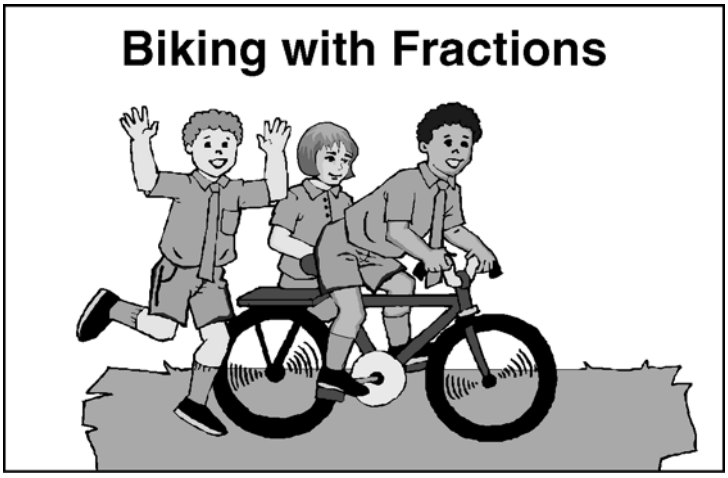
Common Core Mathematics Challenge



Level: Grade Five

Domain: Number and Operations–Fractions

Cluster: Use equivalent fractions as a strategy to add and subtract fractions.

Standard

Add and subtract fraction with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions

The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. Each Challenge includes a set of tasks that require higher-order thinking skills. Because these types of tasks may be new for students and they will have varying levels of understanding, the student responses will vary. The Challenges and guiding questions were designed to help teachers plan their implementation and elicit, analyze, and act on evidence of student understanding.

Each packet contains all the materials necessary to implement the Mathematics Challenge including a grade-appropriate Challenge, the Mathematics Challenge Meeting Protocol, and the Guiding Questions for Analyzing Student Responses to Mathematics Challenges.

For each Challenge, you will complete a six step process of planning, implementation, and analysis and reflection.

The Mathematics Challenge Process

Stage	Step	Task
Planning	Step 1.	Review the Mathematics Challenge Meeting Protocol
	Step 2.	Review and solve the Mathematics Challenge prior to your Professional Learning Community meeting. Think about your responses to the guiding questions on the Meeting Protocol
	Step 3.	Hold your Professional Learning Community meeting and discuss your responses to the Guiding Questions on the Meeting Protocol
Implementation	Step 4.	Implement the Mathematics Challenge with your class
Analysis and Reflection	Step 5.	For your own planning and documentation, respond to the Guiding Questions on the Analyzing Student Responses Protocol
	Step 6.	To help us improve the Challenges and to provide recommendations for teachers implementing them in future years, complete the Mathematics Challenge Feedback Log and provide copies of all student work to the Assessment Coordinator

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Number and Operations–Fractions
Grade 5–Biking with Fractions

Mathematics Challenge Meeting Protocol

Your Professional Learning Community will meet to discuss the implementation of one Mathematics Challenge. In preparation for your meeting, please print and review the Mathematics Challenge, solve all tasks within the Challenge, and think about the guiding questions below. These questions will be used to facilitate a group discussion regarding the implementation of the upcoming Mathematics Challenge.

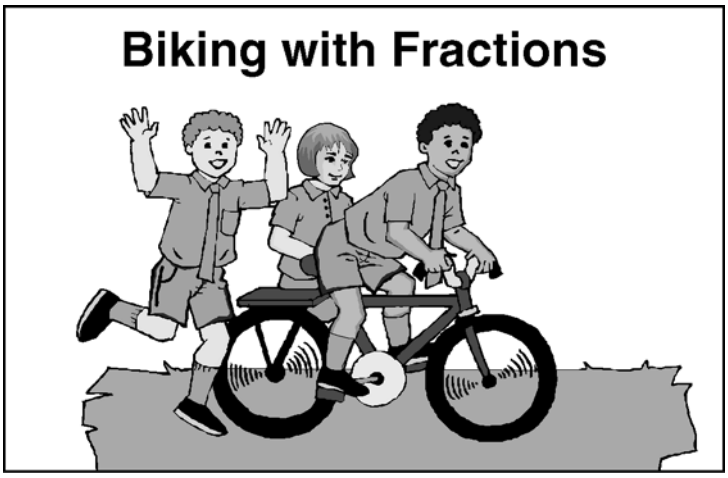
Guiding Questions for Implementing the Mathematics Challenges

1. What is the title of the Challenge that you will use?
2. What skills or standards is this Challenge measuring?
3. Where does this Challenge fit within your curriculum? Within which unit?
4. At what point during the unit will you administer this Challenge (e.g., At the beginning of a unit to determine what students do or do not know, at the end of a unit to assess what students have or have not learned, in the middle of a unit to determine where to go next instructionally)?
5. How will your students complete this Challenge (e.g., individually, one-on-one, in small groups, as a class)? Why?
6. Are there any prerequisite skills, common misunderstandings, or vocabulary needs that you will have to address? What are they?
7. What difficulties do you anticipate your students will have with the Challenge? How will you address them?
8. Are these skills and difficulties different for special needs students, ELL students, etc.? How? Will you do anything different for these students? What?
9. How will you evaluate student responses (e.g., grade responses with the provided rubric, scan responses to identify common mistakes/misconceptions, have students evaluate one another's responses, have students evaluate their own response)?
10. What will student responses to this Challenge tell you about student understanding?
11. How might you use this evidence of student understanding to adapt your teaching and learning?
12. What other materials, resources, or support might you need? Where can you get them?
13. How can your colleagues assist you in the analysis of student understanding?
14. What other questions or concerns do you have about this Mathematics Challenge?

After you have implemented the challenge with your class, be sure to respond to the Guiding Questions on the Analyzing Student Responses Protocol.

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions



Domain: Number and Operations–Fractions

Cluster: Use equivalent fractions as a strategy to add and subtract fractions

Standard:
Add and subtract fraction with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Task Preparation:
Each student will need a copy of the Student Response Sheet, a pencil, and possibly some crayons.

Stimulus Cards (Drawing or Word Description):
None

Manipulatives/Supplies:
A copy of the Student Response Sheet for each student
Pencils
Crayons (optional)

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions

Cues/Directions:
Distribute student response sheets. Students should be directed to look carefully at each figure. Allow students time to answer.

Instruct students to follow along as you read aloud and say: **The number line below shows a bike path in town. The path starts at the park and ends at the school. Different places along the path have been marked on the line.** Have students look at the figure and make observations.

1. Say: **Janine puts number on the number line. She puts the Park at 0 and the School at 1. Her number line is shown on the next page. On the next page draw a line from the places to the fraction that best represents where they are on Janine's number line (Hint: There is an extra fraction!) (TEACHER NOTE:** Students should draw a line from each place in the list to the fraction that best represents the value that would correspond with that place on Janine's number line. One of the fractions should not be used.**)**
2. **The Post Office is not shown on the number line. When the Park is at 0 and the School is at 1, the post office is at $\frac{7}{8}$. Put an X on the number line where you think the Post Office should go. (TEACHER NOTE:** Students should put an X on the number line to show the place that best represents the location of the Post Office.**) How do you know where to put the Post Office on the number line? (TEACHER NOTE:** Students should write their answers in the box.**)**
3. **Nate wants to renumber the number line with the Park at 0 and the School at 2. What number should he use at the Fire House? (TEACHER NOTE:** Students should write a number on the blank provided.**) What number should he use at the Police Station? (TEACHER NOTE:** Students should write a number on the blank provided.**)**
4. **Gloria and Paul are riding their bikes on the path. They stop at the Market and buy a bag of 10 cookies. Gloria eats 2 cookies and Paul eats 4 cookies. What fraction of the cookies in the bag are eaten? (TEACHER NOTE:** Students should write a fraction on the blank provided.**) Show how you get your answer. (TEACHER NOTE:** Students should show their work in the box.**) What fraction of the cookies in the bag are <u>not</u> eaten? (TEACHER NOTE:** Students should write a fraction on the blank provided.**) How do you know? (TEACHER NOTE:** Students should write their answers in the box.**)**

5. **Nicole, Frank, and Tanya are riding their bikes on the path. They stop at the Pizza Shop and order 2 small pizzas. The pizzas are the same size, and each is cut into 8 slices of the same size. Nicole eats 0.5 of <u>one</u> pizza. Shade in the slices she eats on the picture below. (TEACHER NOTE:** Students should shade in 0.5 of one pizza on the figure.**) Frank eats $\frac{5}{8}$ of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole and Frank. (TEACHER NOTE:** On the figure, students should shade in the total number of slices eaten by Nicole and Frank.**) Tanya eats 0.25 of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole, Frank, and Tanya. (TEACHER NOTE:** On the figure, students should shade in the total number of slices eaten by Nicole, Frank, and Tanya.**) What fraction of pizza was <u>not</u> eaten? (TEACHER NOTE:** Students should write a fraction on the blank provided.**) Show how you get your answer. (TEACHER NOTE:** Students should show their work in the box.**)**
6. **Look at the drawing below. (TEACHER NOTE:** Students should look at the figure.**) Write an addition problem with fractions that is the same as the drawing above. Then show the work that leads to the answer. (TEACHER NOTE:** In the box, students should write an addition problem that matches the figure shown and show the steps they follow to answer the addition problem they wrote.**) Show the same addition problem on the number line below. (TEACHER NOTE:** Students should plot the beginning fraction on the number line, show the amount moved because of the fraction that was added to it, and plot the answer to the addition problem.**)**

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions

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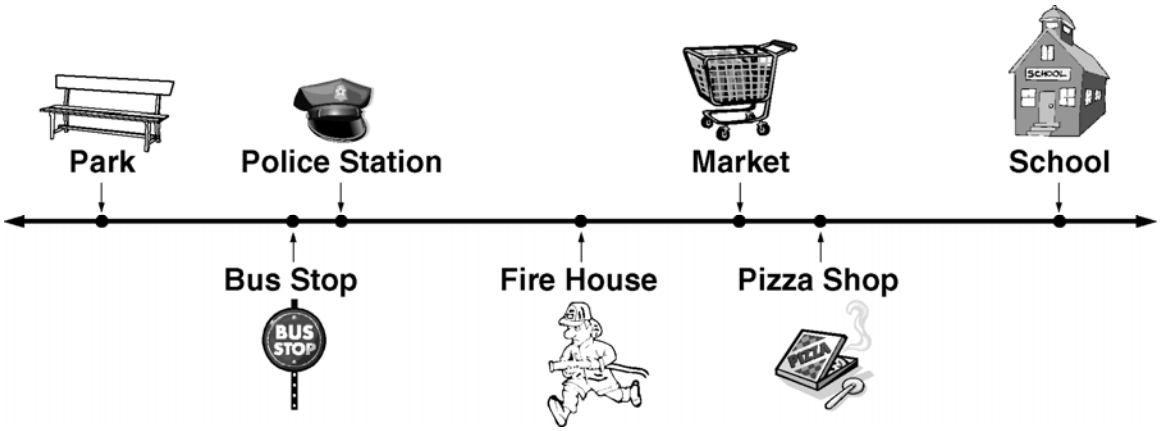
Student Response Sheet

Biking with Fractions

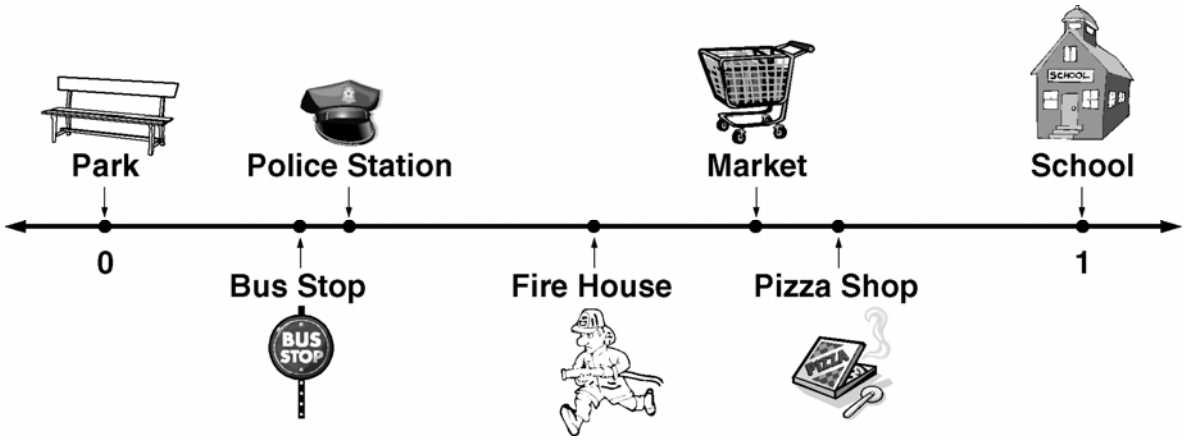
Name: _____ **Date:** _____

The number line below shows a bike path in town. The path starts at the park and ends at the school. Different places along the path have been marked on the line.



1. **Janine puts numbers on the number line. She puts the Park at 0 and the School at 1. Her number line is shown on the next page. On the next page draw a line from the places to the fraction that best represents where they are on Janine's number line. (Hint: there is an extra fraction!)**

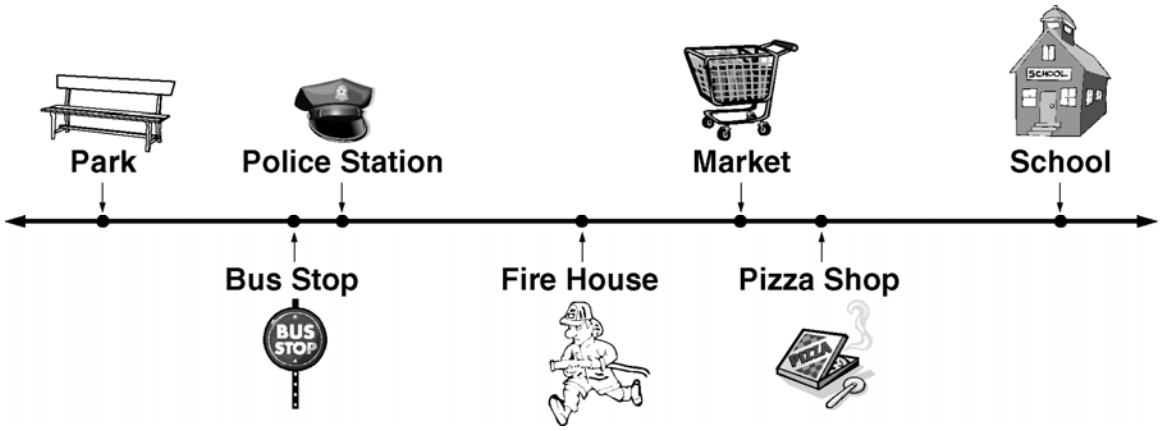
Number and Operations–Fractions
Grade 5–Biking with Fractions



Place	Fraction
Bus Stop	$\frac{1}{2}$
Police Station	$\frac{1}{3}$
Fire House	$\frac{1}{4}$
Market	$\frac{1}{5}$
Pizza Shop	$\frac{2}{3}$
	$\frac{3}{4}$

2. The Post Office is not shown on the number line. When the Park is at 0 and the School is at 1, the Post Office is at $\frac{7}{8}$.

Put an X on the number line where you think the Post Office should go.



How do you know where to put the Post Office on the number line?

3. Nate wants to renumber the number line with the Park at 0 and the School at 2.

What number should he use at the Fire House?

_____

What number should he use at the Police Station?

_____

4. Gloria and Paul are riding their bikes on the path. They stop at the Market and buy a bag of 10 cookies.

Gloria eats 2 cookies and Paul eats 4 cookies. What fraction of the cookies in the bag are eaten?

_____

Show how you get your answer.

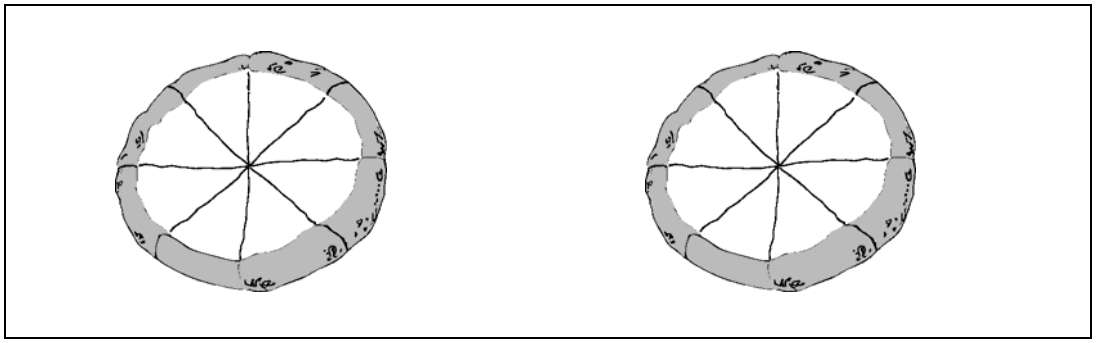
What fraction of the cookies in the bag are <u>not</u> eaten?

_____

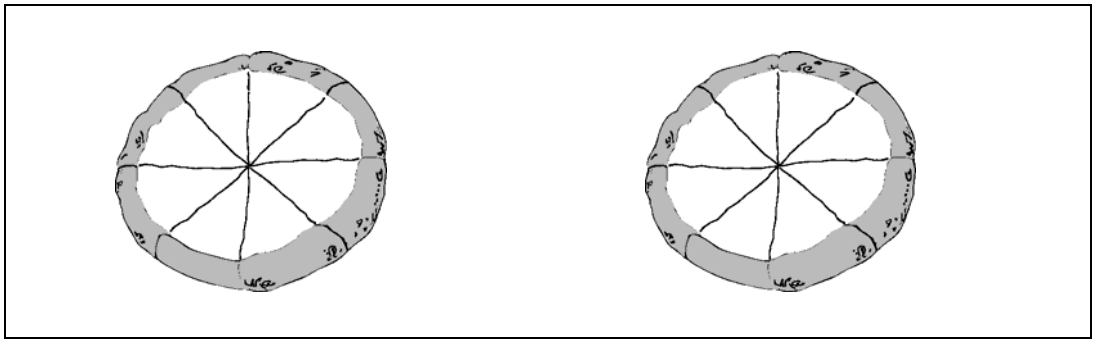
How do you know?

5. Nicole, Frank, and Tanya are riding their bikes on the path. They stop at the Pizza Shop and order 2 small pizzas. The pizzas are the same size, and each is cut into 8 slices of the same size.

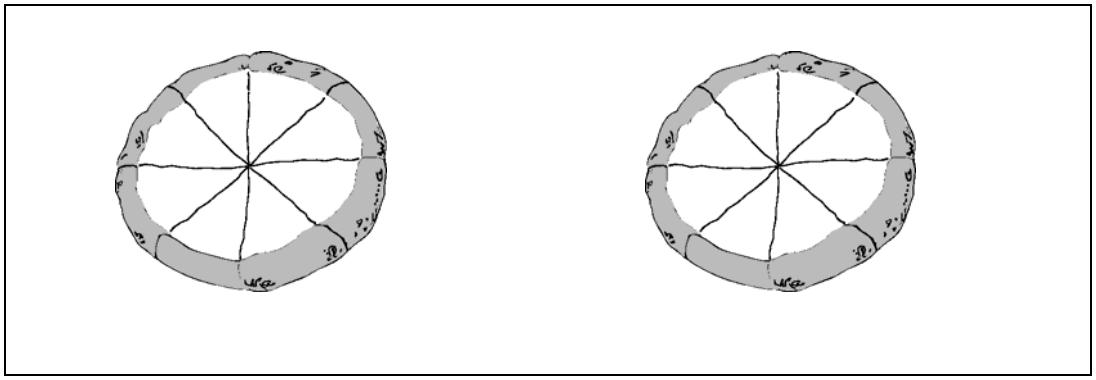
a. Nicole eats 0.5 of <u>one</u> pizza. Shade in the slices she eats on the picture below.



b. Frank eats $\frac{5}{8}$ of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole and Frank.



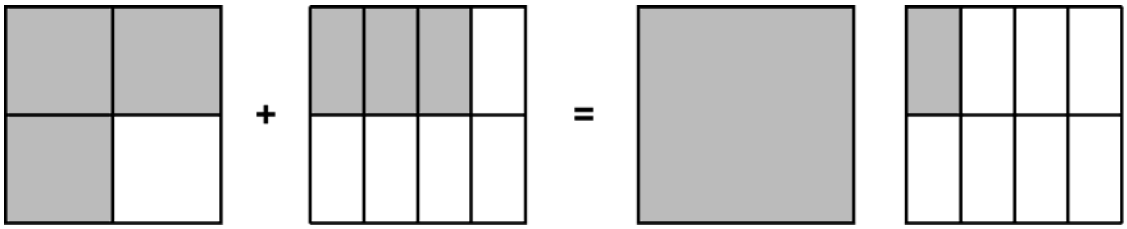
c. Tanya eats 0.25 of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole, Frank, and Tanya.



d. What fraction of a pizza was <u>not</u> eaten? _____

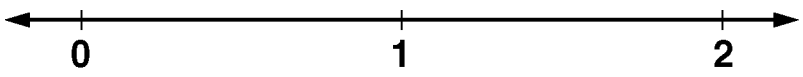
Show how you get your answer.

6. Look at the drawing below.



a. Write an addition problem with fractions that is the same as the drawing above. Then show the work that leads to the answer.

b. Show the same addition problem on the number line below.



Learning and Teaching Considerations

Task 1:

A) Be sure that students understand that fractional parts are equal shares or equal-sized portions of a whole or unit (unit as a length, in this case).

B) Be sure that students understand that fractional parts have special names that tell how many parts of that size are needed to make the whole. The denominator of a fraction indicates by what number the whole has been divided in order to produce the type of part under consideration. The numerator of a fraction counts or tells how many of the fractional parts (of the type indicated by the denominator) are under consideration.

C) Be sure that students understand that two equivalent fractions are two ways of describing the same amount by using different-sized fractions.

D) If a student says or writes, "I just know," prompt him or her by saying something like "I'm glad you know, but it's important in math to be able to explain your answers so other people can understand what you're thinking."

E) If a student says or writes, "I don't know," say something positive like "Let's start with what you do know about this problem." Students often know more than they think or say, and encouraging them to vocalize or write about that knowledge is all they need.

F) The teacher could encourage students to use manipulatives that represent a linear model, such as Cuisenaire rods, to explore fractions.

Task 2:

A) Be sure that students understand that fractional parts are equal shares or equal-sized portions of a whole or unit. The unit is counted as 1. On the number line, the distance from 0 to 1 is the unit.

B) Students may use benchmarks for fractions, such as 0, 1/2, or 1. Understanding why a fraction is close to 0, 1/2, or 1 is a good beginning for fraction number sense.

C) Be sure that students understand that the more fractional parts used to make the unit, the smaller the parts. For example, eighths are smaller than sixths.

D) Students may use paper folding to find fourths and eighths.

E) Students may recognize that 7/8 is 1/8 more than 3/4 or 1/8 less than 1.

Task 3:

A) Students may double all answers or multiply all answers by 2.

B) Students may write a 0 under the Park and a 2 under the School on the number line, then fold or measure.

Task 4:

A) Be sure that students understand that three categories of models exist for working with fractions–area, length, and set of quantity (set of cookies).

B) The teacher can encourage students to use manipulatives that represent a set of quantity model, such as pattern blocks or tiles (or cookies), to explore fractions.

C) Students may show the addition of two fractions with the same denominator, that is, 2/10 + 4/10 = 6/10.

D) Students may show in some way that "eaten" plus "not eaten" make the whole or 1 – 6/10 = 4/10.

Task 5:

A) Students may convert the decimals and/or fraction into slices of pizza.

B) Students may indicate converting 0.5 and 0.25 into eighths.

C) Be sure to give students ample opportunity to develop fraction number sense before starting to talk about rules of computation.

D) Students may have the misconception that adding denominators to each other is the rule when adding fractions with uncommon denominators.

D) Students may answer by using manipulatives, by creating their own pictures, or by using words or symbols. The teacher also can encourage them to link these strategies and/or representations to each other as a way to provide a convincing solution.

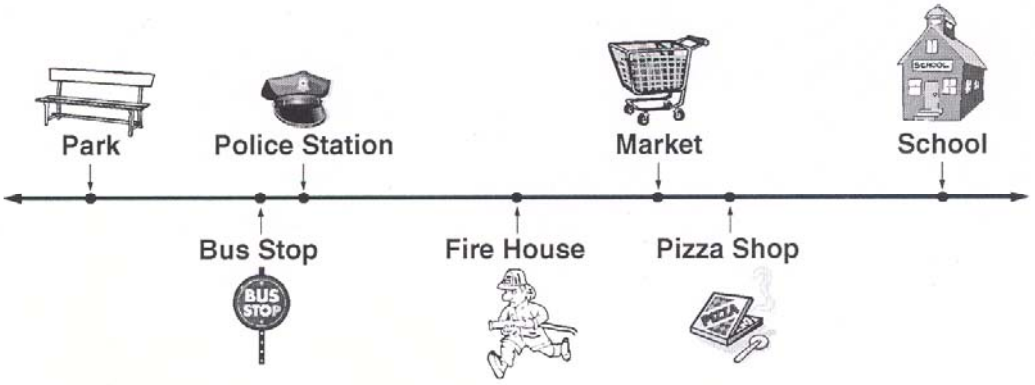
Task 6:

A) Be sure students are able to show why 3/4 + 3/8 = 9/8.

B) Students may show the number line clearly divided into 8 parts between the integers shown.

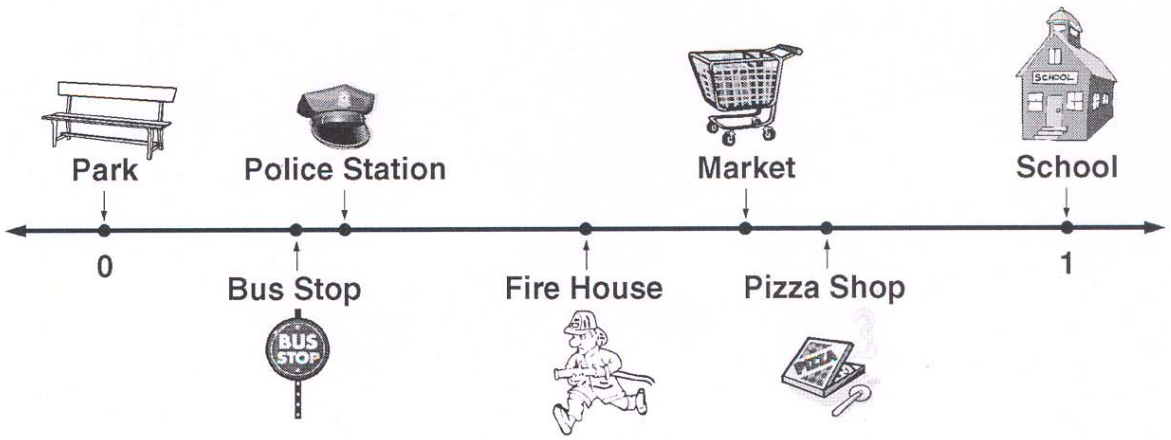
Name: ANSWER KEY Date: _____

The number line below shows a bike path in town. The path starts at the park and ends at the school. Different places along the path have been marked on the line.



1. **Janine puts numbers on the number line. She puts the Park at 0 and the School at 1. Her number line is shown on the next page. On the next page draw a line from the places to the fraction that best represents where they are on Janine's number line. (Hint: there is an extra fraction!)**

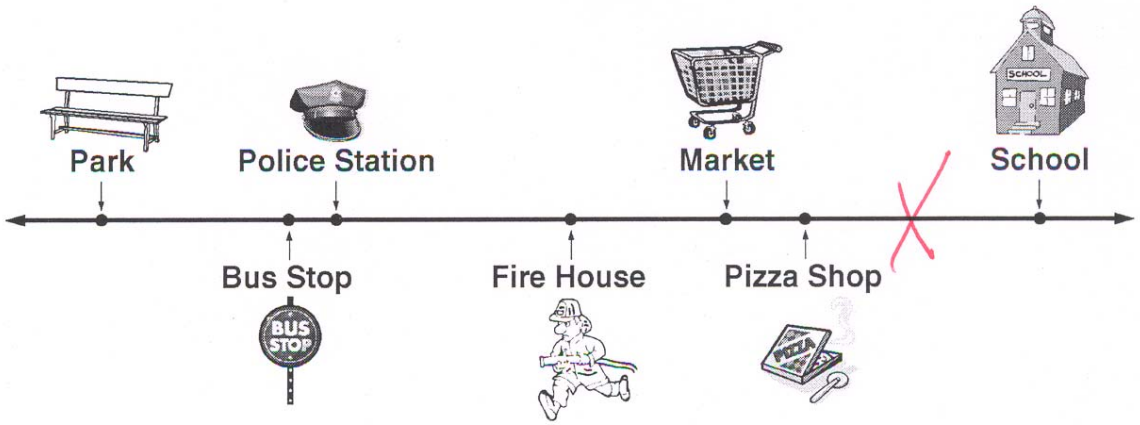
Number and Operations–Fractions
Grade 5–Biking with Fractions



Place	Fraction
Bus Stop	$\frac{1}{2}$
Police Station	$\frac{1}{3}$
Fire House	$\frac{1}{4}$
Market	$\frac{1}{5}$
Pizza Shop	$\frac{2}{3}$
	$\frac{3}{4}$

2. **The Post Office is not shown on the number line. When the Park is at 0 and the School is at 1, the Post Office is at $\frac{7}{8}$.**

   Put an X on the number line where you think the Post Office should go.



How do you know where to put the Post Office on the number line?

THE PIZZA SHOP IS 3/4 AND THE SCHOOL IS 1. 7/8 IS MORE THAN 3/4 + LESS THAN 1. SO THE POST OFFICE GOES BETWEEN THEN.

3. **Nate wants to renumber the number line with the Park at 0 and the School at 2.**

   What number should he use at the Fire House?

   1

   What number should he use at the Police Station?

   $\frac{1}{2}$

4. **Gloria and Paul are riding their bikes on the path. They stop at the Market and buy a bag of 10 cookies.**

   Gloria eats 2 cookies and Paul eats 4 cookies. What fraction of the cookies in the bag are eaten?

   $\frac{6}{10}$ (OR $\frac{3}{5}$)

   Show how you get your answer.

   $\frac{2}{10} + \frac{4}{10} = \frac{6}{10}$

   OR $2 + 4 = 6$

   SO, 6 OF 10 COOKIES EATEN IS $\frac{6}{10}$

   What fraction of the cookies in the bag are <u>not</u> eaten?

   $\frac{4}{10}$ (OR $\frac{2}{5}$)

   How do you know?

   IF 6 OF 10 ARE EATEN, THEN 4 ARE NOT EATEN.

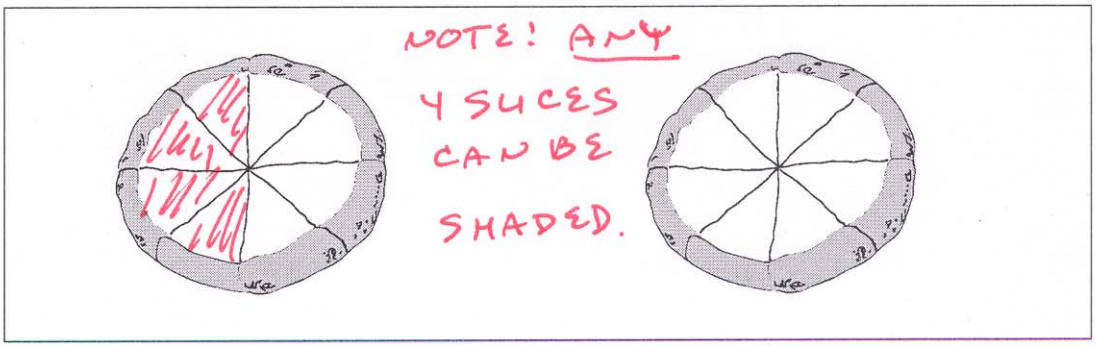
   OR $10 - 6 = 4$

   OR $\frac{10}{10} - \frac{6}{10} = \frac{4}{10}$

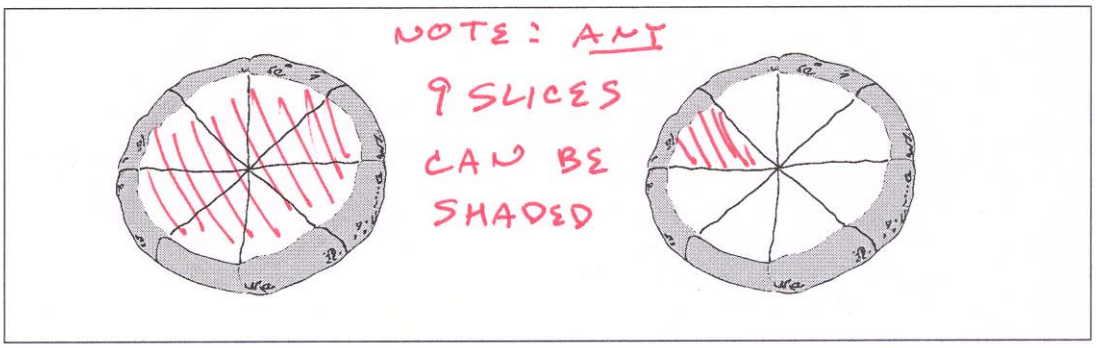
   OR $\frac{6}{10} + \frac{4}{10} = 1$

5. Nicole, Frank, and Tanya are riding their bikes on the path. They stop at the Pizza Shop and order 2 small pizzas. The pizzas are the same size, and each is cut into 8 slices of the same size.

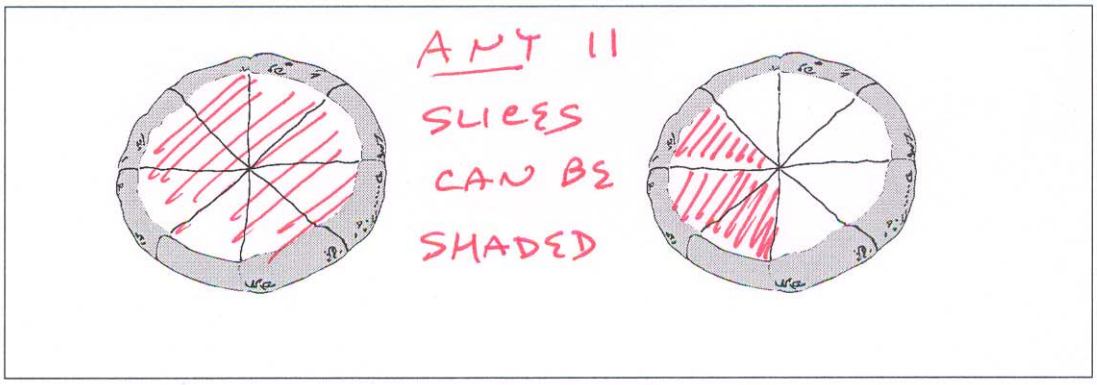
a. Nicole eats 0.5 of <u>one</u> pizza. Shade in the slices she eats on the picture below.



b. Frank eats $\frac{5}{8}$ of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole and Frank.



c. Tanya eats 0.25 of <u>one</u> pizza. On the picture below, shade in all the slices eaten by Nicole, Frank, and Tanya.



d. What fraction of a pizza was <u>not</u> eaten? $\frac{5}{8}$

Show how you get your answer.

NICOLE: .5 = $\frac{1}{2}$ = $\frac{4}{8}$

FRANK: $\frac{5}{8}$

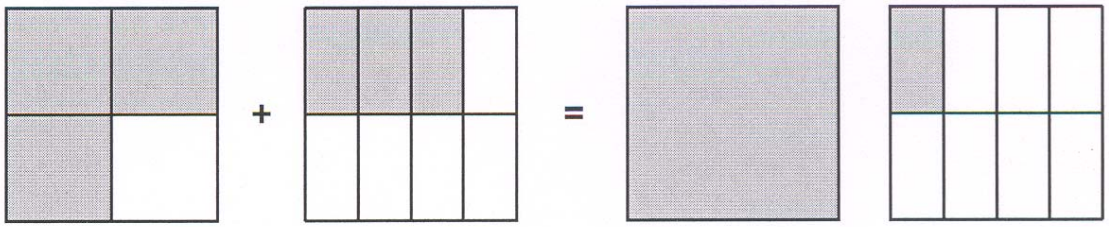
TANYA: .25 = $\frac{1}{4}$ = $\frac{2}{8}$

$\frac{4}{8} + \frac{5}{8} + \frac{2}{8} = \frac{11}{8}$

2 PIES ARE $\frac{16}{8}$

$\frac{16}{8} - \frac{11}{8} = \frac{5}{8}$ NOT EATEN

6. Look at the drawing below.



a. Write an addition problem with fractions that is the same as the drawing above. Then show the work that leads to the answer.

$\frac{3}{4} + \frac{3}{8} = 1\frac{1}{8}$

$\frac{3}{4} = \frac{6}{8}$

$+ \frac{3}{8} = \frac{3}{8}$

$\frac{9}{8} = 1\frac{1}{8}$

OR

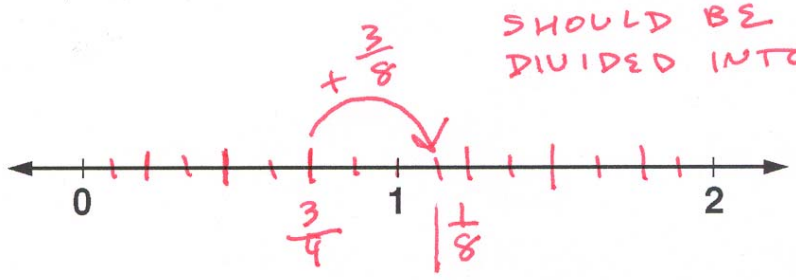
$\frac{3}{4} + \frac{3}{8} =$

$\frac{6}{8} + \frac{3}{8} = \frac{9}{8}$

$= 1\frac{1}{8}$

b. Show the same addition problem on the number line below.

NUMBER LINE SHOULD BE DIVIDED INTO 8THS.



Number and Operations–Fractions
Grade 5–Biking with Fractions

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions Rubric

Category	4	3	2	1
Mathematical Concepts	**Response shows complete understanding of the mathematical concepts used to solve the problem(s).**	**Response shows substantial understanding of the mathematical concepts used to solve the problem(s).**	**Response shows some understanding of the mathematical concepts needed to solve the problem(s).**	**Response shows very limited understanding of the underlying concepts needed to solve the problem(s), OR the response is not written.**
	Response shows evidence in ALL of the following tasks. **Task 1**. Student matches places correctly on number line, as shown on answer sheet. **Task 2**. Student places a mark about halfway between the Pizza Shop and the School. Student explains that 7/8 is greater than 3/4 and less than 1, or explains that 7/8 is halfway between 3/4 and 1. **Task 3**. Student answers 1 and 1/2, as shown on answer sheet. **Task 4**. Student answers 6/10 (or 3/5) and explains why that is the answer to the first question. Student answers 4/10 (or 2/5) and explains why that is the answer to the second question. **Task 5**. Student shades 4 slices in part (a), 9 slices in part (b), 11 slices in part (c), and explains why 5/8 remains. **Task 6**. Student is able to show why 3/4 + 3/8 = 9/8. Student is able to divide number line in part (b) into 8 equal parts between 0 and 1 and again between 1 and 2.	Response shows evidence in ALL of the tasks described in category 4, but may exhibit the following errors. **Task 1**. Police Station, Fire House, and Pizza Shop are correct. Other places are not correct. **Task 2**. Mark for Post Office is noticeably not centered in interval. **Task 6**. Student does not show an addition problem with unlike denominators and/or does not show eighths on the number line.	Response shows evidence in only 4 or 5 of the tasks described in category 4.	Response shows evidence in 3 or fewer of the tasks described in category 4.

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions Rubric

Category	4	3	2	1
Strategy and procedures	**Student typically uses an efficient and effective strategy to solve the problem(s).**	**Student typically uses an effective strategy to solve the problem(s).**	**Student sometimes uses an effective strategy to solve the problem(s), but not consistently.**	**Student rarely uses an effective strategy to solve the problem(s).**
	Response shows evidence in ALL of the following tasks. **Task 1**. Student shows indications somewhere on paper of finding common denominators for fractions or shows indications of dividing number line between 0 and 1 in equal parts (halves, thirds, etc.). **Task 2**. Student shows indications somewhere on paper of comparing 7/8 to one of the fractions given in task 1. **Task 3**. Student shows indications of writing a 0 under the Park and a 2 under the School on the number line. Student may also show a 1 over the Fire House and a 1/2 around the Police Station. **Task 4**. Student shows the addition of two fractions with the same denominator, that is, 2/10 + 4/10 = 6/10. Student also shows in some way that "eaten" plus "not eaten" make the whole; that is, 1 – 6/10 = 4/10. (Student may simplify the fractions, but that is not necessary.) **Task 5**. Student indicates somewhere on paper that he or she is converting the decimals and/or fraction into slices of pizza. Student may indicate converting 0.5 and 0.25 into eighths. In part (d) student shows addition of fractions with unlike denominators. **Task 6**. Student indicates somewhere on paper how to solve the addition problem 3/4 + 3/8.	Response shows evidence in only 4 or 5 of the tasks described in category 4.	Response shows evidence in only 2 or 3 of the tasks described in category 4.	Response shows evidence in 1 or fewer of the tasks described in category 4.

Number and Operations–Fractions
Grade 5–Biking with Fractions Rubric

Category	4	3	2	1
Explanation and communication	**Explanation is detailed and clear; uses appropriate terminology and/or notation.**	**Explanation is clear; uses some appropriate terminology and/or notation.**	**Explanation is a little difficult to understand, but includes critical components; shows little use of appropriate terminology and/or notation.**	**Explanation is difficult to understand, is missing several components, and does not use or include appropriate terminology and/or notation.**
	Response shows evidence in ALL of the following tasks. **Task 2**. Student explains reasoning on where to place the Post Office. Reasoning should compare 7/8 to both 3/4 and 1. **Task 4**. Student provides a correct explanation in both parts–the fraction of the cookies in the bag that has been eaten and the fraction left that has not been eaten. Explanation should include a reference to the whole bag being 10/10 of the bag. **Task 5**. Student shows somewhere in part (d) that the slices from two pies are represented as 16/8. **Task 6**. Student shows the number line clearly divided into 8 parts between the integers shown.	Response shows evidence in only 3 explanations described in category 4.	Response shows evidence in only 2 explanations described in category 4.	Response shows evidence in 1 or fewer explanations described in category 4.

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions Rubric

Category	4	3	2	1
Mathematical accuracy	**All or almost all of the steps and solutions have no mathematical errors.**	**Most of the steps and solutions have no mathematical errors.**	**Some of the steps and solutions have no mathematical errors.**	**Few of the steps and solutions have no mathematical errors.**
	Student provides correct answers for ALL of the following tasks. **Task 1**. All matches are correct, as shown on answer sheet. **Task 2**. Student places a mark on the number line about halfway between the Pizza Shop and the School. **Task 3**. Student answers 1 and 1/2, as shown on the answer sheet. **Task 4**. Student answers 6/10 and 4/10, as shown on the answer sheet. **Task 5**. Student shades the correct number of slices in parts (a), (b), and (c). Student answers 5/8 in part (d). **Task 6**. Student writes equation $\frac{3}{4}+\frac{3}{8}=1\frac{1}{8}$.	Student provides correct answers for only 5 of the tasks described in category 4. The Police Station, Fire House, and Pizza Shop should be correct in task 1.	Student provides correct answers for only 3 or 4 of the tasks described in category 4.	Student provides correct answers for 2 or fewer of the tasks described in category 4.

Scoring notes checklist

Task	Check Yes	Category
Task 1		
Student matches places correctly on number line, as shown on answer sheet.		Concept
Student shows indications somewhere on paper of finding common denominators for fractions or shows indications of dividing number line between 0 and 1 in equal parts (halves, thirds, etc.).		Strategy
All matches are correct, as shown on answer sheet.		Accuracy
Task 2		
Student places a mark about halfway between the Pizza Shop and the School. Student explains that 7/8 is greater than 3/4 and less than 1, or explains that 7/8 is halfway between 3/4 and 1.		Concept
Student shows indications somewhere on paper of comparing 7/8 to one of the fractions given in task 1.		Strategy
Student explains reasoning on where to place the Post Office. Reasoning should compare 7/8 to both 3/4 and 1.		Explanation
Student places a mark on the number line about halfway between the Pizza Shop and the School.		Accuracy
Task 3		
Student answers 1 and 1/2, as shown on answer sheet.		Concept
Student shows indications of writing a 0 under the Park and a 2 under the School on the number line. Student may also show a 1 over the Fire House and a 1/2 around the Police Station.		Strategy
Student answers 1 and 1/2, as shown on the answer sheet.		Accuracy
Task 4		
Student answers 6/10 (or 3/5) and explains why that is the answer to the first question. Student answers 4/10 (or 2/5) and explains why that is the answer to the second question.		Concept
Student shows the addition of two fractions with the same denominator, that is, 2/10 + 4/10 = 6/10. Student also shows in some way that “eaten” plus “not eaten” make the whole; that is, 1 – 6/10 = 4/10. (Student may simplify the fractions, but that is not necessary.)		Strategy
Student provides a correct explanation in both parts–the fraction of the cookies in the bag that has been eaten and the fraction left that has not been eaten. Explanation should include a reference to the whole bag being 10/10 of the bag.		Explanation
Student answers 6/10 and 4/10, as shown on the answer sheet.		Accuracy

Task 5		
Student shades 4 slices in part (a), 9 slices in part (b), 11 slices in part (c), and explains why 5/8 remains.		Concept
Student indicates somewhere on paper that he or she is converting the decimals and/or fraction into slices of pizza. Student may indicate converting 0.5 and 0.25 into eighths. In part (d) student shows addition of fractions with unlike denominators.		Strategy
Student shows somewhere in part (d) that the slices from two pies are represented as 16/8.		Explanation
Student shades the correct number of slices in parts (a), (b), and (c). Student answers 5/8 in part (d).		Accuracy
Task 6		
Student is able to show why 3/4 + 3/8 = 9/8. Student is able to divide number line in part (b) into 8 equal parts between 0 and 1 and again between 1 and 2.		Concept
Student indicates somewhere on paper how to solve the addition problem 3/4 + 3/8.		Strategy
Student shows the number line clearly divided into 8 parts between the integers shown.		Explanation
Student writes equation $\frac{3}{4} + \frac{3}{8} = 1\frac{1}{8}$.		Accuracy

Common Core Mathematics Challenge

Number and Operations–Fractions
Grade 5–Biking with Fractions
Analyzing Student Responses Protocol

The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. They include extended responses, open-ended tasks, and tasks that require higher-order thinking skills. Because these types of tasks may be novel for students and they will have varying levels of understanding, the student responses will vary.

The guiding questions below were designed to assist you in analyzing your class' response to the Challenge and determining appropriate next steps for your teaching and learning.

Guiding Questions for Analyzing Student Responses to the Mathematics Challenges

1. When completing the Challenge, what did your students do well? How do you know?

2. When completing the Challenge, what did your students struggle with? How do you know?

3. When your students completed the Challenge, did they implement multiple correct solutions strategies? What insightful approaches to problem solving did you observe?

4. What, if any, patterns (e.g., common errors/misconceptions) did you observe across your student responses?

5. What questions or concerns did your students have when working through this Challenge or a particular task? Are these things you should address for the class as a whole?

6. What, if any, feedback did you provide to your class? How did you provide it?

7. What did you learn about your students' mathematical understanding based on their responses to this Challenge?