



Number and Operations: Pizza with Friends Grade 5 Formative Assessment Lesson

Designed and revised by the Kentucky Department of Education
Field-tested by Kentucky Mathematics Leadership Network Teachers

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kdemath@education.ky.gov

Revised 2019

This Formative Assessment Lesson is designed to be part of an instructional unit. This task should be implemented approximately two-thirds of the way through the instructional unit. The results of this task should be used to inform the instruction that will take place for the remainder of your unit.

Mathematical goals

This lesson unit is intended to help you assess how well students are able to model addition and subtraction of fractions. In particular, this unit aims to identify and help students who have difficulties with:

- Using equivalent fractions to add and subtract fractions.
- Using benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
- Solving word problems involving the addition and subtraction of fractions.

Kentucky Academic Standards

This lesson involves mathematical content standards from within the grade, with emphasis on:

Grade 5 Number and Operations with Fractions

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

This lesson involves a range of Standards for Mathematical Practice with emphasis on:

MP1. Make sense of problems and persevere in solving them.

MP3. Construct viable arguments and critique the reasoning of others.

MP4. Model with mathematics.

MP7. Look for and make use of structure.

Introduction

This lesson unit is structured in the following way:

- A day or two before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. You then review their work and create questions for students to answer in order to improve their solutions.
- A whole class introduction provides students with guidance on how to engage with the content of the task.
- Students work with a partner on a collaborative discussion task to match the word problem and fraction models. Throughout their work, students justify and explain their decisions to their peers and teacher(s).
- In a final whole class discussion, students synthesize and reflect on the learning to make connections within the content of the lesson.
- Finally, students revisit their original work or a similar task, and try to improve their individual responses.

Materials required

- Each individual student will need two copies of the worksheet *Pizza with Friends*.
- Each partner group of students will need a packet of Card Set A, and three copies each of Card Set B and Card Set C.
- The card sets should be cut up before the lesson. The extra two copies of each card set allow students to use benchmark fractions. These extra sets would not have to be cut apart in the beginning. Students could be given the extra two copies and cut out the benchmark fractions they choose to use themselves. **The models for the collaborative activity can be answered using reduced fractions or with equivalent fractions.** These extra copies allow students to have this option.
- Each pair of students will also need tape or glue to use after they have modeled each task correctly.

Time needed

Approximately fifteen minutes for the assessment task, a one-hour lesson, and 15 minutes for the students to review their work for changes. All timings are approximate. Exact timings will depend on the needs of the class.

Before the lesson

Assessment task:

Have the students do this task in class a day or more before the Formative Assessment Lesson. This will give you an opportunity to assess the work and to find out the kinds of difficulties students have with it. Then you will be able to target your help more effectively in the follow-up lesson.

Give each student a copy of *Pizza with Friends*. Introduce the task briefly and help the class to understand the problem and its context.

Spend fifteen minutes on your own, answering this question.

Don't worry if you can't figure it out. There will be a lesson on this material [tomorrow] that will help you improve your work. Your goal is to be able to answer these questions with confidence by the end of that lesson.

It is important that students complete the task without assistance, as far as possible.

If students are struggling to get started, ask them questions that help them understand what is required, but do not do the task for them.

Assessing students' responses: Remind students they should know most of the content and this is a review for me to see what we need to review on.

- Collect students' responses to the task. We suggest that you do not

The worksheet is titled "Pizza with Friends" and includes the following text: "Jack and Ellen ordered five whole pizzas for their class party. The shaded region below shows the amount of pizza left after the party." Below this text are five circles representing pizzas. The first circle is divided into 4 equal quadrants, with 1 quadrant shaded. The second circle is divided into 8 equal sectors, with 3 sectors shaded. The third circle is divided into 3 equal sectors. The fourth circle is divided into 2 equal halves. The fifth circle is divided into 8 equal sectors. Below the circles is the text: "Ellen predicts that there is one whole pizza left over for them to share. Explain whether or not Ellen is correct in her prediction. Use fraction circles to justify your answer. Then use fraction bars to model your answer in a different way."

actually score student's work. The research shows that this is counterproductive, as it encourages students to compare scores, and distracts their attention from how they may improve their mathematics.

- Instead, help students to make further progress by asking questions that focus attention on aspects of their work. Some questions in the *Common Misconceptions* chat may serve as examples. These questions have been drawn from commonly identified student misconceptions.
- Make some notes on what their work reveals about their current levels of understanding as they model the addition and subtraction of fractions. The purpose of this is to forewarn you of the issues that will arise during the lesson, so that you may prepare carefully.
- Strategically partner students based on pre assessment data. Partner students with others who display similar errors/misconceptions on the pre-assessment task. While this may seem counterintuitive, this will allow each student to more confidently share their thinking. This may result in partnering students who were very successful together, those who did fairly well together, and those who did not do very well together.

We recommend you:

- write one or two questions on each student's work, or
- give each student a printed version of your list of questions and highlight the questions from each individual student or
- display a small list of questions on the board that will be of help to the majority of students
- The solution to all these difficulties is not to teach one particular way of solving a problem, but to help students to find a variety of ways that work in different situations and make sense to them.

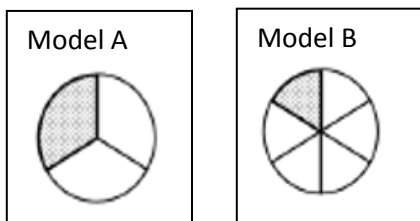
Below is a list of common misconceptions and questions/prompts that may be written on individual tasks, on the board or asked during the collaborative activity to help students clarify and extend their thinking.

Common Issues	Suggested Questions and Prompts
Students who has trouble getting started.	What information do you know? How can you use what you know to begin the problem?
Student does not adjust for a new whole when determining the new amount.	How can you make sure you are only getting a fraction of what is left and not the original amount of pizza?
Student work is unsystematic.	How can you organize your work?
Student uses the wrong fraction operation. Student models problem without explanations.	In this problems are we adding or subtracting? How could you explain/show how you reached your conclusions so that someone in another class understands? How can you use numbers, words, or diagrams to describe the amounts?

Suggested lesson outline

Whole class mathematical introduction (10 minutes)

Give each student a mini white board, marker, and an eraser. Post the following fractional representations on the board.



Record on your white board. What do you notice about these models? List at least five observations.

Possible student answers: $1/3$, $1/6$, both are circles, $2/3$, $5/6$, $3/6$ altogether, $1/2$ altogether. $9/6$ not shaded, the shaded piece in model A is double the size of Model B, etc. This is an opportunity for all students to access the lesson.

Share your thinking with your partner. Show your boards to the class. Teacher selects students to share based on observations from partner share.

Improve individual solutions to the assessment task (10 minutes)

Return your students' work on the *Pizza with Friends* problem. Ask students to re-read both the *Pizza with Friends* problem and their solution. If you have not added questions to students' work, write a short list of your most common questions on the board. Students can then select a few questions appropriate to their own work and begin answering them.

Recall what we were working on previously. What was the task?

Draw students' attention to the questions you have written.

I have read your solutions and I have some questions about your work.

I would like you to work on your own to answer my questions for ten minutes.

Collaborative activity 1 – Matching Card Set A Task Cards and Card Set B Fraction Bars (15 minutes)

Strategically partner students based on pre assessment data. Partner students with others who display similar errors/misconceptions on the pre-assessment task. While this may seem counterintuitive, this will allow each student to more confidently share their thinking. This may result in partnering students who were very successful together, those who did fairly well together, and those who did not do very well together.

Introduce the lesson carefully:

Teacher says: *I want you to work in partners. Begin with a Task card from Card Set A. Model this problem with Fraction Bars from Card Set B to find an answer. Continue this with all task cards. Each time you do this; explain your thinking clearly and carefully. Use the cards from Card Set B to create an equation or inequality, then glue or tape them to answer the tasks from Card Set A. If your partner disagrees with the model you chose, then challenge him/her. It is important that you both understand the math for all the models. There is a lot of work to do today, and it doesn't matter if you don't all finish. The important thing is to learn something new, so take your time.*

You have two tasks during your partner work, to note different student approaches to the task, and to support student problem solving. You can then use this information to focus a whole-class discussion towards the end of the lesson. In particular, notice any common mistakes.

Note different student approaches to the task

Listen and watch students carefully. In particular, listen to see whether they are addressing the difficulties outlined in the *Common Issues* table. You can use this information to focus a whole-class discussion towards the end of the lesson.

Support student problem solving

Try not to make suggestions that move students towards a particular approach to this task. Instead, ask questions to help students clarify their thinking. If several students in the class are struggling with the same issue, you could write a relevant question on the board. You might also ask a student who has performed well on one part of the task to share their thinking a loud and capture the student words on a chart for reference.

The following questions and prompts would be helpful:

- **What information have you been given?**
- **What do you need to find out?**
- **How can you model the fractions you were given in the problem?**

If one student has modeled with a set of bar model cards, challenge their partner to provide an explanation.

- **Maria modeled the problem with these cards. Martin, why does Maria model it this way?**

If you find students have difficulty articulating their decisions, then you may want to use the questions from the *Common Issues* table to support your questioning.

Collaborative Activity 2: Placing Card Set C: Fraction Circles (15 minutes)

As students finish placing the Fraction Bars cards hand out Card Set C: *Fraction Circles*. These provide students with a different way of interpreting the situation. Do not collect *Card Set B*. An important part of this task is for students to make connections between different representations or models of fractions.

Whole-class discussion: comparing different approaches (15 minutes)

Conduct a whole-class discussion about what has been learned and highlight misconceptions and strategies you want to be revealed. Select partners who demonstrated strategies and misconceptions you want to share with the class. Be intentional about the order of student sharing from least complex to most complex thinking. As each partner shares, highlight the connections between strategies.

The intention is for you to focus on getting students to understand the representations of the task to build their conceptual understanding of fractions rather than an algorithm.

Conclude the lesson by discussing and generalizing what has been learned. The generalization involves first extending what has been learned to new examples, and then examining some of the conclusions the students come up with.

Ask: *Which cards were easiest/hardest to match? Why?*
What might be a different way to explain?
Did anyone do the same or something different?
How would you explain in words your model?

Improve individual solutions to the assessment task (10 minutes)

Return to the students their original assessment, *Pizza with Friends*, as well as a second blank copy of the task.

Teacher says: *Look at your original responses and think about what you have learned this lesson. Using what you have learned, try to improve your work.*

If you have not added questions to individual pieces of work then write/display your list of questions on the board.

Students should select from this list only the questions appropriate to their own work.

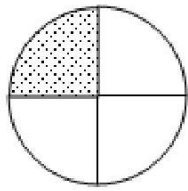
If you find you are running out of time, then you could set this task in the next lesson, or for homework.

This lesson format was designed from the Classroom Challenge Lessons intended for students in grades 6 through 12 from the Math Assessment Project.

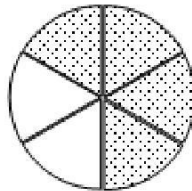
Solutions

Assessment Task: Pizza with Friends

Ellen's prediction was close but not correct. To be a whole pizza there would need to be $12/12$. $11/12 < 12/12$ so it isn't a whole pizza.

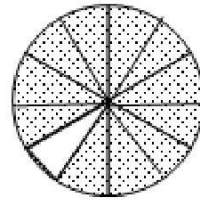


$1/4$

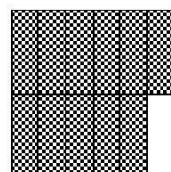
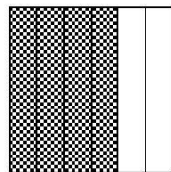
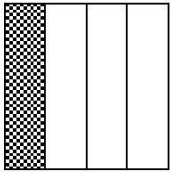


+

$4/6 =$



$11/12$

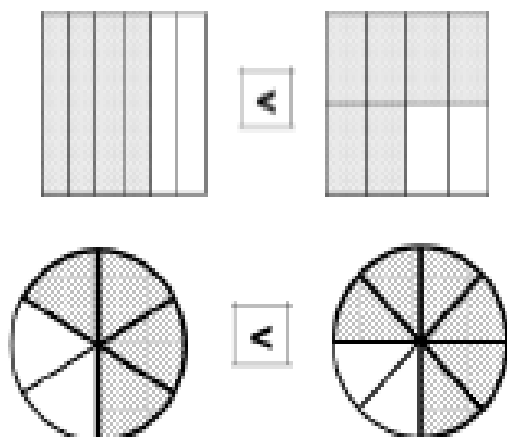


Sample Solutions for Card Sort

Models may vary due to students using fractions given in the problem or equivalent fractions. Answers are not required to be in simplest form.

Task 1:

$$\frac{4}{6} < \frac{6}{8}$$



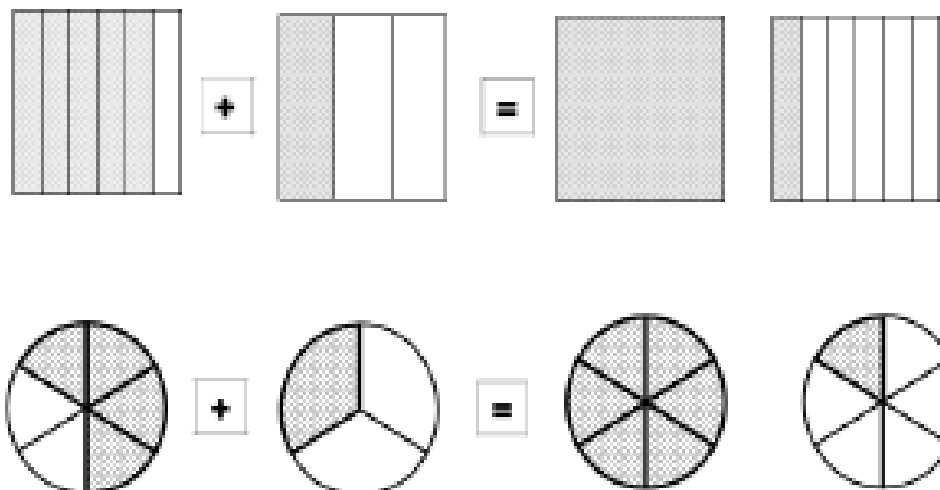
Susan ate less pizza than James because:

Two-thirds is smaller than three-fourths.

OR $8/12 < 9/12$

Task 2:

$$\frac{5}{6} + \frac{1}{3} = 1 \frac{1}{6}$$



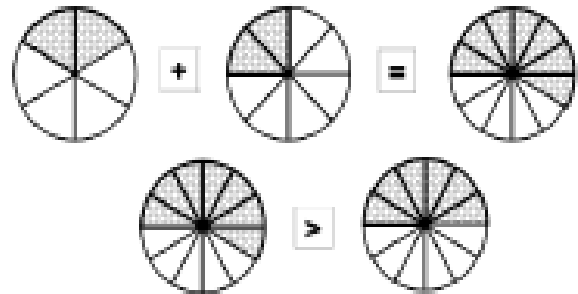
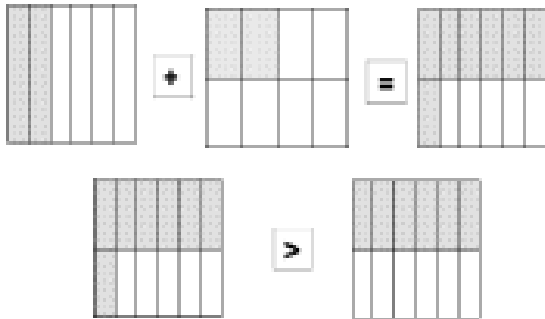
Pepper ate more than one whole pizza. She ate $1\frac{1}{6}$ of a pizza.

$5/6 + 1/3 = 7/6$ or $1\frac{1}{6}$

Task 3:

$$\frac{2}{6} + \frac{2}{8} = \frac{7}{12} \text{ and}$$
$$\frac{7}{12} > \frac{6}{12}$$

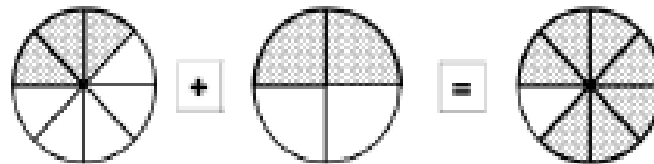
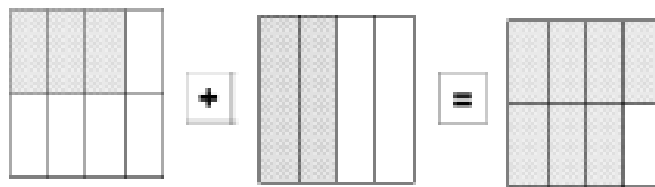
Sam was NOT correct.
Together they ate $\frac{7}{12}$ of the pizza. Since $\frac{7}{12} > \frac{1}{2}$, then less than $\frac{1}{2}$ the pizza is left for a snack.



Task 4:

$$\frac{3}{8} + \frac{2}{4} = \frac{7}{8}$$

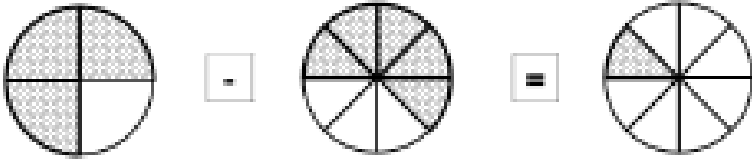
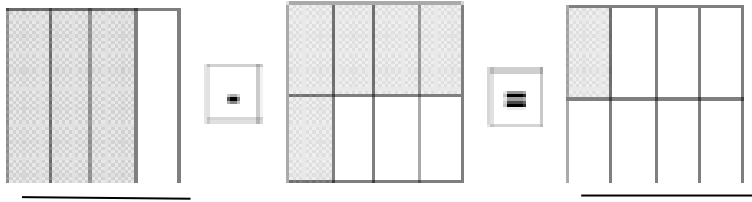
Altogether they ate $\frac{7}{8}$ of a pizza.



Task 5:

$$\frac{3}{4} - \frac{5}{8} = \frac{1}{8}$$

3/4 or 6/8 of the meat lovers pizza was eaten. 5/8 of the vegetarian pizza was eaten. 1/8 more meat lovers pizza was eaten than vegetarian.

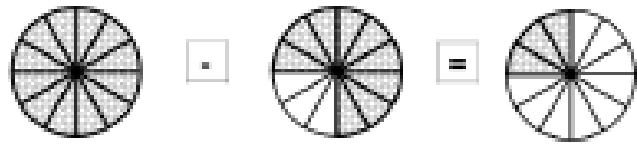
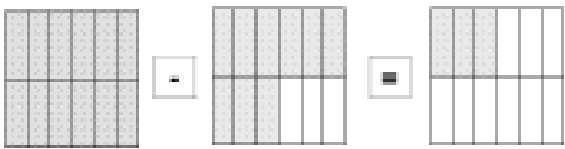
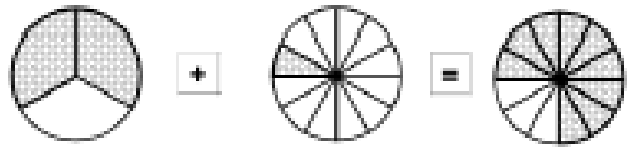
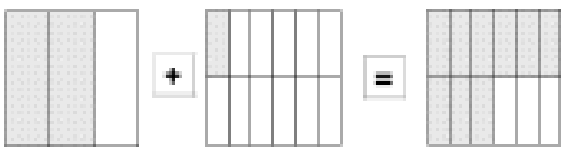


Task 6:

$$\frac{2}{3} + \frac{1}{12} = \frac{9}{12}$$

$$\frac{12}{12} - \frac{9}{12} = \frac{3}{12}$$

Pepper and Chee ate 9/12 or 3/4 of the ham & pineapple pizza. This left 3/12 or 1/4 of the pizza for Pete.

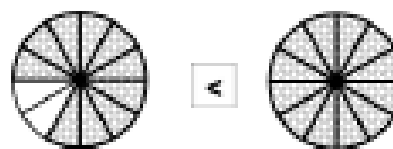
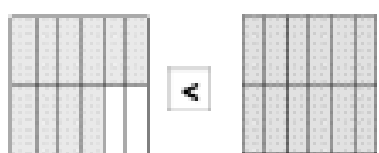
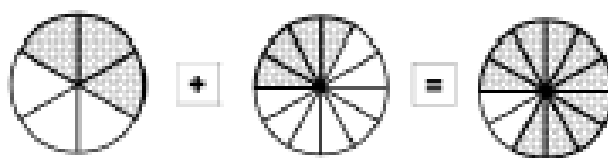
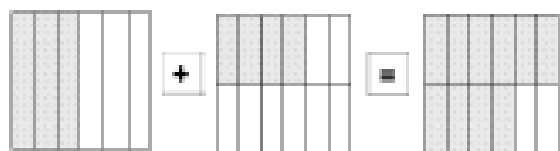


Task 7:

$$\frac{3}{6} + \frac{4}{12} = \frac{10}{12} \text{ and}$$

$$\frac{10}{12} < \frac{12}{12}$$

Pete ate 10/12 or 5/6 of a whole pizza. This is smaller than one whole pizza.



Task 8:

Chase is correct because the sizes of the pizzas were different. This means that the 'wholes' were not the same size and therefore, the halves are not equal.

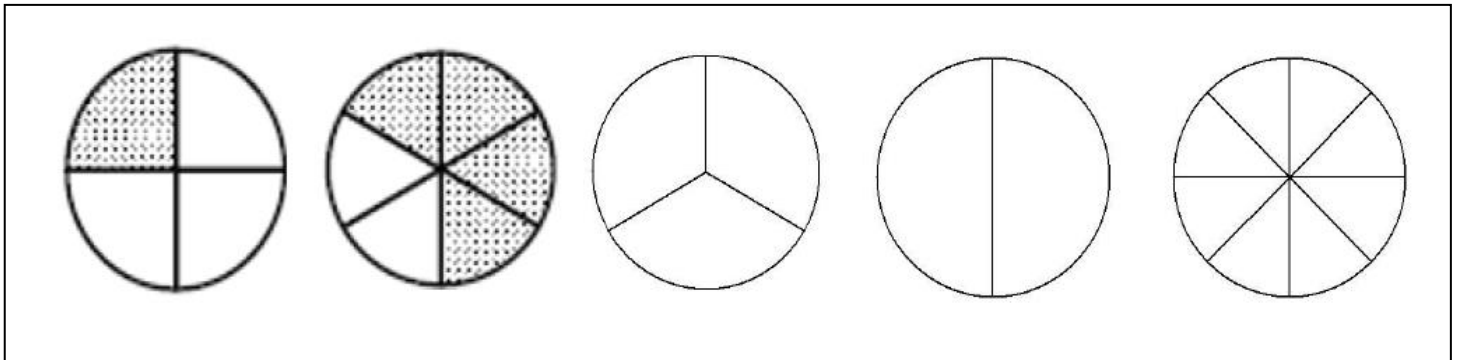
Since Chase began with a larger pizza, his half would be larger than Jennifer's half.

*This task cannot be modeled with the cards available.

Name: _____

Pizza with Friends

Jack and Ellen ordered five whole pizzas for their class party. The shaded region below shows the amount of pizza left after the party.



Ellen predicts that there is one whole pizza left over for them to share. Explain whether or not Ellen is correct in her prediction. Use fraction circles to justify your answer. Then use fraction bars to model your answer in a different way.

CARD SET A: TASK CARDS

1. Susan and Jamie ordered two small pizzas for lunch. Susan ate $\frac{4}{6}$ of her pizza and Jamie ate $\frac{6}{8}$ of his pizza. Did Susan eat more, less, or the same amount of pizza as Jamie?

2. Pepper O'Knee loves pizza. She ate $\frac{5}{6}$ of a pizza for dinner one night. She ordered another pizza the next day and ate $\frac{1}{3}$ of it for lunch. What fraction of a whole pizza did Pepper eat if you combine what she ate both days?

- 3. Jacob ate $\frac{2}{6}$ of a pizza and Sam ate $\frac{2}{8}$ of the same pizza. Sam told Jacob that half of the pizza was left for a snack later.**

Is Sam correct?

- 4. Sarah made a pizza, cut it into eight equal slices and ate three slices. Ben made a pizza of the same size, cut it into four equal slices and then ate two slices. How much pizza did they eat all together?**

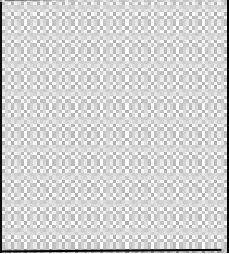
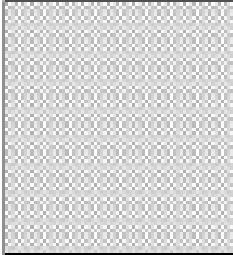
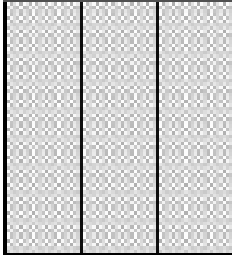
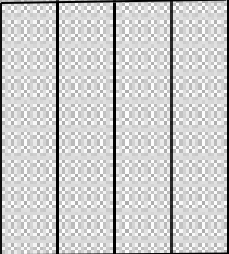
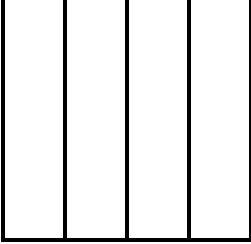
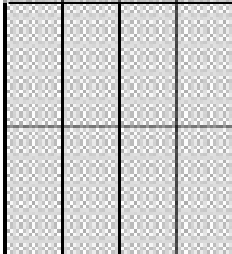
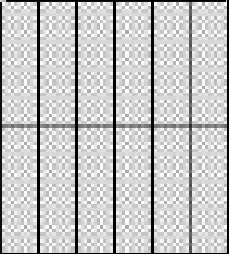
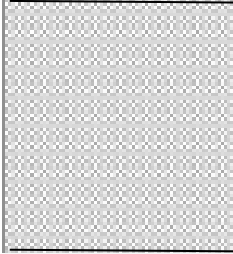
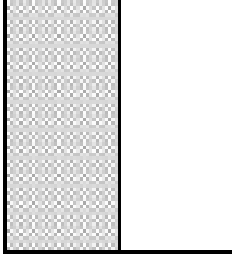
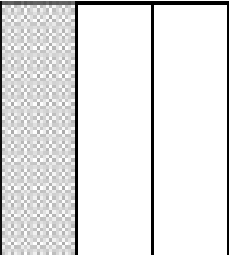
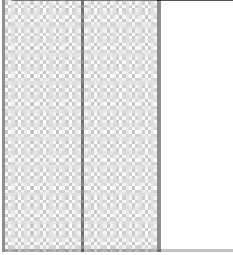
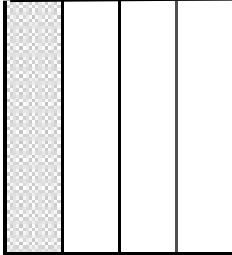
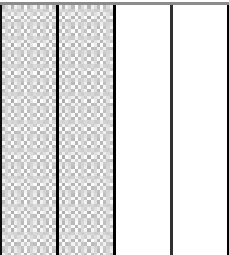
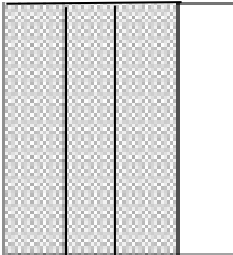
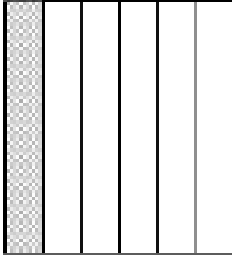
5. Pepper O’Knee and her friend Chee Z. Pie shared two pizzas with some friends. One pizza was a meat lovers and the other was vegetarian. $\frac{3}{4}$ of the vegetarian pizza was eaten and $\frac{5}{8}$ of the meat lovers pizza was eaten. How much more meat lovers pizza was eaten than vegetarian pizza?

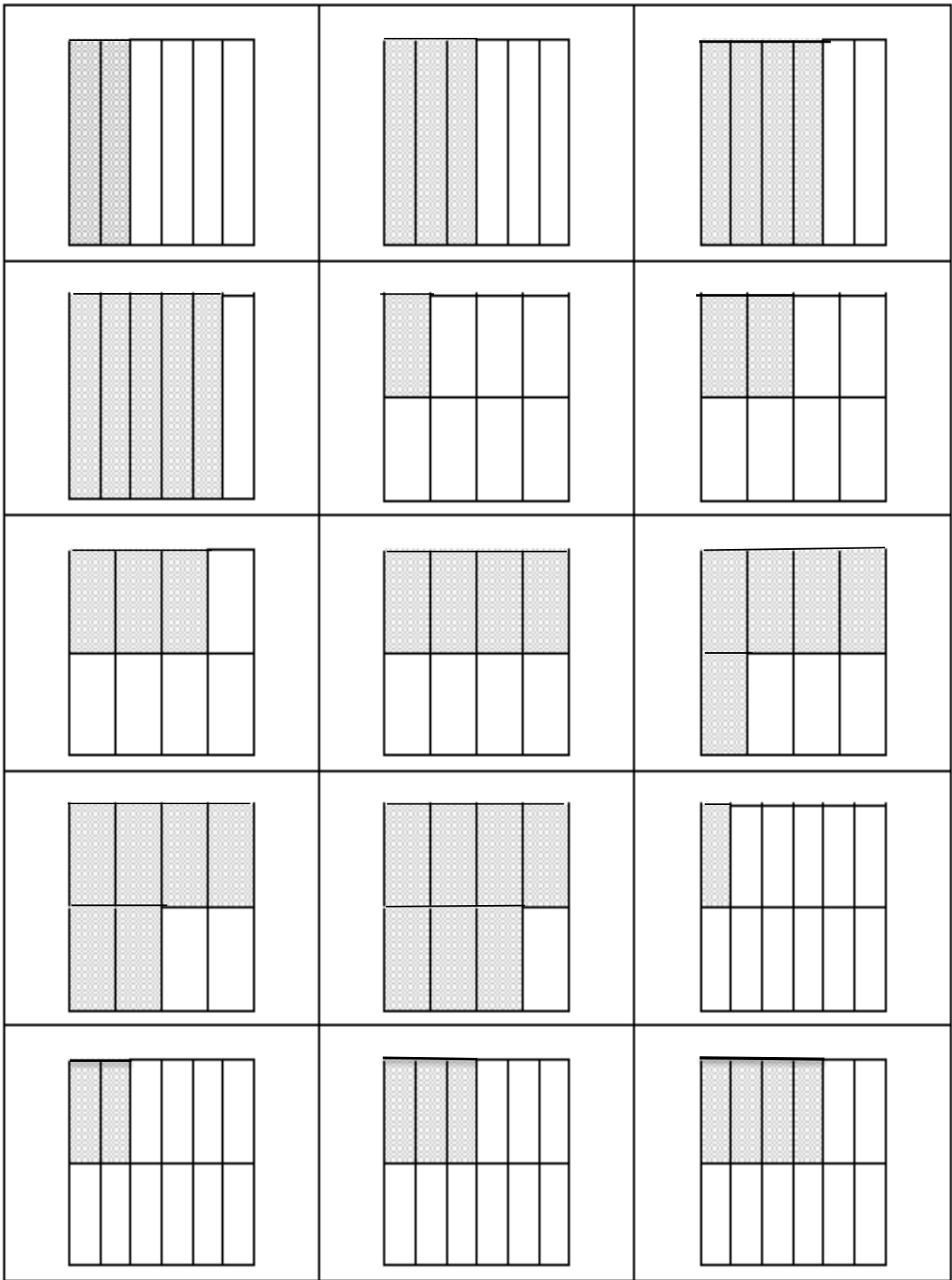
6. Pepper and Chee shared a ham and pineapple pizza. Pepper ate $\frac{2}{3}$ of the pizza and Chee ate $\frac{1}{12}$ of the pizza. What fraction of the pizza was left for their friend Pete Zaphpie?

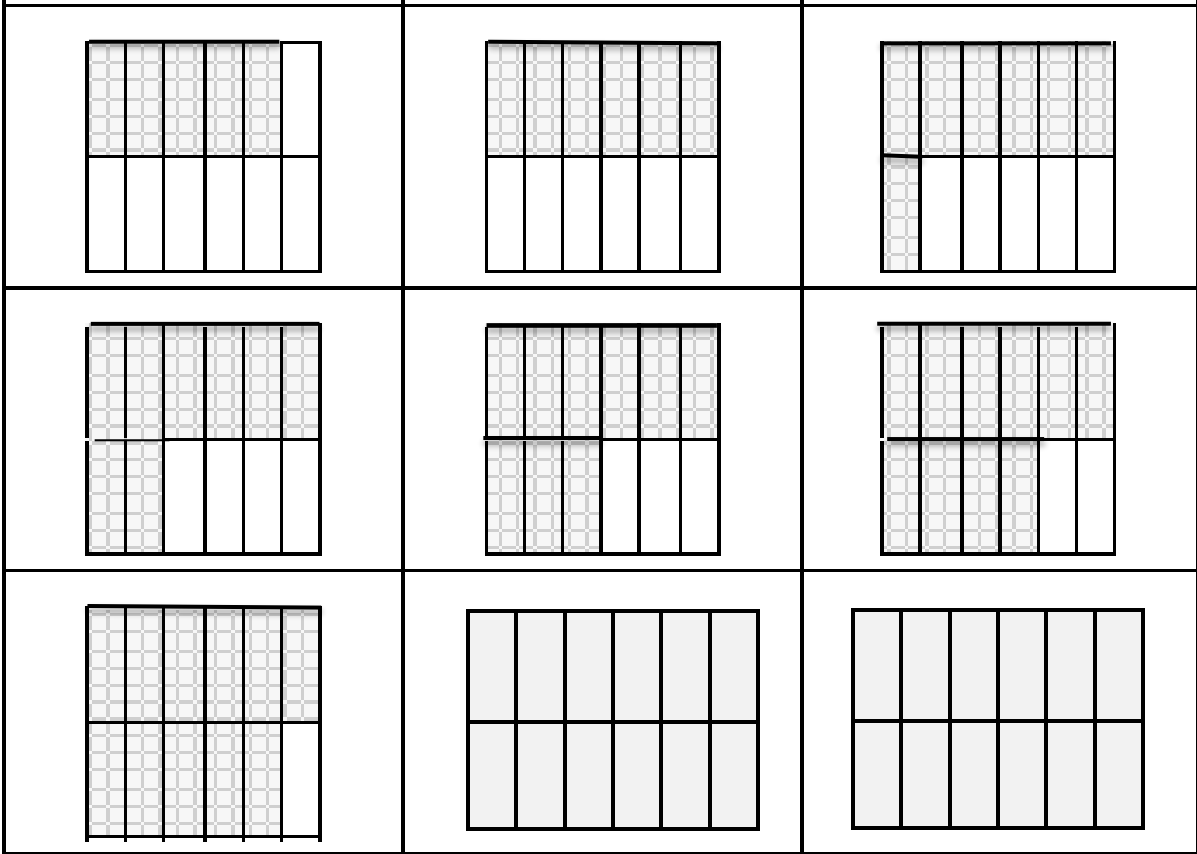
7. Pete decided he didn't like ham and pineapple pizza. He ate $\frac{3}{6}$ of a mushroom pizza and thought he was full. About an hour later he got hungry so he ate $\frac{4}{12}$ of a supreme pizza. Did Pete eat more or less than one whole pizza altogether?

8. Chase brought a large Domino's pizza to the party and Jennifer brought a small Pizza Hut pizza to the party. At the end of the party half the Domino's and half the Pizza Hut pizzas were left. Chase says he has more pizza left and Jennifer says they have the same amount left. Who is correct? How do you know?

CARD SET B - Fraction Bars





Signs to be placed in equations and inequalities

+	+	+	+	+	+	+	+
-	-	-	-	-	-	-	-
=	=	=	=	=	=	=	=
>	>	>	>	<	<	<	<

CARD SET C - Fraction Circles

