning.

**ESSENTIAL QUESTIONS**

* How do I solve problems involving proportional reasoning?
* How do I identify relationships that are directly proportional?

**TASK COMMENTS**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=formative>

The task, *Developing a Sense of Scale*, is a Formative Assessment Lesson (FAL) that can be found at the website: <http://map.mathshell.org/materials/lessons.php?taskid=456&subpage=problem>

The FAL document provides a clear lesson design, from the opening of the lesson to the closing of the lesson.

The PDF version of the task can be found at the link below:

<http://map.mathshell.org/materials/download.php?fileid=1306>

**SE Learning Task**: **Patterns & Percents**

* + - 1. **Introduction: Modeling with math and making generalizations about patterns.**

Let’s begin with 10%.

How would you write 10% as a decimal? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How would you write 10% as a fraction? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Let’s find a pattern using 10%.

If the bar below represents a whole number amount, then what percent would it equal?



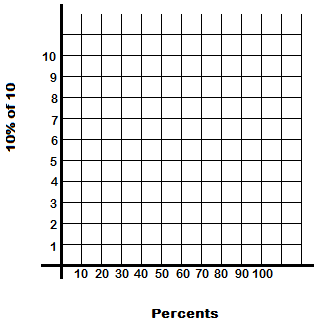
Now let’s give the bar a value. The bar now represents $10 which is 100%. Label the bar.



Divide the bar up into ten equal parts. Label each part with its correct percent value and the correct money value. (*Hint: divide $10 by 10*)



Let’s look at this relationship. Is this a proportional relationship? How do you know?

Fill in the following table and graph the relationship. We will use the values from the bar model above. 

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| --- | --- |
| Percent | Amount based on $10 |
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1. **More Modeling and making use of structure**

For problems 1 – 5, label the percent bar with its appropriate dollar values and percent values. Divide the bar into ten equal parts. Then find 10% of the total. Fill in the pieces of the proportion to represent the relationship.

1] The total amount is $200.



2] The total amount is $800.



3] The total amount is $480.



4] The total amount is $48.



5] The total amount is $64.



1. **Make sense of problems and persevere in solving them:**

Answer the following problems based on what we have learned about percents and patterns. You may use the model, table or graph above to help you. (Hint: Use what you know about 10% of 10 to help you answer each problem.)

1. Mikayla went to the mall to do some shopping. The sign in her favorite store’s window read, *Big Sale-20% off of everything in the store*. Mikayla bought headphones for her I-Pod that were regularly priced $10. Draw a percent bar to show the price of the headphones, the 20% discount, and shade in the part of the bar representing how much Mikayla actually paid for the headphones (before tax).
2. Write a proportion that would help you determine what 20% of $10 is and then show the next steps in finding the price of the headphones (before tax).
3. The county that Mikayla’s lives in charges 5% sales tax on all purchases. What is the final price Mikayla will pay for her headphones after the discount and tax have been applied? Use a percent bar, proportion, or any other method to help you solve this problem.
4. Mikayla wants to buy a dress that is on sale for 25% off. The original price was $84 and sales tax is 5%. What is the total price the cashier at the store will ask Mikayla to pay for the dress?

5. Saira needs to purchase a dress, 2 pairs of shoes, and a tiara for her quincean᷈era. The dress costs $212, both pairs of shoes cost $38, and the tiara is $18. She pays 5% sales tax. Show whether or not she pays more, less, or the same amount of sales tax if she purchases the items all together in one transaction, or buys each item separately from different stores.

6. José referees soccer games on the weekend. He makes $12 per hour when working a recreational league game, and earns 15% extra when he refs for a travel team game. If soccer games are typically an hour and a half long, how much would he get paid for refereeing 2 recreational games followed by 2 travel team games?

**SHORT CYCLE TASK :** **25% Sale**

*In a sale, the store reduces all prices by 25% each week. Does this mean that, after 4 weeks, everything in the store will cost $0? If not, why not?*

*Source: Balanced Assessment Materials from Mathematics Assessment Project*

<http://www.map.mathshell.org/materials/download.php?fileid=1042>

**STANDARDS ADDRESSED IN THIS TASK:**

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks   
 mile in each hour, compute the unit rate as the complex fraction miles per hour, equivalently 2 miles per hour.*

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. **MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations. For example, if total cost *t* is proportional to the number *n* of items purchased at a constant price *p*, the relationship between the total cost and the number of items can be expressed as *t = pn*.

**MCC7.RP.2d** Explain what a point (*x*, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

**STANDARDS FOR MATHEMATICAL PRACTICE**

This task uses all of the practices:

1. Make sense of problems and persevere in solving them

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**STANDARDS FOR MATHEMATICAL PRACTICE**

This task uses all of the practices with emphasis on:

3. Construct viable arguments and critique the reasoning of others.

7. Look for and make use of structure.

**ESSENTIAL QUESTION**

How do I solve and interpret solutions of real-world percent problems?

**TASK COMMENTS:**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=summative>

The task, *25% Sale*, is a Mathematics Assessment Project Assessment Task that can be found at the website: <http://www.map.mathshell.org/materials/tasks.php?taskid=358&subpage=apprentice>

The PDF version of the task can be found at the link below:

<http://www.map.mathshell.org/materials/download.php?fileid=1042>

The scoring rubric can be found at the following link:

<http://www.map.mathshell.org/materials/download.php?fileid=1043>

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**SHORT CYCLE TASK:** **Ice Cream**

*Source: Balanced Assessment Materials from Mathematics Assessment Project*

<http://www.map.mathshell.org/materials/download.php?fileid=1157>

**STANDARDS ADDRESSED IN THIS TASK**

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks   
 mile in each hour, compute the unit rate as the complex fraction miles per hour, equivalently 2 miles per hour.*

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations. For example, if total cost *t* is proportional to the number *n* of items purchased at a constant price *p*, the relationship between the total cost and the number of items can be expressed as *t = pn*.

**MCC7.RP.2d** Explain what a point (*x*, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

**STANDARDS FOR MATHEMATICAL PRACTICE**

This task uses all of the practices:

1. Make sense of problems and persevere in solving them

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**ESSENTIAL QUESTION**

How do I analyze and solve proportional relationships in real-world contexts?

**TASK COMMENTS**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=summative>

The task, *Ice Cream*, is a Mathematics Assessment Project Assessment Task that can be found at the website: <http://www.map.mathshell.org/materials/tasks.php?taskid=389&subpage=expert>

The PDF version of the task can be found at the link below:

<http://www.map.mathshell.org/materials/download.php?fileid=1157>

The scoring rubric can be found at the following link:

<http://www.map.mathshell.org/materials/download.php?fileid=1158>

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**FORMATIVE ASSESSMENT LESSON:** **Increasing and Decreasing Quantities by a Percent**

(Concept Development)

This lesson unit is intended to help you assess how well students are able to interpret percent increase and decrease.

*Source: Formative Assessment Lesson Materials from Mathematics Assessment Project*

<http://map.mathshell.org/materials/download.php?fileid=1249>

**STANDARDS ADDRESSED IN THIS TASK**

**Analyze proportional relationships and use them to solve real-world and mathematical problems.**

**MCC7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

**MCC7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

**MCC7.RP.2c** Represent proportional relationships by equations.

**MCC7.RP.2d** Explain what a point on the graph of a proportional relationship means in terms of the situation, with special attention to the points and where is the unit rate.

**MCC7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

**STANDARDS FOR MATHEMATICAL PRACTICE**

This lesson uses all of the practices with emphasis on:

2. Reason abstractly and quantitatively.

7. Look for and make use of structure.

**ESSENTIAL QUESTIONS**

* How do I translate between percents, decimals, and fractions?
* How do I utilize percent of increase and decrease as an aspect of multiplication?

**TASK COMMENTS**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=formative>

The task, *Increasing and Decreasing Quantities by a Percent*, is a Formative Assessment Lesson (FAL) that can be found at the website: <http://map.mathshell.org/materials/lessons.php?taskid=210&subpage=concept>

The FAL document provides a clear lesson design, from the opening of the lesson to the closing of the lesson.

The PDF version of the task can be found at the link below:

<http://map.mathshell.org/materials/download.php?fileid=1249>

**SE Performance Task: Nate & Natalie’s Walk**

Nate and his sister Natalie are walking around the track at school and they’re walking at a steady rate.  Nate walks 5 feet in 2 seconds while Natalie walks 2 feet in the same amount of time.

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1. Draw a diagram or picture that represents Nate and Natalie’s walk around the track.
2. Set up a table and draw a graph to represent this situation. Let the x-axis represent the number of feet that Nate walks and the y-axis represents the number of feet that Natalie walks.

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1. What patterns do you see in the table? Explain the pattern. Express this as an equation.
2. How do you read the graph? Explain what the coordinate (20, 8) means in the context of Nate and Natalie’s walk?
3. When Nate walks 45 feet, how far will Natalie walk? Explain in writing or show how you found your answer.

**Short Cycle Task:** **Buses**

In this task, students will work with a distance-time graph to describe a bus journey.

*Source: Balanced Assessment Materials from Mathematics Assessment Project*

<http://www.map.mathshell.org/materials/download.php?fileid=1070>

**STANDARDS ADDRESSED IN THIS TASK**

**MCC7.RP.2** Recognize and represent proportional relationships between quantities.

**MCC7.RP.2d** Explain what a point (*x*, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.

**STANDARDS FOR MATHEMATICAL PRACTICE**

This task uses all of the practices with emphasis on:

3. Construct viable arguments and critique the reasoning of others.

7. Look for and make use of structure.

**ESSENTIAL QUESTION**

How do I interpret a distance time graph and determine a point of intersection?

**TASK COMMENTS**

Tasks and lessons from the Mathematics Assessment Project are specifically designed to help teachers effectively formatively assess their students. The way the tasks and lessons are designed gives the teacher a clear understanding of what the students are able to do and not do. Within the lesson, teachers will find suggestions and question prompts that will help guide students towards understanding. For more information access the MAP website:

<http://www.map.mathshell.org/materials/background.php?subpage=summative>

The task, *Buses*, is a Mathematics Assessment Project Assessment Task that can be found at the website: <http://www.map.mathshell.org/materials/tasks.php?taskid=365&subpage=apprentice>

The PDF version of the task can be found at the link below:

<http://www.map.mathshell.org/materials/download.php?fileid=1070>

The scoring rubric can be found at the following link:

<http://www.map.mathshell.org/materials/download.php?fileid=1071>