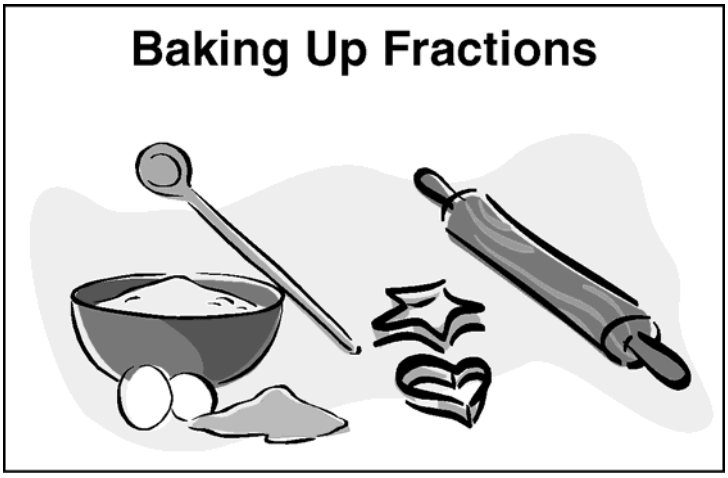
SITES-M Mathematics Challenge



Level: Grade One

Standard: Mathematical Processes

Learning Target: Focus on Fractions

Checks for Understanding

0106.1.10	Match the spoken, written, concrete, and pictorial representations of one-half and one-fourth.
0106.2.11	Recognize the "part-whole" relationship in representations of basic fractions such as ½ and ¼.

SITES-M Mathematics Challenge

Grade 1–Focus on Fractions
Baking Up 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.

You will be able to choose which Mathematics Challenge Packet to implement each month, according to the learning needs of your students and your teaching context. 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 (PLC) meeting. Think about your responses to the guiding questions on the Meeting Protocol
	Step 3.	Hold your PLC 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

SITES-M Mathematics Challenge

Grade 1–Focus on Fractions
Baking Up Fractions

Mathematics Challenge Meeting Protocol

Each month, your Professional Learning Community will meet to discuss the implementation of one Mathematics Challenge. In preparation for your monthly meeting, please print and review this month's 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.

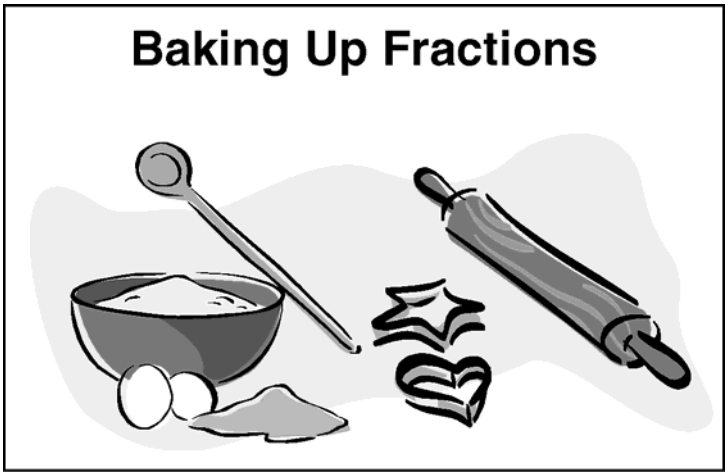
Guiding Questions for Implementing the Mathematics Challenges

1. What is the title of the Challenge that you will use this month?
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.

SITES-M Mathematics Challenge

Grade 1–Focus on Fractions



Standard: Mathematical Processes

Learning Target: Focus on Fractions

Claims:
Students should understand and be able to explain or demonstrate how to:

- ✓ Match the spoken, written, concrete, and pictorial representations of one-half and one-fourth;
- ✓ Recognize the "part-whole" relationship in representations of basic fractions such as ½ and ¼ .

Task Preparation:

Each student will need a copy of the Student Response Sheet, the Cutout Cupcake sheet, a pencil, a pair of scissors, and glue stick or tape.

If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but these responses will need to be documented for scoring.

Stimulus Cards (Drawing or Word Description):

Each student needs a copy of the Cutout Cupcake sheet. The cupcakes can be cut out before administering the challenge to save time.

Manipulatives/Supplies:

Copies of the Student Response Sheet
Cutout Cupcake sheet for each student
Pencils
Scissors
Glue

SITES-M Mathematics Challenge

Grade 1–Focus on Fractions

Cues/Directions:
Distribute student response sheets and picture sheets. If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but these responses will need to be documented for scoring. Students should be directed to look carefully at each figure. Allow students time to answer.

Ms. Clark took her class to the bakery to watch the bakers make desserts.

1. Say: **The students saw pies cut in different ways. Circle the pies below that are cut in half. (Teacher's Note:** Have students circle the pies that are cut in half.**) How can you tell which pies are cut in half? (Teacher's Note:** Have students fill in the text box.**) Circle the pies below that are cut into quarters. (Teacher's Note:** Have students circle the pies that are cut in quarters.**) How can you tell which pies are cut into quarters? (Teacher's Note:** Have students fill in the text box.**)**

2. **Cut out the 9 cupcakes on the Cut-out Cupcakes page. (Teacher's Note:** Have students cut out the cupcakes on the Cupcakes page, or, do this ahead of time to save class time.**) Glue on enough cupcakes to fill in $\frac{1}{2}$ of the pan below. (Teacher's Note:** Have students glue or tape the correct number cupcakes in the pan.**) What fraction of the pan is <u>not</u> filled with cupcakes? (Teacher's Note:** Have students write the correct fraction on the line.**) How do you know? (Teacher's Note:** Have students fill in the text box.**) Glue on enough cupcakes to fill in $\frac{1}{4}$ of the pan below. (Teacher's Note:** Have students glue or tape the correct number cupcakes in the pan.**) What fraction of the pan is <u>not</u> filled with cupcakes? (Teacher's Note:** Have students write the correct fraction on the line.**) How do you know? (Teacher's Note:** Have students fill in the text box.**)**

3. **Circle all the pans below that are filled in $\frac{1}{4}$ with cupcakes.**

   (Teacher's Note: Have students circle the correct drawings.**)**

SITES-M Mathematics Challenge

Grade 1–Focus on Fractions

Student Response Sheet

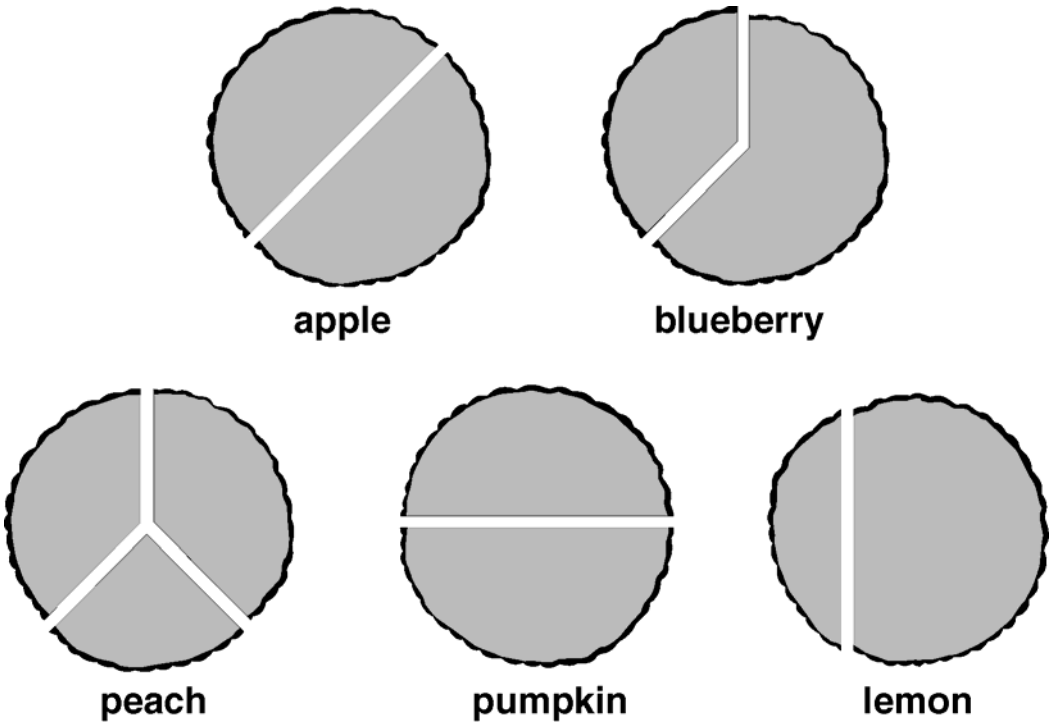
Baking Up Fractions

Name: _____ **Date:** _____

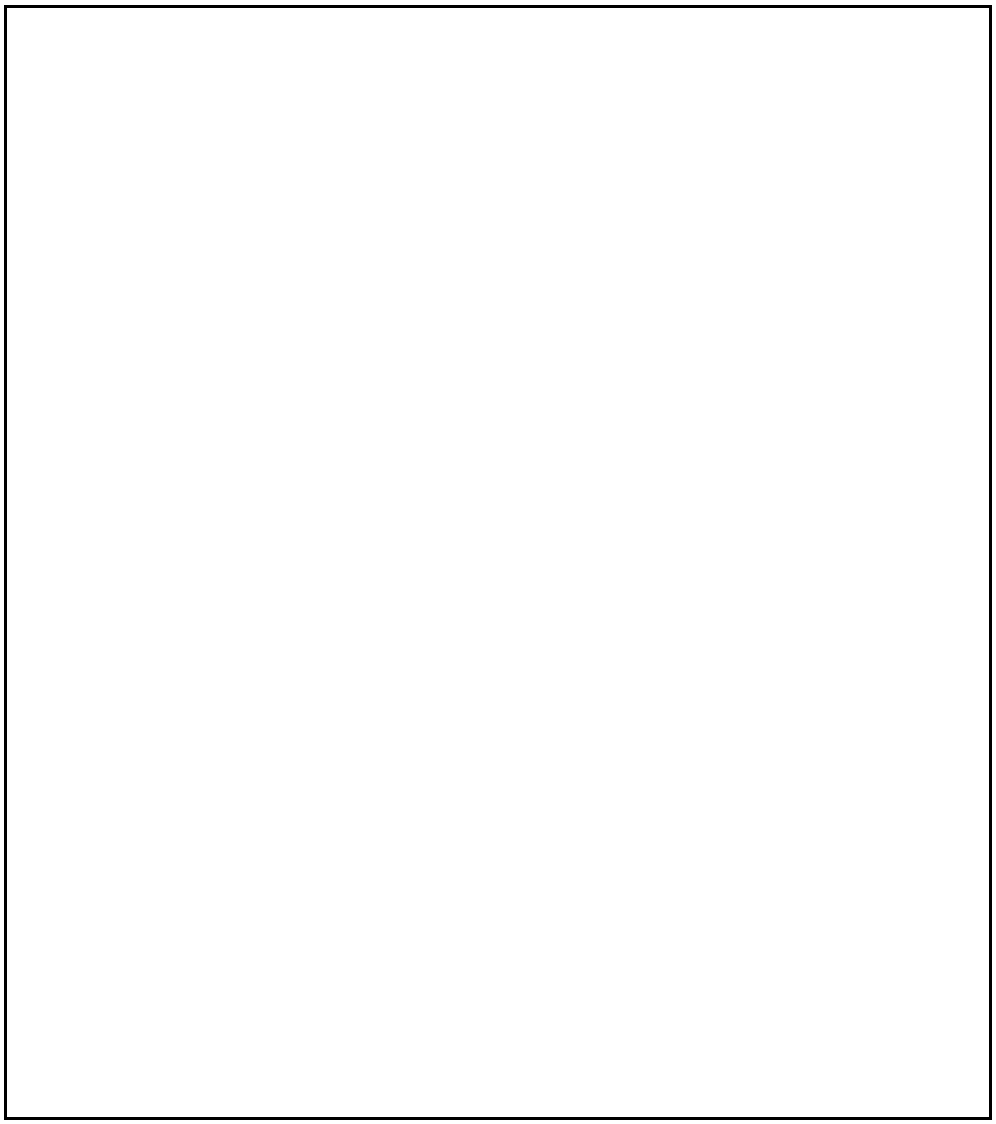
Ms. Clark took her class to the bakery to watch the bakers make desserts.

1. **The students saw pies cut in different ways.**

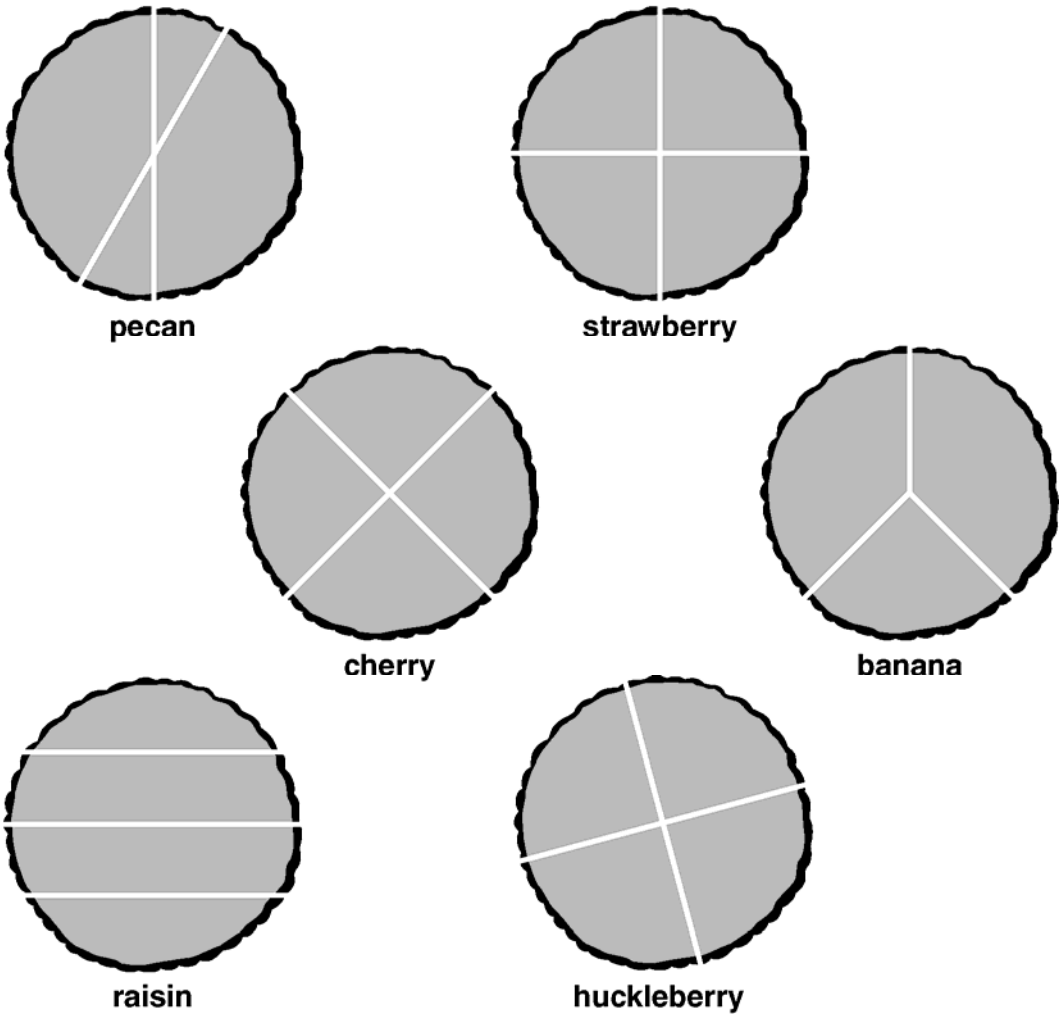
   a. **Circle the pies below that are cut in half.**



How can you tell which pies are cut in half?



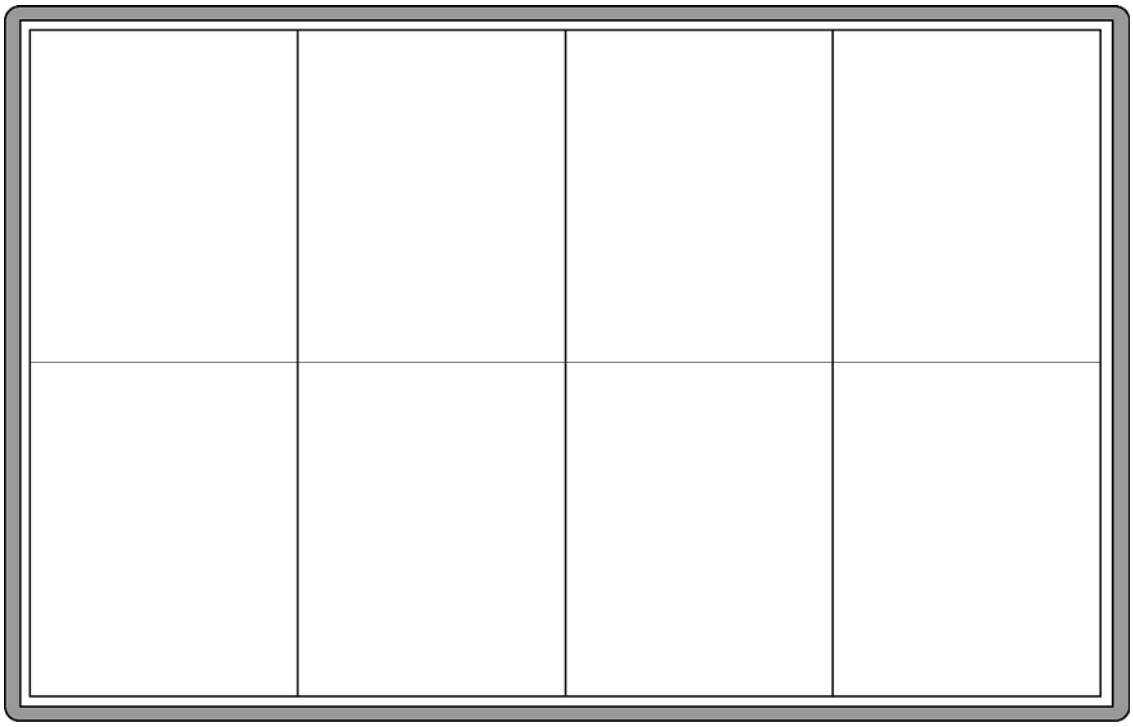
b. Circle the pies below that are cut into quarters.



How can you tell which pies are cut into quarters?

2. Cut out the 9 cupcakes on the Cut-out Cupcakes page.

a. Glue on enough cupcakes to fill in $\frac{1}{2}$ of the pan below.

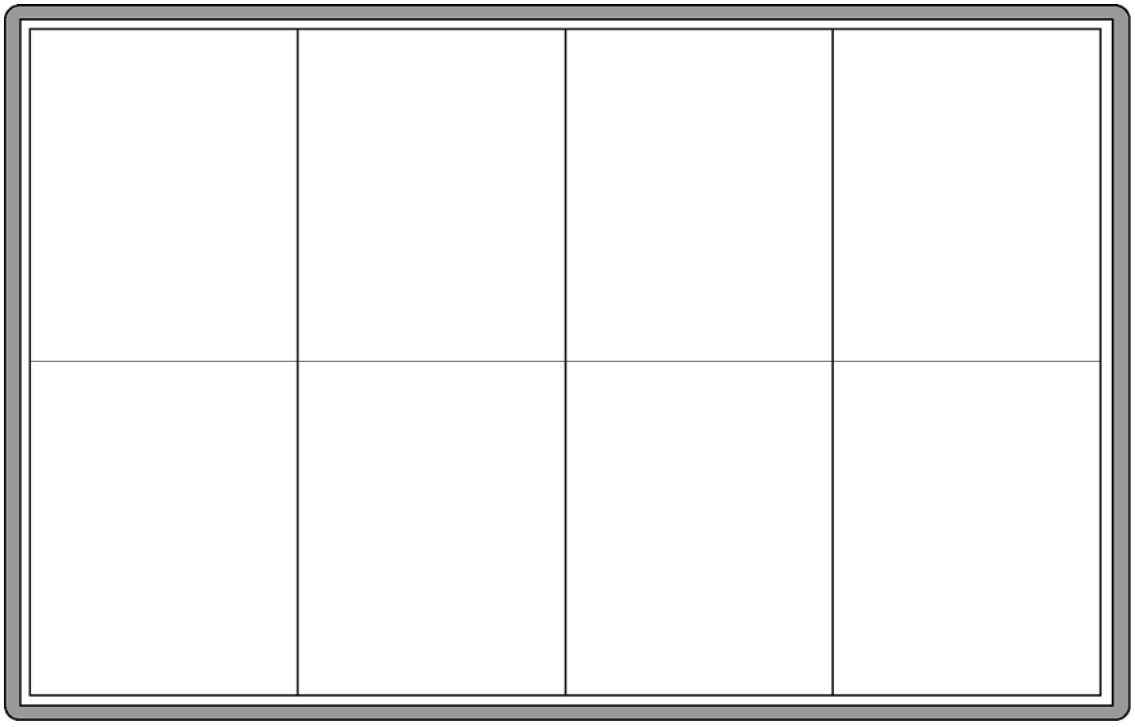


b. What fraction of the pan is <u>not</u> filled with cupcakes?

_____

How do you know?

c. Glue on enough cupcakes to fill in $\frac{1}{4}$ of the pan below.

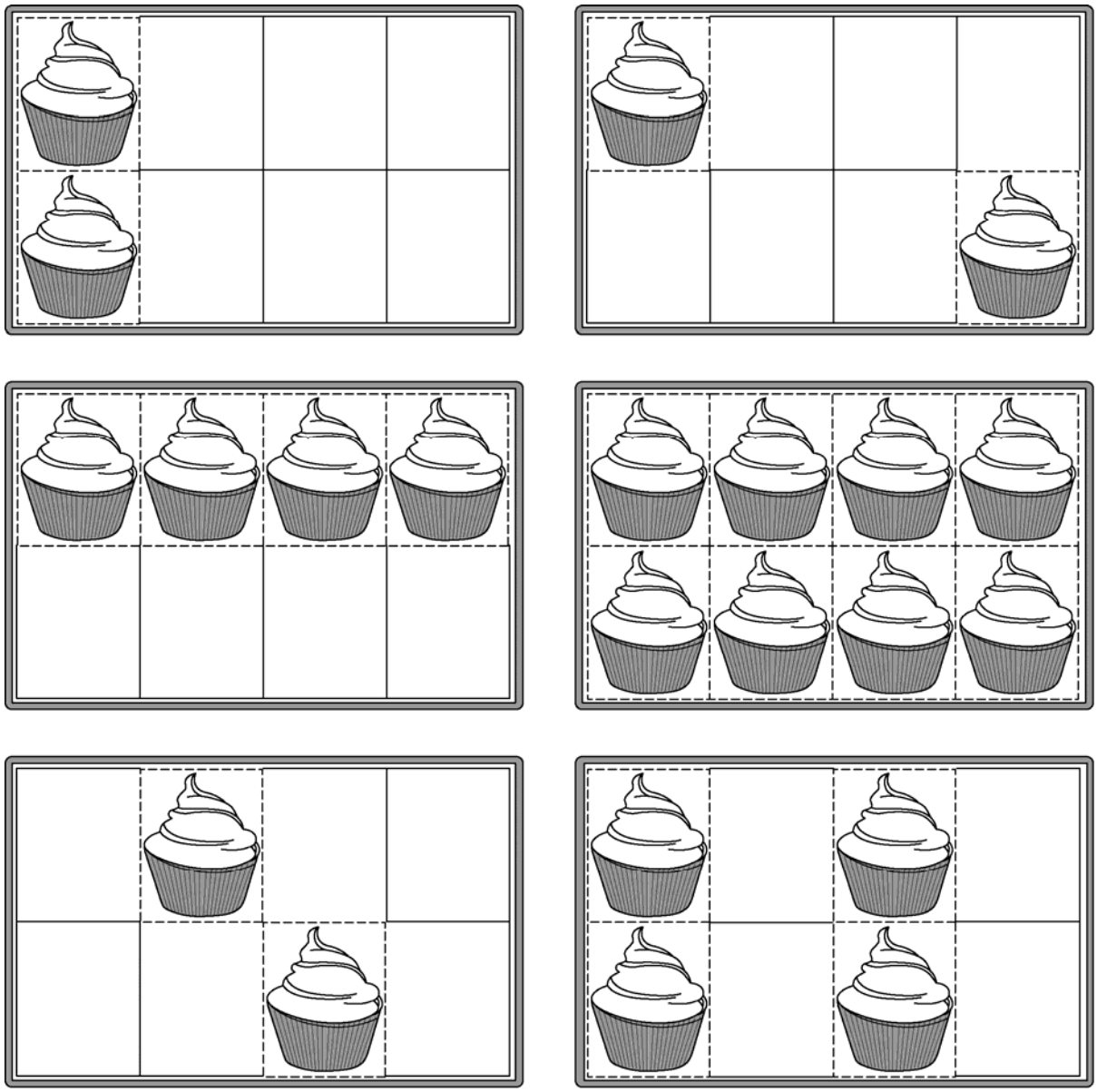


d. What fraction of the pan is <u>not</u> filled with cupcakes?

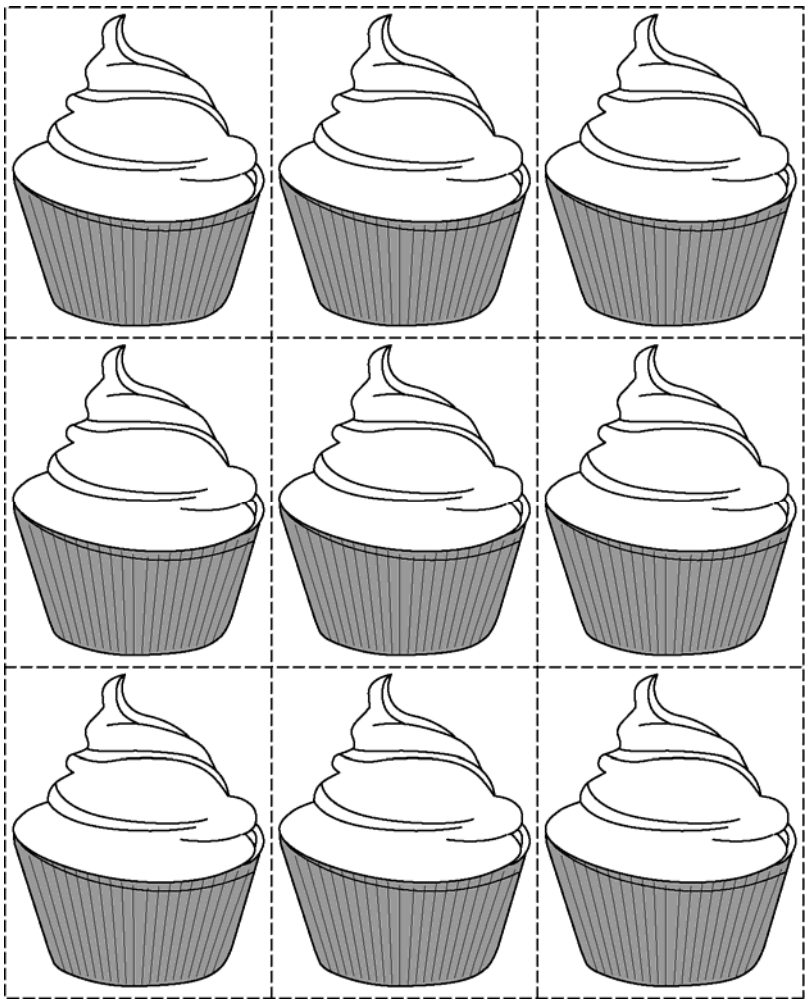
_____

How do you know?

3. Circle all the pans below that are filled in $\frac{1}{4}$ with cupcakes.



Cut-out Cupcakes



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, that is, unit as an object.

B) 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."

C) 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.

D) The teacher could encourage students to cut out parts of the pies to figure out which parts are equal.

Task 2:

A) Be sure that students understand that fractional parts have special names that tell how many parts are needed to make the whole. For example, fourths require 4 parts to make the whole.

B) Students may have the misconception that 4 cupcakes on the pan will what is needed to fill in ¼ of the pan (using the number of cupcakes as the denominator).

C) Be sure students understand that the numerator tells the number of cupcakes selected and the denominator tells the total number of parts (cupcakes) in the full pan.

Task 3:

A) Students may understand that 2 cupcakes will cover ¼ of the full pan.

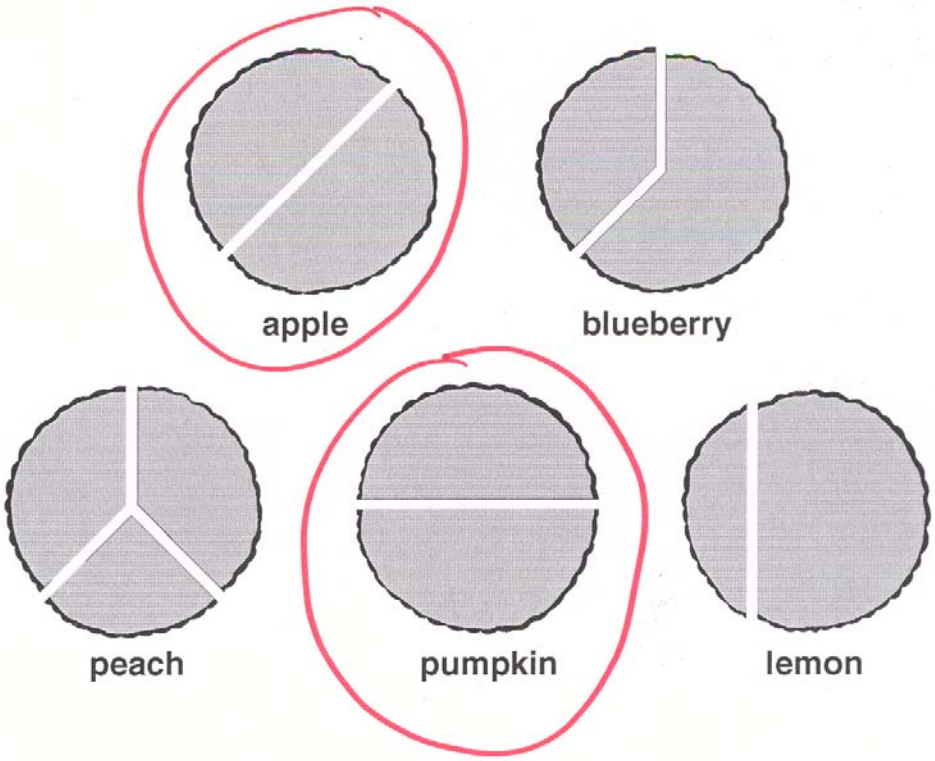
B) Students may have the misconception that 4 cupcakes represent ¼ of the pan (using the number of cupcakes selected as the denominator).

Name: ANSWER KEY Date: _____

Ms. Clark took her class to the bakery to watch the bakers make desserts.

1. The students saw pies cut in different ways.

   a. Circle the pies below that are cut in half.



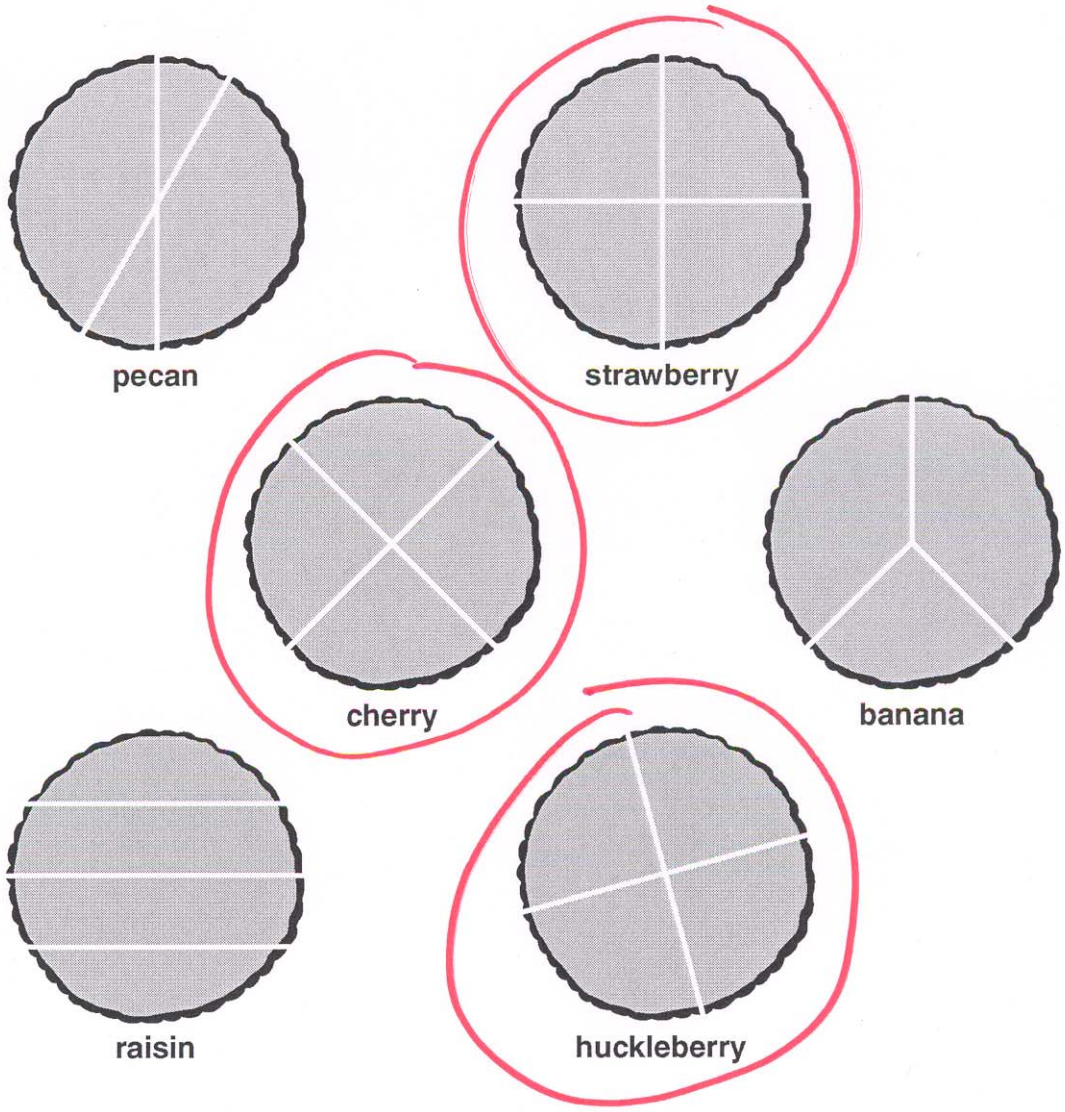
How can you tell which pies are cut in half?

CUT IN HALF MEANS THE PIE IS CUT INTO 2 PARTS OF THE SAMESIZE.

PEACH IS CUT IN 3 PARTS.

BLUEBERRY & LEMON ARE CUT IN 2 PARTS, BUT THE SIZES ARE DIFFERENT.

b. Circle the pies below that are cut into quarters.



How can you tell which pies are cut into quarters?

STRAWBERRY, CHERRY, & HUCKLEBERRY ARE CUT INTO 4 PARTS OF THE SAME SIZE.

THE OTHER PIES ARE NOT.

2. Cut out the 9 cupcakes on the Cut-out Cupcakes page.

a. Glue on enough cupcakes to fill in $\frac{1}{2}$ of the pan below.

b. What fraction of the pan is not filled with cupcakes?

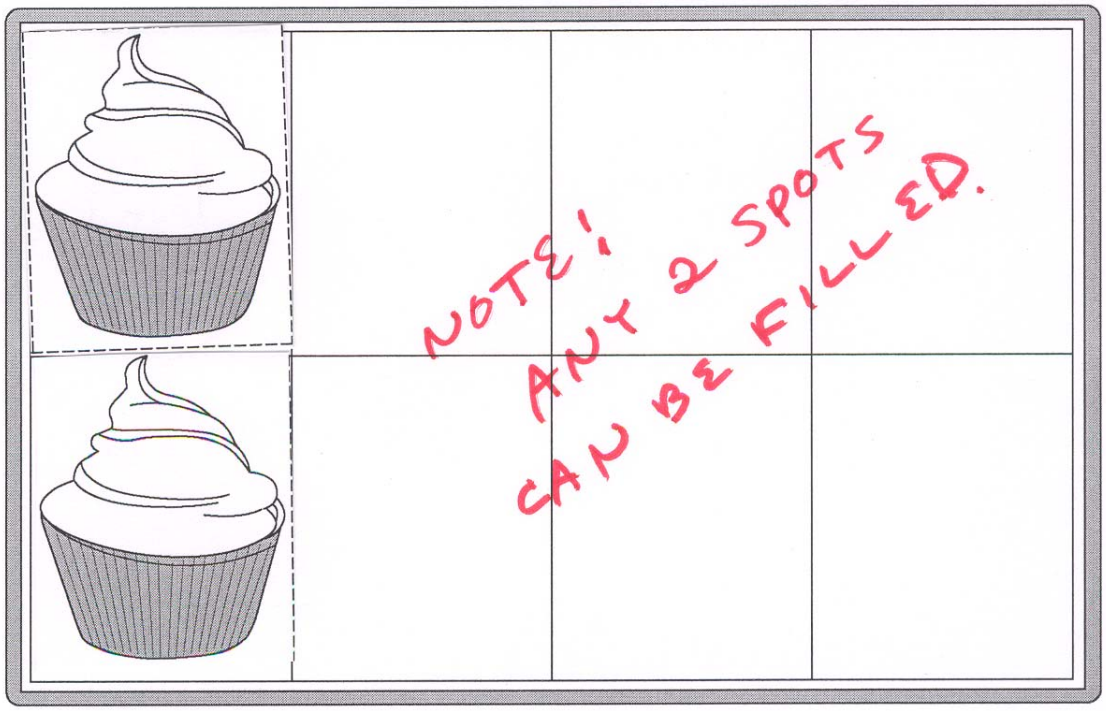
$\frac{1}{2}$

How do you know?

THE PART FILLED & THE PART NOT FILLED ARE THE SAME.

OR THERE ARE 4 CUPCAKES IN THE PAN & 4 SPOTS LEFT THAT DON'T HAVE CUPCAKES.

c. Glue on enough cupcakes to fill in $\frac{1}{4}$ of the pan below.



d. What fraction of the pan is not filled with cupcakes?

$\frac{3}{4}$

How do you know?

THERE ARE 6 SPOTS NOT FILLED. IF 2 CUPCAKES MAKE $\frac{1}{4}$, THEN

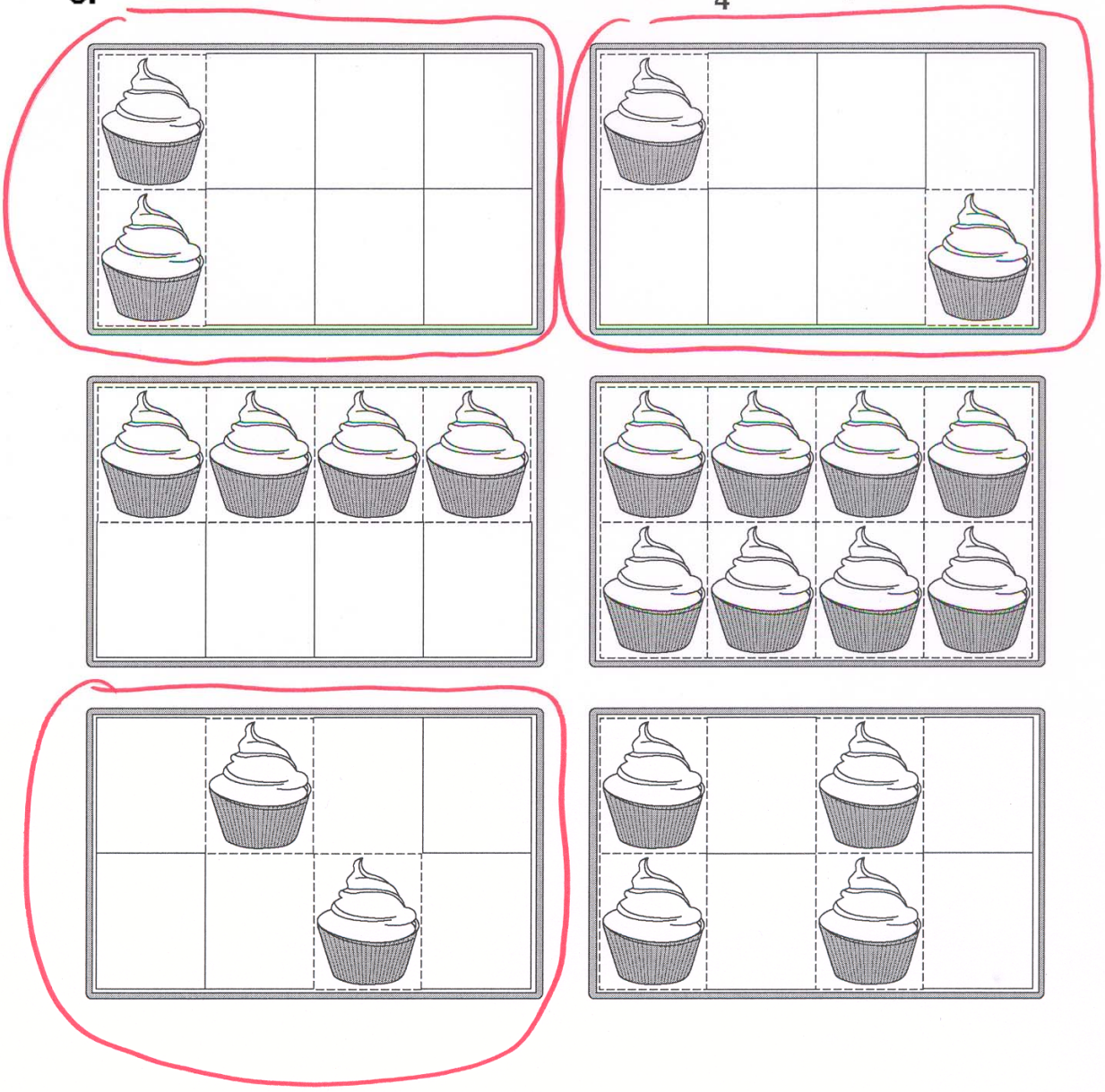
$2 + 2 + 2 = 6$

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

OR AREA RESPONSE – IF $\frac{1}{4}$ IS FILLED THEN $\frac{3}{4}$ IS NOT FILLED

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

3. Circle all the pans below that are filled in $\frac{1}{4}$ with cupcakes.



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**. In part (a) student circles the apple and pumpkin pies and nothing else. Student explains that the 2 parts of those pies are the same size. In part (b) student circles strawberry, cherry, and huckleberry pies and nothing else. Student explains that the 4 parts of those pies are the same size. **Task 2**. Student glues 4 cupcakes into any 4 spots in part (a) and answers 1/2 for part (b). Student uses area, numbers, or fractions to explain why 1/2 of the pan is not filled. Student glues 2 cupcakes into any 2 spots in part (c) and answers 3/4 for part (d). Student uses area, numbers, or fractions to explain that 3/4 of the pan is not filled. **Task 3**. Student circles all pans filled with 2 cupcakes only and nothing else.	Response shows evidence in only 2 of the tasks described in category 4.	Response shows evidence in only 1 of the tasks described in category 4.	Response shows no evidence of mathematical concepts described.

SITES-M Mathematics Challenge

Grade 1–Focus on 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 may indicate drawing lines through pies to assess one-half. Student may indicate drawing lines through pies to assess one-fourth. **Task 2**. Student may indicate somewhere on paper the counting of spaces in pans. **Task 3**. Student may indicate somewhere on paper the counting of spaces in pans.	Response shows evidence in only 2 of the tasks described in category 4.	Response shows evidence in only 1 of the tasks described in category 4.	Response shows no evidence of strategy or procedure.

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 1**. In part (a) student clearly indicates that the two pieces must be of the same size. A high-level response will also indicate that other pies do not have 2 parts of the same size. A similar explanation should be made in part (b), with 4 parts of equal size. **Task 2**. In part (b) student explains why 1/2 of the pan is not filled using an area argument, a number argument, or a parts argument. A similar explanation is made in part (d) on why 3/4 of the pan is not filled.	Response shows evidence in ALL explanations described in category 4, but may exhibit the following errors. Student is unable to explain part (d) of task 2.	Response shows evidence in only 1 explanation described in category 4.	Response shows no evidence of explanations.

SITES-M Mathematics Challenge

Grade 1–Focus on 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**. In part (a) student circles the apple and blueberry pies and nothing else. In part (b) student circles the strawberry, cherry, and huckleberry pies and nothing else. **Task 2**. Student glues 4 cupcakes into any 4 spots of tray and answers 1/2 in part (a). Student glues 2 cupcakes into any 2 spots of tray and answers 1/4 in part (c). **Task 3**. Student circles only trays with 2 cupcakes, as shown on answer sheet.	Student provides correct answers for ALL tasks but misses part (d) of task 2.	Student provides correct answers for only 2 of the tasks described in category 4.	Student provides correct answers for 1 or fewer of the tasks described in category 4.

Scoring notes checklist

Task	Check Yes	Category
Task 1		
In part (a) student circles the apple and pumpkin pies and nothing else. Student explains that the 2 parts of those pies are the same size. In part (b) student circles strawberry, cherry, and huckleberry pies and nothing else. Student explains that the 4 parts of those pies are the same size.		Concept
Student may indicate drawing lines through pies to assess one-half. Student may indicate drawing lines through pies to assess one-fourth.		Strategy
In part (a) student clearly indicates that the two pieces must be of the same size. A high-level response will also indicate that other pies do not have 2 parts of the same size. A similar explanation should be made in part (b), with 4 parts of equal size.		Explanation
In part (a) student circles the apple and blueberry pies and nothing else. In part (b) student circles the strawberry, cherry, and huckleberry pies and nothing else.		Accuracy
Task 2		
Student glues 4 cupcakes into any 4 spots in part (a) and answers 1/2 for part (b). Student uses area, numbers, or fractions to explain why 1/2 of the pan is not filled. Student glues 2 cupcakes into any 2 spots in part (c) and answers 3/4 for part (d). Student uses area, numbers, or fractions to explain that 3/4 of the pan is not filled.		Concept
Student may indicate somewhere on paper the counting of spaces in pans.		Strategy
In part (b) student explains why 1/2 of the pan is not filled using an area argument, a number argument, or a parts argument. A similar explanation is made in part (d) on why 3/4 of the pan is not filled.		Explanation
Student glues 4 cupcakes into any 4 spots of tray and answers 1/2 in part (a). Student glues 2 cupcakes into any 2 spots of tray and answers 1/4 in part (c).		Accuracy
Task 3		
Student circles all pans filled with 2 cupcakes only and nothing else.		Concept
Student may indicate somewhere on paper the counting of spaces in pans.		Strategy
Student circles only trays with 2 cupcakes, as shown on answer sheet.		Accuracy

SITES-M Mathematics Challenge
Grade –Focus on 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. Responses to these questions are for your reflection and documentation and will not be collected.

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?

Reminders:

1) After you have completed the Challenge with your class and responded to these Guiding Questions for Analyzing Student Responses, please complete the Challenge Feedback Log. A link to this Log is e-mailed to you each month. Responses will be used to improve the Challenges and to provide recommendations for teachers implementing the Challenges in future years.

2) Please provide copies of all student work to the Assessment Coordinator.