Grade Level	Content Area	Course Title *(For 9-12 Samples Only)*	Unit Title
Grade 6	Mathematics		Ratio and Percent

Length of Unit	Time of Year Taught	Expected Prior Knowledge
Two/Three Weeks	Beginning of 2nd Qtr.	Fractions and Decimals

Unit Description This unit introduces the relationships in ratios and percentages as found in the Fifth Grade section of the *Core Knowledge Sequence*. This study will include the relationship between percentages to fractions and decimals. Finally, this study will include finding averages and compiling data into various graphs.

Standards: Common Core State Standards for Mathematics	**Domain:** Ratios and Proportional Relationships **Cluster:** Understand ratio concepts and use ratio reasoning to solve problems. **Standard**: #1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*
Summative Assessment *In addition to the description, include a copy of the summative assessment in the application package.*	Students complete the **ratio**s from the word problems about eggs and marbles. Students complete 12 problems total.
Scoring for Summative Assessment *In addition to the description, include a copy of the answer key and scoring rubric (if applicable) for the summative assessment in the application package.*	(See answer key) Mastery is set at 80%. Students must correctly answer 10 problems in order to reach mastery.
Materials/Resources Needed *Include all items for the entire unit.*	*Alexander, Who Used to Be Rich Last Sunday* by Judith Viorst; Decimals and Fractions: Grade 4-8 (*The Mysterious Fraction Zone*, pg. 9; *The Wheel of Fractions*, pg. 11-12); jelly beans; 2 types of soda or other drinks; index cards; sets of play money; Handouts: Appendixes A, B, D, E, G, I, J, M

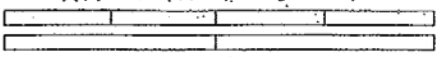
	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Instruction and Timeline	**Percent** *Key Vocabulary* 1. percent- one part in each hundred 2. percentage- a rate or proportion per hundred 3. percentile- a number that divides a series into a hundred groups having equal frequencies Place 1 green jellybean in a jar with 9 red jellybeans. Place 10 green jellybeans in another jar with 90 red jellybeans. Tell the students that you have placed these jellybeans in the jar and the student who can pick a green jellybean from one of the two jars may have a free homework pass. Have the students discuss among themselves which jar they think would be the best from which to try and pick a green jellybean while blindfolded. Use your own method to decide the order in which your students will draw from the jar. Have each student draw one bean from the jar of his or her choice. Keep a record of the beans chosen and have the students brainstorm relationships they find among the outcomes.	**Ratio** *Key Vocabulary* 1. ratio- A ratio is used to compare two quantities; It can be written: in words- one to two with a symbol- 1:2 as a fraction- ½ 2. simplify (reduce)- to make simple or lessen in size 3. greatest common factor (GCF)- greatest factor shared between numbers Pass out the flavored sodas to boys and girls. (One kind for each group.) Ask the students to find a pattern for which they received their sodas. (They will probably notice the boys received one kind and the girls another. Introduce the idea of ratio. Compare the number of girls to boys in class. Example: eight girls to twelve boys or twelve boys to eight girls Also, point out the ratio of one flavor of soda to the other flavor of soda and also one manufacturer to the other manufacturer. Ask students to give you examples of ratios. Demonstrate how ratios can be written in words- eight to	**Proportion** *Key Vocabulary* 1. Proportion- a number sentence that maintains two ratios is equal. 2. Scale- a relationship between the size of things in a drawing and its actual size. 3. Least Common Multiple- the lowest, common value between two or more numbers. Proportion and scale are terms that express relationship. Relationships are comparisons. To understand the relationship between proportion and scale, you must also understand Least Common Multiple (LCM), which allows us to compare fractional quantities. Give each of 10 students an index card with the multiple of 3 and have them line up consecutively shoulder - to - shoulder. Then, give each of ten more students an index card with multiples of 4 and have them line up consecutively shoulder - to - shoulder facing the multiples of 3. Have the "4" multiples look for the first "3" multiple that is the same as theirs and call him over Red Rover style. Then, the "3" multiples should call back the	**Proportion** *Key Vocabulary* (Review) 1. mph- miles per hour Use a map to locate the actual distance from your hometown to San Diego, California. *Rate and ratio: solve problems on speed as a ratio.* Using the formula S = D/T (or D = R x T) have the students figure how long it would take them to drive from hometown to San Diego, CA if they traveled at a rate of 65 mph. Example: 65 mph = 1665 mi hrs (Speed or Rate) = (Distance) (Time) 1665 mi 65 mph = 26 hrs (Distance) (Rate or Speed) = (Time) 65 mph = 1665 mi 26 hrs (Speed or Rate) = (Distance) (Time) 1665 mi = 65 mph x 26 hrs (Distance) (Rate or Speed) x (Time) *Assessment/Evaluation* 1. Scale	**Percentage** *Key Vocabulary* (Review) 1. None In play money, give groups of students 1 dollar, 4 quarters, 10 dimes, 20 nickels and 100 pennies. Walk students through how various quantities of each of the different coins is equal to one dollar. As you demonstrate this concept with play money, also write the values in decimal form. Again, walk the students through the decimal value of each coin and how many are needed to equal one dollar. But, this time, show the percentage of each coin needed to equal one dollar by using the fraction circles and writing the percentage. Once the students have made a connection between decimals, fractions, and percentages using money, read the story *Alexander, Who Used To Be Rich Last Sunday.* Give each student 3 dollars, 5 quarters, 6 dime, 12 nickels, and 31 pennies in play money. Read page one and have

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
	Make a list of what the students' brainstorm. Explain to the students that the chances of picking one bean, from one jar, one time, are the same for each jar because 1 out of 10 is = 10 out of 100. [1:10 = 1/10 = 0.10 = 10%] [1:100 = 1/100 = 0.100 = 100%] *Assessment/Evaluation* Teacher Observation	twelve, with a symbol- 8:12, or as a fraction- 8/12 Demonstrate as many examples as necessary, writing the 3 forms of ratio, until student confidence is acquired. Examples are checked as a whole class when everyone has had a chance to answer once. Once confident students have knowledge of writing the 3 forms of ratio, move onto simplifying fractional ratios and writing the reduced form as a decimal and percent. *Assessment/Evaluation* 1. Teacher Observation / Appendix D (*Homework*)	LCM's. In this manner, students should begin to understand the Least Common Multiple between numbers. Continue with more sets of multiples. Use Appendix G to allow students further practice with LCM. *The Mysterious Fraction Zone* (pg. 9) from Decimals and Fractions: Grades 4–8 can be used as further guided practice. *The Wheel of Fractions* (pg. 11-12) from Decimals and Fractions: Grades 4–8 can be used as Independent Practice. *Optical Illusions* (pg. 13-14) from Decimals and Fractions: Grades 4–8 can be used as homework. *Fraction Line-Up* (pg. 17) from Decimals and Fractions: Grades 4–8 can be placed in a center to reinforce LCM. *Assessment/Evaluation:* *The Wheel of Fractions* and *Optical Illusions*		students count out money. Continue reading the story. Use Appendix M as an overhead transparency and a copy for each student and have the students follow along "spending" one dollar. *Assessment/Evaluation* **1.** Appendix M

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student Activities and Timeline	Students will discuss among themselves which jar they think would be the best from which to try and pick a green jellybean while blinded. Students will select a jellybean from their choice of jar and record responses.	Student will give examples of ratios. Student will write the three forms of ratio. Student will simplify fractional ratios and write the reduced form as a decimal and percent. Partner Activity: Ratio & Percent	Students will participate in group activity to identify Least Common Multiple. Students will complete independent activities: *Optical Illusions* and *Fractional Line-Up*	Students will use Appendix I to make a scale showing the distance between their hometown and San Diego, California. The scale may use metric or customary units of measure. Students should use their scale measurement and their actual measurement to show the relationship in proportion of their map to the actual distance. *For ease of demonstration, round each measurement.* For example: The distance between Lubbock, Texas and San Diego, California is approximately 1,665 miles and measures 15cm Find a fraction equivalent to the scale. The scale is 1 centimeter. The actual length on the map is 15 centimeters. The actual distance is 1,665 miles. Therefore, 1,665 divided by 15 = 111. You multiply 1 cm x 111 to get 111, and you multiply 15 by 111 to get 1,665. Length on plan: 1 cm = 111 cm Actual length: 15 cm = 1665 mi	Students will count out how much money Anthony has after reading page one. Students tell you how many dollars, quarters, dimes, nickels and pennies Nicholas has after counting what is left. Students will begin to follow along “spending” their money as Alexander does after receiving one dollar from Grandma Betty and Grandpa Louis. This will require them to regroup their dollar. It may be necessary to allow some students to work in groups. At the completion of the story, the students may then use the handout to convert the decimal dollar amount left after each exchange to a fraction and then to a percentage of the dollar Alexander has spent.

Ratio & Percent

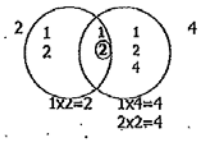
To simplify (reduce) a ratio written in the form of a fraction, like 2/4. We must find its value as expressed using the fewest pieces necessary (1/2) to show equal value to its original form 2/4.



It is easy to see the fractional ratio 2/4 simplified to ½ using the above picture, but we need another way to simply fractional ratios when we do not have access to accurate pictures, or manipulatives. Have you ever heard your Mother say, "Everything isn't always as it appears"?

A good way to do this is by finding the Greatest Common Factor, or GCF, of the denominators. This can be done using a Venn Diagram. You may have used a Venn Diagram to compare things before. We will use it to compare factors that are shared between denominators.

Begin listing factors of the first given number being careful to always begin with 1 x ☐ = ☐ and continue in a consecutive manner until all factors of ☐ are found.



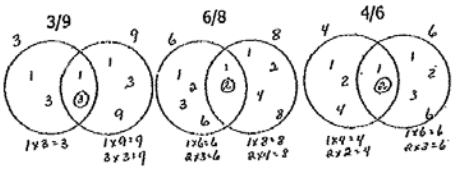
Divide the numerator and the denominator by the GCF to simplify the fractional ratio to its lowest terms (value of fraction using fewest pieces).

fraction	words	symbol
$\frac{2 \div 2}{3 \div 2} = \frac{1}{2}$	one to two	1:2

Appendix A

Ratio & Percent

Demonstrate the following examples with students until they are confident simplifying fractional ratios using the Greatest Common Factor (GCF) of the denominators. Remember to write each simplified form of ratio in fractions (2/4), in words (two to four), and using a symbol (2:4).



$\frac{3 \div 3}{9 \div 3} = \frac{1}{3}$	$\frac{6 \div 2}{8 \div 2} = \frac{3}{4}$	$\frac{4 \div 2}{6 \div 2} = \frac{2}{3}$
one to three	three to four	two to three
1:3	3:4	2:3

Appendix B

Ratio & Percent

All of Jessica's pets are dogs except one, and all of her pets are cats except one. How many dogs and how many cats does she have? To solve this riddle, simplify the fractions below. Then, match the letters in the problem boxes with the answers printed at the bottom of the page. Finally, write the correct letters on the lines.

Example: $\frac{5}{25} = \frac{5 \div 5}{25 \div 5} = \frac{1}{5}$ The fraction, $\frac{1}{5}$, is now in its simplest form.

H = $\frac{9}{15}$	I = $\frac{12}{15}$	T = $\frac{6}{14}$	S = $\frac{10}{12}$	E = $\frac{4}{6}$
A = $\frac{3}{16}$	E = $\frac{4}{16}$	A = $\frac{3}{6}$	C = $\frac{9}{24}$	E = $\frac{6}{8}$
G = $\frac{2}{8}$	N = $\frac{16}{20}$	J = $\frac{4}{10}$	C = $\frac{3}{18}$	N = $\frac{4}{20}$
O = $\frac{4}{32}$	A = $\frac{9}{27}$	D = $\frac{15}{18}$	O = $\frac{9}{10}$	O = $\frac{9}{12}$
A = $\frac{3}{21}$	S = $\frac{12}{36}$	N = $\frac{4}{12}$	S = $\frac{5}{25}$	D = $\frac{6}{16}$

$\frac{2}{3}$ $\frac{2}{3}$ $\frac{5}{6}$ $\frac{1}{3}$ $\frac{4}{5}$ $\frac{3}{8}$ $\frac{1}{3}$

$\frac{3}{5}$ $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{4}{5}$ $\frac{1}{4}$ $\frac{5}{6}$ $\frac{3}{5}$ $\frac{1}{4}$

$\frac{1}{3}$ $\frac{1}{5}$ $\frac{3}{8}$ $\frac{3}{4}$ $\frac{1}{3}$ $\frac{3}{4}$ $\frac{1}{6}$ $\frac{1}{4}$ $\frac{3}{4}$

Appendix D

Ratio & Percent

Games are great for strengthening students' skills. Spike your ability to find equivalent fractions with Tic-Tac-Toe Volleyball. Grab a partner, a dice, and different colored game markers. Best 3:4 is the winner.

Gameboard 1

$\frac{3}{6}$	$\frac{2}{16}$	$\frac{3}{24}$
$\frac{2}{6}$	$\frac{3}{12}$	$\frac{4}{6}$
$\frac{6}{9}$	$\frac{5}{10}$	$\frac{9}{12}$

Winner: _____

Gameboard 2

$\frac{5}{20}$	$\frac{6}{18}$	$\frac{7}{14}$
$\frac{12}{18}$	$\frac{4}{6}$	$\frac{9}{18}$
$\frac{4}{32}$	$\frac{6}{8}$	$\frac{3}{24}$

Winner: _____

Gameboard 3

$\frac{5}{40}$	$\frac{12}{16}$	$\frac{10}{15}$
$\frac{2}{4}$	$\frac{2}{8}$	$\frac{8}{12}$
$\frac{6}{12}$	$\frac{4}{16}$	$\frac{9}{27}$

Winner: _____

Gameboard 4

$\frac{6}{8}$	$\frac{2}{8}$	$\frac{8}{12}$
$\frac{3}{9}$	$\frac{4}{32}$	$\frac{4}{16}$
$\frac{4}{12}$	$\frac{4}{8}$	$\frac{6}{12}$

Winner: _____

Appendix E

Ration & Percent

Use the Least Common Multiple (LCM) between two denominators of a fraction to compare. List the multiples of the denominators in a table until you find the LCM.
For example: Compare 2/5 and 9/10

5	10
10	

Since 10 is the LCM of 5 & 10, 10 will be the new denominator (Least Common Denominator) of the original fractions.

Divide the new denominator (10) by the original denominator (5) to find a factor that can be multiplied by the original numerator to find the new numerator. Explain to the students that both the numerator, and the denominator, can be multiplied by the same number because the value is 1, and any number multiplied by 1, is itself. Therefore, the value of the fraction is not changed. You have merely found equivalent fractions that can be easily compared.

$\frac{2}{5} = \frac{n}{10}$ $10 \div 5 = 2$ $\frac{2 \times 2}{5 \times 2} = \frac{4}{10}$

$4/10 < 9/10$

$\frac{9}{10} = \frac{n}{10}$ $10 \div 1 = 10$ $\frac{9 \times 1}{10 \times 1} = \frac{9}{10}$

Continue to have students compare fractions they demonstrate proficiency. This would be another good time to "play for tickets".

Appendix G

Ratio & Percent

Directions: Use the formulas below to create a scale of the distance between your hometown and San Diego, California.

S = D T
__mph ____mi ☐ hrs

D = R x T
____mi = __mph x ☐ hrs

The Inverse Operation of Multiplication allows us to rearrange the previous Number Sentence to:

D R = T
____mi __mph = ☐ hrs

Scale ____cm = ____mi
Actual cm = mi

Appendix I

Ratio & Percent

Scale Model of Golden Gate Bridge

Directions: Using what you know about proportion and scale, figure what the measurements for a model of the Golden Gate Bridge would be if 1 centimeter = 10 feet. Round answers for easier calculating. The first one has been done for you. Use the back of the page to show your work. Write your answers in the spaces provided.

(scale) 1 cm = 10 ft (represented)
(model measurement) 898 cm = 8981 ft (real measurement)

You multiply 1 cm (scale) by 10 to get 10 ft (represented). To find the model measurement, you must divide 8,891 ft (real measurement) by 10 to get 898 cm (model measurement).

Bridge			
Length of approach to bridge	1,265.5	ft	
Length of one side span	1,125	ft	
Length of main span	4,200	ft	
Total length of bridge	8,981	ft	898 cm
Width of Bridge	80	ft	
Width of Roadway Between curbs	62	ft	
Width of sidewalk	10.5	ft	
Clearance of water	220	ft	
Clearance below water	110	ft	
Base of each leg	1,782	ft. sq.	
Tower			
Height Above Water	746	ft	
Height Above Roadway	500	ft	
Width of tower	80	ft	
Length of the cables	7,650	ft	

Appendix J

Ratio & Percent

Directions: Keep a running record of the money Alexander spends.

		Ones	.	1/10	1/100		
$ 1.00 -	start	1	.	0	0	100/100	100%
$. -			.				
$. -			.				%
$. -			.				%
$. -			.				%
$. -			.				%
$. -			.				%
$. -			.				%
$. -			.				%
$ 0.00	$	0	.	0	0		0 %

Appendix M

Student Name: _____ Score:

Ratio Worksheet

Fill the blanks from the given statements:

6 eggs were rotten and 5 eggs were broken in the total of 40.

Ratio of good eggs to rotten eggs is _____

Ratio of rotten eggs to broken eggs is _____

Ratio of broken eggs to good eggs is _____

Ratio of broken eggs to total is _____

Ratio of rotten eggs to total is _____

Ratio of good eggs to total is _____

There are 35 marbles in a basket. Out of which 8 are red marbles, 11are purple marbles and the remaining are black marbles.

Ratio of red marbles to purple marbles is _____

Ratio of black marbles to red marbles is _____

Ratio of purple marbles to black marbles is _____

Ratio of black marbles to total is _____

Ratio of purple marbles to total is _____

Ratio of red marbles to total is _____

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Student Name: _____ Score:

Answers

6 eggs were rotten and 5 eggs were broken in the total of 40.

Ratio of good eggs to rotten eggs is 29:6

Ratio of rotten eggs to broken eggs is 6:5

Ratio of broken eggs to good eggs is 5:29

Ratio of broken eggs to total is 5:40 or 1:8

Ratio of rotten eggs to total is 6:40 or 3:20

Ratio of good eggs to total is 29:40

There are 35 marbles in a basket. Out of which 8 are red marbles, 11are purple marbles and the remaining are black marbles.

Ratio of red marbles to purple marbles is 8:11

Ratio of black marbles to red marbles is 16:8 or 2:1

Ratio of purple marbles to black marbles is 11:16

Ratio of black marbles to total is 16:35

Ratio of purple marbles to total is 11:35

Ratio of red marbles to total is 8:35

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